As veterinary practices have become more modern, sophisticated and technologically advanced, so has our ability to perform veterinary dentistry to a much higher level than was ever thought possible. Through specialization of the profession and a wider availability of these specialists, we are able to offer our clients’ referrals for more advanced care to board certified veterinary dentists.

As veterinary technicians and veterinarians we need to be completely aware of what kinds of dental care and treatments are available, and when to offer a referral instead of opting for more basic dental care in hospital.

The primary concern that we often see in dogs and cats is periodontal disease; however if teeth can be salvaged instead of extracted through periodontal surgical techniques and home care, then through these treatments we could benefit the patient over the long term, to retain important teeth for their function.

Dental radiographs
Radiographs must be obtained to fully assess the extent of any suspected bone loss. Evaluation of a full set of intraoral dental radiographs will help determine the success of any proposed advanced dental procedure, as well as give the veterinarian a baseline to monitor the progress of treatment. If your veterinary practice does not have the ability to obtain those dental radiographs and the client is interested in advanced dental care and saving teeth rather than extraction, then considering referral from the onset may be in the best interest of the patient.

Advanced periodontal therapy
Larger and more important teeth can be difficult to extract even with significant periodontal disease, which can result in horizontal or vertical bone loss, furcation bone loss and tooth mobility due to loss of attachment. When we look at teeth through clinical observations and measurements as well as radiographically, we must assess the true extent of the pathology. A tooth can be evaluated on a root by root basis as well as an individual side of each tooth root. A tooth with significant bone loss (>50%) on a tooth root’s surface may have a very poor prognosis even with advanced periodontal surgery, especially if the bone loss is all the way around the root or what is called a four-walled defect. The area in between a multi-rooted tooth’s roots is called a furcation and if the bone is lost from this area it reduces the success of an advanced procedure even further.

Total attachment loss
This is the sum of the measurement of any gingival recession on the root’s surface, as well as any pocket depth beyond that gingival recession. If gingival recession is not present then it is just the measurement of any periodontal pocket depth beyond what may be considered to be a normal sulcular depth for that specific tooth, in that specific pet’s mouth. This differs depending on the size of the animal, size of the tooth and length of the tooth root specifically.

In order to measure total attachment loss you must use a periodontal probe with clearly marked 1mm increments and measure from the marginal gingival edge to the bottom of the sulcus or periodontal pocket if there is attachment lost. The bottom of the sulcus is normally attached to the tooth’s surface at or very near to the cementoenamel junction (CEJ). When attachment is lost at this point a periodontal pocket is created and a pathological process begins. The periodontal probe should be used with a gentle hand, in line with the vertical axis of the tooth and walked around the tooth’s structure recording measurements in at least four places around each tooth root. Whenever these measurements are greater than what would be considered a normal sulcular depth around that particular tooth, the measurement should be recorded on the patient’s dental chart.

Conditions such as gingival enlargements further diagnosed by histopathology as gingival hyperplasia, can create a false pocket depth and not true attachment loss so careful measurement of the excess gingival tissue and noting if the bottom of the sulcus is at the CEJ is important to determining the extent of attachment on these teeth.

If the bone loss or total attachment loss is <50% and there is not significant furcation involvement, or less than a four walled defect, it may be possible for advanced periodontal surgical techniques, frequent follow up care (possibly under anesthesia) and daily homecare which is a commitment that the client must make when attempting to “save” important or strategic teeth.

If a periodontal pocket depth exceeds 5mm, it is recommended that open root planing: RP/O (root planing-open) be performed with the use of flap surgery to facilitate the visualization of the bony defect and exposed root surface and allows the practitioner to treat the area to the best of their ability to get the best possible outcome from periodontal therapy.

If the periodontal pocket depth is less than 5mm, root planing-closed can be performed (RP/C). This technique involves the use of a hand curette instrument below the gingival margin, adapted to the surface of the root that requires cleaning. Using the sharp blade of the curette, we want to carefully remove the bacterial laden debris from the cementum of the root surface. Thus improving the health
of the local periodontal tissues and smoothing the rough root surfaces allowing the re-attachment of the periodontal ligament as possible.

The use of any curette involves four basic steps:

1. Holding the curette in a modified pen grasp, create a fulcrum by placing your ring finger near the tooth area to be instrumented but not in the “line of fire” to avoid the blade cutting your finger.

2. Insert the curette with the face of the blade in the “closed position” face towards the tooth root, this allows for adaption of the curette beyond the calculus below the gingival margin.

3. Rock blade handle so as to bring the terminal shank into a parallel position to the root, thus engaging the sharp edge of the blade into the root surface.

4. Working stroke: pull the instrument in either a vertical direction towards the crown tip, oblique direction across the crown or horizontal direction.

5. Readapt and repeat the motions in overlapping strokes to ensure the cementum of the root is free from bacterial laden debris and smooth to the touch of the instrument.

**Periodontal bactericidal ultrasonic debridement**

The final step in ultrasonic cleaning. A specially made periodontal tip insert is required for this procedure or some dental ultrasonic units are already equipped with a tip that can be safely inserted sub-gingivally. Please consult your ultrasonic equipment manual regarding which tips are safe to insert under the gum line into the sulcus, and at what setting the machine should be turned down to, reducing the frequency of vibrations to a safe level for this purpose.

Periodontal bactericidal ultrasonic debridement occurs due to the ultrasonic sound waves causing microscopic bubbles to form and then implode in the gingival sulcus, cavitation. These implosions can cause the bacterial cell walls to be disrupted and along with the water rinsing through the area at a certain pressure further reduces the concentration of bacteria within the space.1

**Advanced periodontal flap surgeries**

Techniques to perform flap surgeries are fully described in several dental text books and can be learned by veterinarians at wet labs taught by veterinary dentists on the subject, however if surgical procedures are indicated that are beyond the practitioner’s skill level then referral may be the preferred option.

**Apically repositioned flap**

This technique can be used to help attached gingiva lay over any remaining alveolar bone, it requires that there is at least 2mm of gingiva to extend towards the crown.1 This surgery moves the gingiva down onto the root surface after the area is cleaned of unhealthy bone, granulation tissue and debris; and then the area is allowed to heal.2 This procedure can be performed on mandibular incisors to allow for a reduction in periodontal pocket depths, allow for daily cleaning by the client and to allow easier cleaning of areas of furcation exposure on multi-rooted teeth.2

Contraindications for this procedure would be >50% bone loss especially on a four-walled defect, grade three (3) tooth mobility and the presence of less than 2mm of attached gingiva before surgery.1

**Laterally positioned (pedicle) flap**

**Indications**

When the root surface of a single tooth is exposed significantly due to a cleft that extends to or near the mucogingival line.1

**Contraindications**

Tooth mobility due to loss of bone on more than one wall of the alveolar socket, furcation bone loss or lack of commitment on the client’s part for daily homecare and more frequent follow up professional dental care.1

Carefully created and planned vertical releasing incisions, and the creation of a donor flap which is moved laterally over the area and sutured, is required for this technique.1 The goal is to partially cover this exposed root surface and allow for at least 2mm of attached gingiva to help preserve the health of this particular tooth, the area of tissue that is exposed from the donor site will heal in by second intention.1, 3

**Free gingival graft**

Indicated in specific individual teeth with a cleft like defect that are free of endodontic disease and tooth mobility is not present.3

Contraindicated if endodontic disease is the cause and endodontic disease is not treated first.3 Concurrent periodontal disease must be treated and controlled, if there is tooth mobility the success of this technique will be poor.3 Success will also depend on the client’s willingness to perform daily recommended homecare and follow up treatment with the veterinarian.3

In this procedure a gingival graft is obtained from a donor site separate from the site to be treated and often on the buccal surface of attached gingiva over the maxillary canine, this site offers the largest expanse of tissue.3 The donor graft is carefully harvested using a template and careful technique is used to avoid damage to the periosteum under this split thickness of tissue.3 The donor tissue is then used to graft over the recipient site with careful surgical techniques that are fully described in dental surgical texts.3
**Guided tissue regeneration**

The goal of this type of advanced periodontal therapy is to help facilitate the development of cementum on the root’s surfaces and the regeneration of healthy periodontal attachments.¹ Barrier membranes that are either absorbable or non-absorbable are specifically positioned to prevent granulation tissues from invading the area and to allow bone and periodontal ligament cells to develop in the area where they have been destroyed by periodontal disease.¹

The use of bone inductive materials can assist in such procedures where significant bone has been lost in two and three walled bony defects, and areas of class two (F2) furcation bone loss in multi-rooted teeth.

**In summary**

Basic uses of dental hand curettes, as well as knowledge of dental, periodontal anatomy and treatment techniques that will help regain attachments and healthy periodontium, are very important to the improvement of oral health in our companion animal patients. Further techniques for periodontal therapy using these hand instruments, should be pursued in a dental lab format as well as further reading on the subject.

**References**

Dental instruments range from power instrumentation such as that of the dental delivery unit which may house many different handpieces such as the high-speed, low-speed, air-water syringe, the ultrasonic scaler and maybe even suction. A stand alone motor pack can be used for low-speed work and you can also use a separate ultrasonic scaler unit instead. Fine tipped sharp hand instruments are also an important part of thorough and complete veterinary dentistry.

These items will all need care and maintenance to ensure their proper function, safe use and longevity. The veterinary dental technician should perform daily safety checks on the power equipment, provide the maintenance that is recommended by the manufacturer’s guidelines and clean the equipment in between patients to prevent cross-contamination and ensure infection control.

**Handpieces**

High and low-speed dental handpieces need care and maintenance. These are the hand held air or motor-driven pieces to which we attach the prophylaxis angle, dental burs for cutting and drilling or contra-angles or reduction gear angles to do more advanced dental procedures. The use of an approved lubricant is recommended by most manufacturers; it may be in the form of a spray or liquid. This lubricant is placed in the smaller of the two holes in the bottom of the handpiece, and then the handpiece is reinserted and screwed on to the cord and then operated for 20-30 seconds to distribute the lubricant into the working parts in the hand piece.

This should be done as often as recommended by that particular handpiece’s manufacturer.

The dental delivery system may require that dilute bleach and water solution or a manufacturer approved solution be run through the water lines in the system without the handpieces attached to remove the bio-film or bacteria that builds up in the water containers and the water lines. Check with the manufacturer before you perform this kind of maintenance for the unit’s specific requirements.

Clean the outside of the hand pieces with 70% isopropyl alcohol to remove debris, then the hand pieces may be autoclaved if desired.

**Scaler tips**

The scaler tip should also be cleaned to remove debris and then can be autoclaved to ensure sterility in between patients. Each scaler tip comes with a guide that will help you determine when the tip needs to be replaced due to wear down. If a tip loses even 2-3 millimeters of length, it is much less effective than it should be. Piezoelectric type scaler tips are less expensive than the magnetostrictive stack type inserts, however due to the higher frequency that the piezoelectric tip operates at, wear down will occur and it will need to be replaced much more often.

Ferrite rod inserts are easily broken if accidentally dropped so the hospital should always have an extra replacement rod on hand if you are using this type of scaler.

The leaves of nickel alloy in the magnetostrictive type insert should be inspected daily for any fractures in the stack or separations at the base of the insert. If these are detected, the insert will need to be replaced. It is a good idea to have an extra insert on-hand to replace a broken or damaged insert without interrupting the quality of patient care during a procedure.

**Fine hand instruments**

Scalers and curettes require daily care and sharpening to maintain a useful instrument. The fine metal blade edges of these instruments should be kept sharp at the proper angulations and undamaged. Damage can occur due to dropping the instrument, improper use of the instrument or incorrect sharpening techniques.

It can be very helpful to have a new instrument kit handy for a quick comparison when you are discerning if an instrument is damaged, incorrectly shaped or angled at the working end. You can quickly replace an instrument that has been damaged or worn beyond repair with these extra instruments without having to wait for an ordered instrument to arrive.

**The parts of the scaler and the curette**

When holding an instrument to locate the parts of the instrument, first locate the terminal shank and orient it so that the terminal shank is perpendicular to the floor, the face of the instrument is up towards the ceiling and the toe is pointing towards your nose when you look at the instrument. When holding a curette this way, the handle will often be angled out to one side or the other when the terminal shank is perpendicular to the floor.

- **Handle:** This is the part of the instrument on which we place our thumb and fingers for the main grip to hold the instrument. Different sizes, weights and textures are available. Dental scalers and curettes are double ended so the handle is in the center of the instrument extending on each side to the instrument’s working ends.
- **Shank**: This is the next portion of the instrument on each end. It is made of metal and depending on the type and use of the instrument.
- **Terminal/Distal Shank**: Farther down toward the working end, the terminal shank is where the actual working end of the instrument attaches on each end of the double-ended instrument.
- **Blade**: The working end or tip of the instrument. It is a mirror image of the opposite end.
- **Face**: The top surface of the blade end of the instrument.
- **Heel**: The heel is the opposite end from the toe/tip of the blade.
- **Toe/Tip**: The final tip of the instrument on each end, rounded on a curette and very pointed on a scaler.
- **Cutting Edge**: The edge where the face and the sides of the working end of the instrument meet forming a sharp edge that is used in removal of dental calculus.

It is important to understand where the cutting edge is on each instrument if you are planning to sharpen that edge!
**Instrument sharpening: Goals**

1. Keeping the instrument’s cutting edges sharp enough so that the operator can be effective with each working stroke at removal of calculus without a tremendous effort and to avoid burnishing the calculus on to the dental surfaces.
2. Maintaining the instruments’ integrity, original shape and function as much as possible.

**Scalers** that are to be used on the coronal surfaces above the gingival margin have two blade cutting edges, one on each side of the working end. The tip of the scaler is not blunted but kept at a sharp point; just the sides of the instrument’s working end are to be sharpened.

**Curettes** are to be sharpened in a similar manner, however care should be taken to make sure that each cutting surface is sharpened at the proper angle and that the tip or “toe” of the instrument is “blunted” or rounded off at each sharpening to prevent obtaining a sharpened tip that would not be appropriate to insert subgingivally because it would lacerate sulcular attachments.

There are two main methods used for sharpening instruments with a sharpening stone:

1. Moving stone- stationary instrument method
2. Stationary stone-moving instrument method

The choice of method depends on the operator and what they find easiest to use.

- **Required items for instrument sharpening:** Coarse and fine stones
- **Arkansas stone (fine grit):** This is a fine grit stone that is used for instrument maintenance and finishing or after re-contouring with a course grit stone if that is necessary. This stone does not remove as much metal when used so it is not appropriate for use when an instrument is very dull or needs to be re-contoured.
- **India stone (medium grit):** These stones are more coarse in grit and helpful when more metal removal is required to re-contour or sharpen an excessively dull instrument.
- **Honing stone oil:** Both types of stones require that special honing stone oil be placed on the face of the stone before sharpening and gently wiped into the crevices of the stone. Be careful not to remove all of the oil when spreading it across the stone with a finger or paper towel. When the oil is on the stone it protects the stone from the metal shards embedding in the stone and shortening the life of the stone, and the oil reduces friction.
- **Ceramic stone:** (Not required): Ceramic stones are not as commonly used in sharpening veterinary dental instruments, however if this stone is what you have available to use, it is a fine grit stone (not as useful for reworking or reshaping a dull instrument) and requires water as a lubricant not honing oil.
- **Care and disinfection of the sharpening stones:** Stones can be autoclaved if desired, however instrument sharpening should take place after the instrument has been cleaned with water and an approved cleaning solution, dried and autoclaved. The heat from the autoclave will dull metal instruments so sharpening after autoclaving is recommended. Autoclaved instruments used on the sharpening dental stones should not contaminate the dental stones which should eliminate the need for autoclaving the stones unless they are used to sharpen instruments during dental procedures.
- **Stone shapes and sizes:** The most common size for the flat Arkansas stone is one inch wide by four inches long. This is a good size for most people to hold in their hands when sharpening. The India stone should also be a flat type of stone, larger in size; approximately 1 ¾” X 4 ½” long with a rounded side and a contoured sloping edge on the other long side. Using a conically shaped Arkansas stone on the face of the instrument will be the last quick step in the sharpening procedures. All stones are easily broken if dropped so care should be taken to ensure a firm grip on the stone and the stones should be kept in a cushioned container when not in use to prevent damage.
- **Acrylic test stick:** This round short piece of plastic about the size of a straw is used to “test” the hand instrument’s cutting edges for sharpness both before and after the sharpening procedure. The cutting edge of the instrument should “bite” into the acrylic stick when engaged slightly. It should not bounce off the test stick.

**Moving stone-stationary instrument method**

1. Hold the instrument very steadily on the edge of the counter top with the terminal Shank perpendicular to the floor at 12 o’clock and the tip or toe pointing towards the operator.
2. Immobilize the instrument by bracing the instrument on the edge of the counter and resting your lower arm on the counter top.
3. Hold the oiled stone face towards the side of the working tip of the instrument at approximately 70 degrees or at 1 o’clock or 11 o’clock. The stone is then moved using an up and down motion, ending on a down stroke to sharpen the cutting edge of the instrument. Sharpening should be done by moving from the heel of the instrument at first and then more towards the tip or toe of the instrument last.
4. When sharpening a curette with a blunted toe the operator must take the stone and bring it forward in an up and down motion around the toe at a 70 degree angle to make sure it is blunted and not sharpened into a point. **Always end on a down stroke.**
Universal curettes have a cutting edge on both sides of the instrument so you can keep the instrument in the exact same position and just move the stone to the opposite edge and repeat the process on that cutting edge.

1. The conical stone is then oiled and rolled over the face of the instrument a couple of quick times to remove any metal filings off of the cutting edges or face of the instrument.
2. The instrument is then turned over, repositioned, stabilized and the stone is repositioned in the other hand so that the cutting surface(s) on the other end may be sharpened in a similar way.

If you do not have a guide to help you position the instrument, then the terminal shank should be as close to lined up with 12 o’clock (90 degrees) on an imaginary clock face as possible. The angle off of that for the stone should be at or near 70-80 degrees for universal curettes and scalers but not for Gracey curettes. Gracey curettes are off-set already at 70 degrees so you will need to line the stone up with the one cutting surface at or near 50-55 degrees and only sharpen the lower side not both sides.

A protractor or a paper guide can be tremendously helpful in visualizing the above angles.

**Methods of sharpening dental elevators and luxators**

Usually a stationary stone-moving instrument technique is employed to sharpen these tools.

It is very important for the instrument's working end to maintain its shape and integrity. Using a method that sharpens the back side of the edge of the instrument will avoid removal of the wings on a winged elevator and prevent thinning of the instruments cutting surface which could weaken the end of the instrument over time.

1. Place stone on table and hold stone with one hand to keep it stationary. Drop a couple of drops of sharpening oil on the stone and smooth this over the surface.
2. Place side of working end on stone, pointer finger on top. Handle at table top. Holding instrument firmly in hand.
3. Raise handle to 45 degrees off of the table.
4. While rotating the working end under in a fashion on the stone that draws a "smile" on the stone. Rotate palm up and sharpen all the way around the back side edge of the elevator or luxator, then go back over the "smile" to the beginning position.
5. Use care not to press down too hard when you start the movement, when you get to the palm up position with the pointer finger under the instrument you will automatically not be putting as much force on the stone with the instrument.
6. Maintain the 45 degree angle off of the stone's surface through-out the whole movement.
7. After several passes across the stone in the "smile" format make sure to take the conical stone and run it through the face or concave side of the working end a couple of times to remove the "wire-edge" that will accumulate on the instrument.
8. Use your magnification to visually inspect the convex surface to insure even sharpening.
9. Use the Arkansas stone for daily sharpening and the India Stone for more aggressive sharpening and fixing metal spicules that may be on the instruments edge from misuse.

**Mechanical sharpening devices**

There are a few very nice mechanical sharpening devices available. Though the mechanical sharpeners are more expensive initially, they have the advantage of taking the positioning guess work out of the technique to produce consistently sharp and correctly angled instruments.

- Rx Honing Machine® (This machine can even sharpen scissors!)
- Side-Kick® by Hu-Friedy®  [www.hu-friedy.com](http://www.hu-friedy.com)

**References**


Oroal Anatomy and Pathology

Before we can recognize what may be abnormal we need to have a full understanding of what is considered normal anatomy in the canine and feline patient’s mouth. Dental disease can affect the patient throughout the entire body due to bacterial shed from oral infection spreading through the bloodstream and affecting vital body systems and organs over the long term. A general physical exam and pre-anesthetic blood and urine testing and any other testing recommended by the veterinarian should ideally be performed prior to anesthesia to further assess the overall health and anesthetic risk for the veterinary dental patient.

Oral anatomy can be divided into soft tissues and bony or hard tissues. As we assess the veterinary patient we will assess both types of structures for any abnormalities. It is a normal tendency to focus on looking inside the patient’s mouth and focusing on the teeth when we are looking for oral disease; however we need to start by examining the patient’s head, skull and facial areas first and then moving on to the inner oral cavity.

Patient examination

On the conscious patient we want to begin by visually observing the head and face of the patient.
- Do we see any areas of swelling, inconsistencies or imbalances?
- We should notice the eyes of the patient, are they protruding out of the orbital sockets, and is there any ocular discharge, masses or drainages around the eye margins? Are the pupils dilated or constricted in a bi-lateral manner?
- Does the patient tilt the head to one side or the other?

Once a visual inspection of the head and neck has been performed then we can move on to palpate the structures of the skull and face.
- Palpate the bones of the skull, above and below the eye areas, over the cheeks and zygomatic arches.
- Palpate the mandibular bones from the mandibular symphysis to the caudal edge of the mandible and continuing on back to the temporomandibular joint on each side.
- Palpate the lips on all sides assessing for any swellings or signs of pain or discomfort.
- Palpate the mandibular lymph nodes and any other regional lymph nodes in the area.
- A visual inspection of the ear canals with an otoscope is an important part of the overall skull area exam.
- Does the patient respond appropriately to simple neurological tests done on the face and head?
- Assess the patient’s occlusion. This must be documented while the patient is either awake or just after induction of anesthesia prior to the placement of an endotracheal tube so that the mouth can be closed completely without any obstructions.

These same parameters should be re-examined once the patient is properly anesthetized, intubated and at a safe plane of anesthesia for examination. A much more thorough oral examination will take place at that time.

Inside the patient’s mouth we can further divide this area into two regions; the first region encompasses all of the soft tissues of the lips, which inside the mouth are covered by oral mucosa, called the buccal mucosa, which consists of stratified squamous epithelium. This area, called the vestibule, continues until it reaches the area demarcating the beginning of attached gingiva known as the mucogingival margin. The second region begins at the attached gingiva and extends medially towards the hard palate on the maxilla and from the mucogingival margin on the mandibles medial towards the tongue, this is called the oral cavity proper.

Anatomy of the teeth and surrounding structures

- **Alveolar Bone:** This is not the name of a particular bone but more of a descriptor of the bone that surrounds and supports the tooth structures in the mouth.
- **Alveolar Jugum:** This is the palpable alveolar bone that overlays a large tooth root such as the maxillary canine tooth.
- **Alveolar Margin:** This is the most coronal edge of the alveolar bone that surrounds the teeth; it consists of very dense cortical bone.
- **Attached Gingiva:** Covering the alveolar process this attached gingiva which is highly keratinized can withstand the forces of mastication.
- **Cementum:** Serving as a protective covering for the tooth root and a surface for the periodontal ligament fibers to attach, this calcified mesenchymal tissue is avascular in nature.
- **Cementoenamel Junction (CEJ):** This is the junction where the enamel from the crown surface of the tooth and the cementum that covers the root surface of the tooth meets.
- **Crown:** This is the portion of the tooth structure that is supragingival or above the gingival margin when erupted. It is covered with a very hard substance called enamel.
- **Dentin:** This substance consists of hard calcified tissue containing tubules and makes up the greater volume of the inside of the tooth. Overtime the dentin becomes thicker as the patient ages. Dentin surrounds the pulp chamber and root canal’s blood and nerve supply and fuses with the cementum on the inside of the tooth root and the enamel on the inside of the tooth crown.

- **Enamel:** This is the smooth and shiny surface that covers the coronal aspect of the tooth and serves to protect the dentin from environment of the oral cavity. It consists of hydroxyapatite crystalline compounds and is the hardest substance in the body. Once the enamel is destroyed or lost it cannot be regenerated.

- **Free Gingival Margin:** The most coronal edge of gingival tissue and circumnavigates the tooth crown and forms the gingival sulcus. It is not attached to the tooth’s surface.

- **Gingival Sulcus:** This is the area that lies between the marginal gingiva that is resting against the crown of the tooth but is not attached and the tooth crown itself. We use our periodontal probe to explore the gingival sulcus for loss of attachment at the bottom of this sulcus where the normal attachment should be.

- **Junctional Epithelium:** At the base of the gingival sulcus this tissue is the beginning of the attachment of the attached gingiva to the alveolar bone. This should be located at or near the cementoenamel junction. Care should be taken not to destroy this attachment when cleaning the patient’s sulcus.

- **Mucogingival Junction (MGJ):** The line that demarcates the transition from the attached gingiva to the alveolar mucosa.

- **Odontoblasts:** These cells line the pulp cavity and produce dentin throughout the tooth’s life which causes the dentinal walls to thicken as the tooth ages. This decreases the size of the pulp canal over time.

- **Occlusion:** The positional relationship between the maxillary teeth and the mandibular teeth when the mouth is in a fully closed position.

- **Periodontal Ligament (PDL):** These ligaments attach the tooth via the cementum on the outside of the tooth root in many directions to the bone that lines the tooth’s socket. Consisting of cells, collagen fibers and nearly 70 percent water these ligament fibers play a significant role in the tooth’s capability to withstand the daily forces of chewing.

- **Periodontium:** The periodontium are the structures that support and surround the teeth themselves. It consists of the alveolar bone, attached gingiva to the mucogingival junction, the periodontal ligament fibers which attach the tooth root to the tooth socket and also the cementum which is the outside covering of the tooth root.

- **Pulp Cavity:** Containing the highly vascular and nerve tissues; this cavity can be further divided into the root canal in the root section of the tooth and the pulp chamber in the crown section of the tooth.

- **Root:** This is the portion of the tooth structure that is below the gum line or subgingival, the root is covered with a substance called cementum and should be firmly attached to the alveolar socket by periodontal fibers. These periodontal fibers run from the alveolar bone to the cementum on the root surface acting like shock absorbers when the pet masticates and the teeth need to move in the socket slightly as this process of chewing occurs.

- **Dental Directional terms:**
  - **Mesial:** This refers to the tooth surface that is directed toward that of the first incisor in the quadrant.
  - **Distal:** This surface is the surface that is opposite to the mesial surface.
  - **Lingual:** This is the tooth surface that is closest to the tongue.
  - **Palatal:** This is the surface that is closest to the palate. Usually used with maxillary teeth only.
  - **Caudal:** Refers to structures or moving in the direction towards the back of the mouth.
  - **Rostral:** Refers to structures or moving in the direction towards the front of the mouth.
  - **Apical:** In the direction of the apex of the tooth root.
  - **Coronal:** In the direction of the tooth crown.
  - **Labial:** Surface towards the lips of the patient.
Charting the patient’s oral structures

Now that we have a better grasp on how to properly do an orofacial exam on the conscious and also anesthetized patient we need to understand the techniques involved and methods of proper documentation of the findings on a dental chart using the American Veterinary Dental College’s (AVDC) method of abbreviations and notations.³

It is important to have and use a complete dental chart that allows us to document findings in a three dimensional way to create an overall picture of all sides of the tooth and root structures below and above the gum line. Having a pre and post treatment image of the mouth structures is also an important step to help follow treatment over time and to ease the documentation and readability of the chart.

The chart should also have a place to document the patient’s signalment, hospital and practitioner information, date of charting and treatment, skull type, occlusion, periodontal disease, plaque, calculus, gingivitis and notations regarding regional anesthesia.⁴

**Instrument required for charting**

**Periodontal probe and explorer**

This instrument on one end is used for measuring periodontal pocket depths, loss of gingival attachments, extent of gingival hyperplasia and furcation bone loss. A shepherd hook explorer is used as a tactile instrument to further assess for any defects in the enamel or exposed dentin surfaces, the cementoenamel junction and/or exposed root surfaces if any. A probe and shepherd hook explorer is often a double ended instrument.

Charting should be performed in a systematic and consistent fashion each time. The practitioner should start at the midline and working in quadrants document all findings as thoroughly as possible, noting all abnormal findings on the chart at their location using the buccal, coronal or palatal/lingual view to illustrate. Using the AVDC abbreviations as necessary to document certain conditions and findings, further defines our charting.

Once the dental chart has been completed for the pre-treatment pathology then a plan can be made for further diagnostics and treatment of the patient’s oral cavity. Further diagnostics such as radiographs, will assist in the proper documentation of structures that we cannot visualize below the gingival margin.

If a tooth appears to be missing because the crown is not present in the mouth, a radiograph should be obtained and if the root structure is missing then the whole tooth can be circled as missing on the chart. If there is root structure still present then only the crown of the tooth should be circled on the chart. If a tooth is **unerupted** then it should be documented on the chart within the bone in which it resides.

The patient’s dental chart is a part of its permanent medical record and should be further documented with a written account of all pathology, diagnosis, radiographic interpretation, treatment or procedures performed, prognosis, client discussions, homecare recommendations, follow up care recommended and a long term plan for management and prevention of oral disease for that particular patient.

During the procedure a proper anesthesia record should be maintained including all drugs, doses and methods used for the general anesthesia, analgesia and any other drug therapy. A record of all anesthesia monitoring as it is documented should be kept during the procedure as well.

**AVDC abbreviations**

These abbreviations help us to document specific findings easily and allows us to communicate within the veterinary profession about these findings through a defined understanding of what each abbreviation means.

It is important to have an understanding of the differences in using the words: stage, index and grade. Each of these has a different meaning when we are discussing disease.

- **Stage**: This is used when we are discussing the extent of pathological lesions in a course of a disease that is likely to progress.³
- **Grade**: The quantitative assessment of the degree of severity of a disease or abnormal condition at the time of diagnosis, irrespective of whether or not the disease is progressive.³
- **Index**: The quantitative expression of predefined diagnostic criteria whereby the presence and/or severity of pathological conditions are recorded by assessing a numerical value.³

Below is a list of the most commonly used abbreviations in the general practice of veterinary dentistry.

**Triadan numbering system**

100=maxillary right  200=maxillary left  300=mandibular left
400=mandibular right

*Deciduous teeth are noted 500-800 starting at the animal’s upper right quadrant and moving clockwise.

**Dogs have 28 deciduous teeth and 42 adult teeth**

**Cats have 26 deciduous teeth and 30 adult teeth**

**Remember the rule of 4’s and 9’s. 4’s=canines and 9’s =first molars**

775
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Diagnostic</th>
<th>Treatment</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>Abrasion</td>
<td></td>
<td>Object caused tooth wear</td>
</tr>
<tr>
<td>ALV</td>
<td>Alveolectomy/Alveoloplasty</td>
<td>Bone removal or contouring alveolus</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>Attrition</td>
<td></td>
<td>Tooth on tooth wear</td>
</tr>
<tr>
<td>ATE</td>
<td>Extrusion</td>
<td></td>
<td>Abnormal tooth extrusion</td>
</tr>
<tr>
<td>B</td>
<td>Biopsy( see specific types)</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>Caries</td>
<td></td>
<td>Carious lesions</td>
</tr>
<tr>
<td>CB/C</td>
<td>Crossbite caudal</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>CB/R</td>
<td>Crossbite rostral</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>CEJ</td>
<td></td>
<td></td>
<td>Cementoenamel junction</td>
</tr>
<tr>
<td>CL/B/L/T/P</td>
<td>Chewing lesion</td>
<td>Buccal/labial/sublingual-tongue/palatal</td>
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</tr>
<tr>
<td>CR/A</td>
<td>Crown Amputation</td>
<td>crown amputation/intentional root retention</td>
<td></td>
</tr>
<tr>
<td>CU</td>
<td>Contact Mucositis</td>
<td>contact mucosal ulceration</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Diastema</td>
<td></td>
<td>open space between teeth</td>
</tr>
<tr>
<td>DT/P</td>
<td>Deciduous Tooth</td>
<td>Deciduous tooth/persistent</td>
<td></td>
</tr>
<tr>
<td>DTC/R</td>
<td>Dentigerous cyst R=removal of cyst</td>
<td>cyst defect around unerupted tooth</td>
<td></td>
</tr>
<tr>
<td>E/D</td>
<td>Enamel Defect</td>
<td>involves only the enamel</td>
<td></td>
</tr>
<tr>
<td>E/H</td>
<td>Enamel Hypoplasia</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>E/HM</td>
<td>Enamel Hypomineralization</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>GC</td>
<td>Gingival Curettage</td>
<td>Curettage of gingival lining only</td>
<td></td>
</tr>
<tr>
<td>GE</td>
<td>Gingival Enlargement</td>
<td>in the absence of a histopathology dx</td>
<td></td>
</tr>
<tr>
<td>GR</td>
<td>Gingival Recession</td>
<td>measured in millimeters</td>
<td></td>
</tr>
<tr>
<td>GV</td>
<td>Gingivectomy/Gingivoplasty</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>IO IO/R</td>
<td>Intraoral fistula IO/R-repair</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>LAC/R</td>
<td>Laceration LAC/R- repair</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
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<tr>
<td>MAL/1/2/3/4</td>
<td>Classifications of Malocclusions</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>OAF</td>
<td>Oroantral fistula OAF/R-repair</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>OM</td>
<td>Oral Mass</td>
<td>Oral or maxillofacial mass: see <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>ONF</td>
<td>Oronasal fistula ONF/R-repair</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>PD 1/2/3/4</td>
<td>Periodontal disease</td>
<td>Stages of Periodontal disease</td>
<td></td>
</tr>
<tr>
<td>PRO</td>
<td>Professional dental cleaning</td>
<td>Scaling/polishing/irrigation</td>
<td></td>
</tr>
<tr>
<td>RCT</td>
<td>Root canal therapy-standard</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>RP/C, RP/O</td>
<td>Root planing Closed/Open</td>
<td>Root planing without or with visualization</td>
<td></td>
</tr>
<tr>
<td>RTR</td>
<td>Retained tooth root</td>
<td>tooth root remains</td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td>Stomatitis ST/CS: Caudal stomatitis</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>T/A, T/LUX</td>
<td>Avulsed or Luxated tooth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T/FX</td>
<td>Fractured tooth</td>
<td>See additional handout</td>
<td></td>
</tr>
<tr>
<td>T/NE</td>
<td>Near pulp exposure</td>
<td>See tooth fracture classifications</td>
<td></td>
</tr>
<tr>
<td>T/NV</td>
<td>Non-vital tooth</td>
<td>Tooth ceased to mature-dead tooth</td>
<td></td>
</tr>
<tr>
<td>T/SN</td>
<td>Supernumerary tooth</td>
<td>Extra tooth in the quadrant</td>
<td></td>
</tr>
<tr>
<td>T/SR</td>
<td>Supernumerary root</td>
<td>Tooth has atypical extra root</td>
<td></td>
</tr>
<tr>
<td>T/U</td>
<td>unerupted tooth</td>
<td>Tooth did not erupt-remains in bone</td>
<td></td>
</tr>
</tbody>
</table>
Classifications of tooth fractures
www.avdc.org
EI: Enamel Infraction (Craze lines)
EF: Enamel Fracture (enamel only)
UCF: Uncomplicated Crown Fracture (Does not involve the pulp/crown only)
UCRF: Uncomplicated Crown/Root Fracture (Does not involve pulp)
CCF: Complicated Crown Fracture (Pulp is open)
CCRF: Complicated Crown and Root Fracture (Open pulp both root and crown)
RF: Root Fracture

Tooth resorption
Type 1: Traceable periodontal ligament space, roots not resorbing
Type 2: Periodontal ligament space mostly absent, roots are resorbing (root by root basis)
Type 3: Combination of type 2 and type 1 in same tooth.
TR1: Mild loss of hard tissue * Cementum or cementum and enamel only.
TR2: Moderate loss of hard tissue that does NOT extend into the pulp.
TR3: Deep dental hard tissue loss that does extend into the pulp; most of the tooth remains intact and retains its integrity.
TR4: Deep hard tissue loss extending into the pulp; Most of the tooth has lost its integrity.
TR4a: Both crown and root(s) are equally involved
TR4b: Crown is more severely affected than the root(s)
TR4c: Root(s) are more severely affected than the crown
TR5: Remnants of dental hard tissues are only visible as irregular radiopacities and the gingival covering is complete. (End stage tooth resorption).

References
www.AVDC.org/nomenclature
Pathophysiology

Pain, by definition, is a localized suffering associated with bodily disorder, a basic perceived sensation induced by a noxious stimulus, received by naked nerve endings, characterized by physical discomfort and typically leading to evasive action. Pain can facilitate self-preservation and is a deep-seated natural defense mechanism to prevent bodily harm. This kind of response by the body to a potentially harmful sensation such as burning, pressure or a forceful jolt allows us time to respond quickly and move away from the danger of a harmful object causing the above sensation. This type of pain can be referred to as physiologic pain, and is the result of Adelta (fast) and unmyelinated C fibers which transmit a slower, less intense pain sensation being stimulated through nociceptors, or bare nerve endings at the site of potential injury on the body.3

Somatic pain, a type of peripheral pain involving the joints, muscles or periosteum, can best describe our veterinary patient’s oral pain due to the localized sensation of pain in the mouth and skull structures.3 It can be further described as a sudden sharp jolt, pulsating discomfort or a dull constant pain. When these raw nerve endings or nociceptors are continually activated due to the ongoing insult to the oral tissues through periodontal treatment, root canal therapy, extractions, excision or incision of oral masses, gingivectomy, fracture repair and other invasive dental procedures, clinical pain will be perceived as a result.3 This stimulation causes a response called “wind up” which can produce alterations in the way that the patient responds to even the gentlest touch during recovery from a procedure eliciting this over-stimulation of the Central Nervous System (CNS).4 This response is termed allodynia and is something that we can and should prevent in our patients through the use of a multimodal approach to anesthesia/analgesia.5 This article does not go into a full discussion of multimodal drug protocols used in pre-anesthetic pain relief and prevention plans, these should be referred to in other texts.

The prudent use of local or infiltrative anesthetic drugs and regional, or area specific, nociceptive obtunding techniques should be used to prevent transduction or the conversion of unpleasant stimuli at the site of insult into impulses in the trigeminal afferent nerves, transmission or conveyance of these electrical impulses towards the CNS, modulation which in the case of oral stimulation happens between the neurons from the A-delta and C fibers synapsing with specific neurons in the nucleus caudalis within the medulla of the brain.5 Finally the perception of pain takes place in the cerebral cortex of the brain, and is the true manifestation of conscious pain perception in our patients.3 If this perceived pain is not treated or prevented then hyperalgesia ensues and the pain response increases even into nearby uninjured tissues resulting in further central sensitization or the “wind-up” phenomenon of pain.5

Why use regional anesthesia for dentistry?

The use of regional anesthetics in dental patients has many advantages. These include:

- Extensive analgesia to the targeted tissues thus reducing the quantity of inhalant anesthetic required and the elimination of the “roller coaster” up and down effect if the anesthetized patient perceives painful stimuli.2
- Reduction in the amount of inhaled anesthetic by the patient will lower the incidence of adverse events due to low blood pressure and bradycardia.5
- Prevention of pain can also reduce the time of convalescence through a decrease in the harmful catabolic process, which can hasten tissue healing and prevent a depressed immune response, which decreases the likelihood of infection overall improving patient recovery.3

Drugs used in regional anesthesia such as bupivacaine hydrochloride 0.5% and lidocaine hydrochloride 2% act to affect all three areas of the nociceptive pathway: transduction, transmission and modulation.5 Due to its length of action (3-10 hours) bupivacaine hydrochloride 0.5%, with or without epinephrine, is the most routinely used regional dental anesthetics today in veterinary dentistry.2

Disadvantages of regional anesthesia include

- Potential nerve damage
- Accidental intravenous injection, which can cause cardio- toxicity or arrhythmias with the use of bupivacaine 0.5%. Or as in the case of lidocaine hydrochloride 2% which can be given IV, excessive doses given intravenously can cause CNS or cardiac toxicity.6
- Feline patients have a much lower threshold for drug toxicities. Lidocaine hydrochloride should be only used very cautiously in cats.

Expediting the use of the appropriate regional anesthetic technique will allow adequate time for the onset of drug action prior to any noxious stimulation.
A thorough knowledge of cranial anatomy and foramina used in these techniques is required. The use of a canine and a feline skull can be very helpful as an example to visualize and palpate the target areas on the anesthetized patient. **Regional Anesthetic Drugs and Dosages**

The maximum toxic dose should be calculated every time, for each patient.  
**For Bupivacaine the maximum dose should be calculated at 2mg/kg of patient body weight.**

Each regional block to be performed should have its own pre-determined quantity of drug not to exceed the total maximum volume of anesthetic. Common quantities used are 0.10mL per 10 pounds of body weight. Not to exceed the maximum quantity calculated. Bupivacaine has a delayed onset of action of at least 6-10 minutes and some authorities report even up to 30 minutes, once given in a foramen, but it has duration of 3-10 hours. Regional anesthetics cause vasodilatation, which hastens the reversal of the pain preventative effects due to the added blood supply to the area injected, aiding in the removal of the drug. The addition of epinephrine to bupivacaine will cause vasoconstriction and increases the drugs’ duration of action.

- Products containing epinephrine should not be used in patients with hyperthyroidism or cardiac disease or in conjunction with the use of halothane as and inhalant anesthetic.

**Glossary**

- **Allodynia**- When a normally non-painful stimulus causes a painful response.
- **Analgesia**- Absence of a pain perception.
- **Buccal Mucosa**- Lines the oral cavity facing the cheeks.
- **Central Sensitization**- Hyper-excitability of pain perception. Also referred to as “wind up”.
- **Clinical Pain**- A painful response that is noted by the clinician after ongoing nociceptors stimulation has changed the way the afferent nerve system responds to stimuli from injury.
- **Hyperalgesia**- An increase in pain response caused by local inflammation as a result of noxious stimulation to the area.
- **Mandible**- Lower jawbones separated into a right and left mandible joined by a symphysis.
- **Maxilla**- The bones of the upper jaw structure.
- **Multimodal analgesia**- The use of analgesic drugs from different classes that act in synergism to promote a more complete pain prevention protocol.
- **Nociceptors**- Nerve endings that can be activated by noxious stimuli to transmit electrochemical impulses through the afferent nerve pathways for perception of pain in the brain.
- **Regional Anesthesia**- The use of an anesthetic solution injected into an area at or near a foramen containing a major nerve branch to effectively “block” the pain pathway to a specific region of the mouth.

**Table 1: Infraorbital regional nerve block**

This block affects the bone and soft tissues of the anterior maxilla in that quadrant.

The bony margin of the foramen is palpated just dorsal to the distal root of the maxillary third pre-molar. The needle is then inserted just into the opening using caution to aspirate the syringe in 4 different planes to confirm that a blood vessel has not been punctured, only then should the anesthetic be injected very slowly into the space. Digital pressure over the injected area for 30-60 seconds will further allow the agent to disperse into the canal.
Table II: Maxillary regional nerve block
This blocking technique affects the bone, palatal aspects, soft tissue and all maxillary teeth of the dental quadrant injected.

**Site for maxillary nerve block in a dog.**
The injection site is located dorsal to the last molar at the ventral junction of the zygomatic bone on the maxilla, by injecting the anesthetic agent slowly into this area after careful aspiration to avoid any accidental injection into a vessel you will effectively block pain sensation to all of the maxillary teeth in this quadrant. Great care should be taken not to advance the needle past the intended area due to the location of large vessels and the ocular globe in this area.

Table IV: Inferior alveolar (mandibular) regional nerve block
The tongue, mandibular teeth and soft tissue are affected on the infiltrated quadrant to the symphysis.

The mandibular foramen is easily palpated intra-orally in the dog. It is located just rostral and dorsal to the prominent
angular process on the lingual side of the mandible. Careful intra-oral palpation along with extra-oral injection technique to place the tip of the needle over the foramen will accurately deposit the anesthetic agent to effectively block all ipsilateral mandibular teeth and adjacent soft tissues and tongue.

References

When we think of the words “a dental” which we have commonly come to know as really any dental care that is done under general anesthesia for our veterinary patients, we are really over simplifying what is, or should be, occurring when we undertake professional dentistry for animals.

Dentistry is a large discipline that requires its own specific set of skills, knowledge, correct instrumentation and equipment to accomplish prophylactic and therapeutic treatment. Extensive training and practice by the practitioner are required to ensure the correct methods are used to reduce or eliminate infection and pain in our patients’ mouths.

A thorough knowledge of anatomy and pathology as previously discussed is a starting point for the professional dental treatment of veterinary patients. Only after diagnostic methods have been employed by an oral exam, complete charting of the oral cavity and obtaining dental radiographs, can we determine the extent of the disease and create a treatment plan for the patient. When the diagnostics have been completed then the actual treatment can begin.

If there are no indications of periodontal disease, fractured teeth, tooth resorption, missing or unerupted teeth, supernumerary, crowding, mobile teeth or other situations that will need more advanced treatment, the dental prophylaxis can begin. Prophylaxis, which means the prevention of disease, really can only apply to healthy mouths that need to be thoroughly cleaned of any plaque and tartar to help prevent pathology that may develop if the plaque and bacteria that it contains is allowed to stay in contact with the oral soft and hard tissue structures.

Periodontal therapy requires more involved and invasive treatment of pathology to bring their mouth back to a healthy state. This should be discussed with the client to help inform and increase understanding of why disease has already occurred and why treatment of this disease will require longer anesthetic procedures, possible tooth extractions and dedication to homecare procedures if the client desires to try and save teeth instead of having teeth extracted. Sometimes the periodontium has undergone such destruction that saving teeth even through more advanced methods is simply not a feasible option due to a poor prognosis for the tooth, lack of commitment to homecare or future anesthetic visits, to allow follow-up therapy to be performed.

General anesthesia is required for all veterinary dental patients and should be undertaken with all of the same precautions that would be allowed for any surgical candidate. Pre-operative blood/urine or other diagnostic testing should be performed and interpreted. An estimate for treatment should be presented to the client with a contingency plan for further authorization once the patient is fully evaluated under anesthesia and radiographs have been obtained. Prevention of hypothermia, hypotension or other anesthetic complications should be carefully assessed and steps should be in place to manage the patient as closely as possible to prevent any situations that could be avoided.

A multimodal pain management protocol should be taken into consideration as well, especially if periodontal surgery or extractions are part of the dental treatment plan. The use of regional dental anesthetic blocks is fast becoming a standard of care in oral and dental pain management when painful procedures are to be performed.

Use of a cuffed endotracheal tube is a must to prevent accidental aspiration of fluids or debris from the oral cavity into the airways. This tube should be monitored closely for any obstructions and the cuff should be checked again several minutes into the procedures to ensure a secure seal without causing any trauma to the trachea by over-inflation.

There are several steps involved in the Complete Professional Dental Prophylaxis, these are outlined below and will be discussed in further detail. If the patient is not in the prophylactic category then periodontal therapy and possible exodontics or extraction of diseased teeth will take place. We will discuss the dental prophy first.

15 step oral evaluation and treatment

1. Oral exam on “conscious” patient: Evaluate occlusion as well as all soft and hard oral and facial tissues as much as possible.
2. Take “before” treatment photographs at this time.
3. Oral exam on anesthetized patient: rinse mouth with a 0.12% chlorhexidine oral rinse prior to this evaluation. Gross Calculus may need to be removed to allow for access to soft tissues.
4. Thorough charting and documentation of all oral structures. Attempt to locate any areas of concern or pathology: missing teeth, fractured teeth, periodontal pockets, mobile teeth, extra teeth etc.
7. Perform regional anesthetic blocks at this time if necessary.
8. +/- Periodontal Therapy and Exodontics.
9. Obtain post-extraction or treatment radiographs as indicated prior to suturing extraction sites.
10. Re-evaluate occlusion as necessary after extractions. Extubate and then re-intubate.
11. Clean all dental surfaces both supragingival and subgingival by instrumentation to ensure coronal and root surfaces are completely clean.
12. Polish all crown surfaces with fine grit prophy paste.
13. Irrigate all tissues and the periodontal sulcus with water and gently dry tooth surfaces with air to further evaluate that all areas are clean and free of debris, calculus and polish.
14. Take “after” treatment photographs
15. Optional treatments: Apply sealants such as Oravet™ or Sanos® to dry clean crown surfaces.

**Basic dental instrumentation**

<table>
<thead>
<tr>
<th>Item</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explorer/probe:</td>
<td>Probe/explorer combination (UNC15/23) General use</td>
</tr>
<tr>
<td>Scalers-dog:</td>
<td>Towner/Jacquette Sickle Scaler</td>
</tr>
<tr>
<td>Scalers-cat:</td>
<td>Morse 0-00</td>
</tr>
<tr>
<td>Curettes-dog:</td>
<td>Gracey 1/2</td>
</tr>
<tr>
<td></td>
<td>Barnhart 1/2 Universal curette</td>
</tr>
<tr>
<td></td>
<td>Columbia 13/14 Universal curette</td>
</tr>
<tr>
<td></td>
<td>Columbia 4R/4L Universal curette</td>
</tr>
<tr>
<td>Curettes-cat:</td>
<td>Double ended NV series feline curette (Shorter working end is ideal for cats)</td>
</tr>
<tr>
<td>Sharpening kit:</td>
<td>India slip stone (for reworking instruments), Arkansas stone kit (daily sharpening), stone oil and plastic test sticks.</td>
</tr>
<tr>
<td>Power Instruments:</td>
<td>Ultrasonic scaler of either a piezoelectric, magnetostrictive stack insert or a magnetostrictive type with a ferrite rod insert. This scaler must have a water source to cool and irrigate the working end while in operation. It can be a stand-alone unit that is attached to a pressurized water bottle or integrated into a dental delivery unit that houses a compressor, which uses compressed air to drive the slow-speed handpiece, ultrasonic scaler, high-speed handpiece and air/water syringe.</td>
</tr>
<tr>
<td></td>
<td>Low-speed handpiece: The handpiece is either driven by an electric motor pack or integrated into an air driven dental delivery unit.</td>
</tr>
<tr>
<td>Prophy Angle:</td>
<td>This attaches to the low-speed handpiece and allows a prophy cup to be placed on the working end. This is used to polish the teeth after the cleaning. Disposable angles are important to prevent patient cross-contamination.</td>
</tr>
<tr>
<td>Prophy paste:</td>
<td>These should be single use individual cups of prophy paste, to prevent patient cross-contamination, which when used on the teeth following the ultrasonic and hand instrumentation of the tooth will reduce any microscopic grooves created in the enamel to eliminate a rough, plaque-retentive surface that can be created by scaling and curettage. Fine, medium or coarse grits are available, however it is usually recommended to choose a fine or medium grit paste to prevent removal of too much enamel when polishing and to create a smooth surface. Some prophy pastes contain fluoride so be aware that fluoride can interfere with some restoration procedures and should not be used in these cases on a tooth that will have a restoration performed. Flour pumice is a good choice for those needs. <strong>Do not use a fluoride type of prophy paste if you plan to use Sanos® Sealant on the patient.</strong></td>
</tr>
</tbody>
</table>

Chlorhexidine Oral Solution: This 0.12% chlorhexidine solution is used to irrigate the oral structures to help reduce bacterial aerosolization exposure to the operator and bacteremia to the pet’s bloodstream.

**The fifteen step dental cleaning procedure with/without advanced care**

**Step 1 : The basic oral/facial/skull examination**

This exam should occur in the awake patient. This helps us to create a treatment plan for the client prior to anesthesia. This is just the initial exam however. Please see the notes in the pathology and anatomy section.

**Step 2 : Photographs**

With the use of a digital camera we can take before photos of the oral cavity and hard and soft tissues of interest so that we may offer the client a visual comparison.

**Step 3 : Oral exam on the anesthetized patient**

This is a more thorough evaluation of the oral and facial structures including a complete occlusal evaluation. (Evaluate occlusion prior to the placement of the endotracheal tube on the sedated patient.)
Step 4: Charting:
Thorough documentation as previously discussed is a must in locating any areas of concern or pathology and working towards creating a plan for further diagnostics and treatment. The use of the instrument called the explorer/probe is necessary during this step. Also a dental mirror can further enhance our ability to visualize the areas of concern. Proper lighting and magnification will greatly increase our ease of recognition of oral structure abnormalities. A complete chart that allows full documentation of pre and post treatment with multi-directional views of each tooth will assist in complete and accurate documentation as well. Decontamination of the gross calculus may be necessary at this time to help facilitate correct charting.

Step 5: Radiology
As fully discussed in the radiology notes, this is an important step in further diagnostics and documentation of oral structures and should be obtained prior to commencing treatment. Some prophyl pastes can be seen on radiographs so post-treatment radiographs should be obtained prior to the polishing step.

Step 6: Treatment plan
The creation of a treatment plan for each and every tooth. Paring the clinical findings from the oral examination, documented by charting and the radiographic findings to create this plan. If the plan is to truly perform only prophylactic procedures such as supra and subgingival cleaning and polishing then regional anesthesia and a more complicated treatment plan will not be necessary.

Step 7: Regional anesthetic blocks
These should be performed now and given a few minutes to take effect before more painful stimulus is caused by extractions or subgingival curettage.

Step 8: Advanced periodontal therapy, exodontics, endodontics or other procedures
Prioritize these procedures as directed by the veterinarian.

Step 9: Post extraction radiographs
As indicated by changes to tooth or bone structure these radiographs should be obtained prior to suturing the extraction sites to avoid the need to undo sutures to retrieve root or tooth structure that was inadvertently left behind during the extractions.

Step 10: Re-evaluate occlusion as necessary
This can be an important step if extractions of major teeth were performed to insure that there are no complications from the patients jaws closing more fully or if we are extracting teeth to alleviate any current malocclusion issues.

Step 11: Dental cleaning procedure
If the patient does not require any other procedures as outlined above then step 7 will be omitted. The dental prophylaxis consists of removal of gross calculus and then removal of all dental calculus from the crown surface or supragingival. The use of the ultrasonic scaler to do most of the major work and then the hand scalers to perfect the work are helpful for this.

The ultrasonic scaler, which operates at a vibration range of 18,000 to 45,000 cycles per second, is utilized to break up the calculus or tartar deposits on the coronal surface of the teeth. The handpiece should be carefully held in the hand with a comfortable grip only using the active sides of the instrument’s tip with the handpiece held parallel to the long axis of the tooth.

The instrument tip should be continuously in motion over the surface of the enamel in a cross-hatching pattern. Care should be taken to keep moving on to the next tooth and allowing each tooth to cool down in between sessions of cleaning. Ultrasonic vibrations can generate enough heat that if persistent can cause thermal damage and possible necrosis to a tooth’s vital inner blood and nerve supply. Water spray, in a fine mist, further reduces the heat that is created and should be sufficient and always in use. The water also helps rinse the debris off of the tooth as it is being scaled clean.

Subgingival calculus and plaque must be removed if there are periodontal pockets below the gingival margin. This is a very important step if truly effective dental cleaning is desired. If there is any debris left below the gum line in the gingival sulcus or in a periodontal pocket then the prevention of oral infection and disease will not be accomplished.

The use of curettes which can safely be inserted under the gingival tissues and into periodontal pockets is recommended. Due to the rounded back and toe of the curette, this instrument, which will reduce the likelihood of damage to the attachments at the bottom of the sulcus if used properly, should be used instead of a sharper pointed scaler.

Curettes must be held in a modified pen grasp, a fulcrum should be established, the instrument should be adapted to the surface to be cleaned, the blade of the instrument should be engaged and then the down or cleaning stroke performed. Overlapping strokes in different planes will ensure that the surface that needs to be cleaned will be completely cleaned.

Different variations of dental curettes are available and help with instrument adaption whether working in the most rostral portion of the mouth on incisors or adapting the instrument to caudal pre-molars and molars. Choosing the correct instrument for the area to be curetted is important to successful adaption, effective plaque and tartar removal and prevention of operator injury due to inappropriate handling of the instruments at awkward angles.

Periodontal bactericidal ultrasonic debridement is the final step in ultrasonic cleaning. A specially made periodontal tip insert is required for this procedure or some dental ultrasonic units are already equipped with a tip that can be safely inserted sub-gingivally.
Please consult your ultrasonic equipment manual regarding which tips are safe to insert under the gum line into the sulcus, and at what setting the machine should be turned down to, reducing the frequency of vibrations to a safe level for this purpose. Periodontal bactéricidal ultrasonic debridement occurs due to the ultrasonic sound waves causing microscopic bubbles to form and then implode in the gingival sulcus, cavitation. These implosions can cause the bacterial cell walls to be disrupted and along with the water rinsing through the area at a certain pressure further reduces the concentration of bacteria within the space.1

**Step 12: Polish tooth crowns**

This important step helps to create a smooth, non-plaque retentive surface so that the teeth will remain free of plaque.3 Polishing can remove any plaque that was missed during the scaling and curettage phase of cleaning and helps to remove stains from the enamel.1 This requires that a prophy cup, usually a fairly soft cup, be attached to the working end of a disposable oscillating prophy angle. This is attached to the slow-speed handpiece either on the motor pack dental unit or the air-driven dental delivery unit which rotates at between 1,000 to 3,000 rpm.3 The oscillating disposable prophy angle reduces excessive heat from being generated by rotational forces on the tooth surface and also prevents the patient’s hair from winding around the angle when in use near the patient’s hair on the lip or cheek areas.1 Disposable, one-use prophy paste cups further prevent patient cross-contamination from the alternative of a multi-use large container of paste.1 Metal non-disposable prophy angles can be used but generally are not oscillating and require cleaning and maintenance to keep them functioning correctly.

Ample prophy paste should be applied or rubbed onto the tooth surface via the non-spinning prophy cup prior to commencing polishing. It is the prophy paste and not the cup that does the actual smoothing of any enamel defects so this is an important step. By smoothing the paste on the teeth in quadrants prior to polishing you avoid spraying as much prophy paste around the mouth and onto the operator. The use of prophy paste helps to reduce the friction on the surface and minimizes the heat that is generated as well. The choice of prophy paste will depend upon whether fluoride is desired and the grit of the paste required.1,2,3 Standard paste is either fine or medium grit and usually contains fluoride.3 Course prophy paste can be used to remove stains from the enamel, however it will remove more enamel and also should be followed up by a fine paste as the ending step to polishing.1,2

All coronal surfaces, buccal, palatal or lingual, mesial and distal should be polished in a systematic fashion by starting at the most caudal teeth and working towards the midline or central incisor in each quadrant. The prophy cup should be applied to each surface with only enough pressure to slightly flare the cup out onto the surface and into the gingival sulcus area.1 Thermal damage to the tooth pulp can occur if the oscillating prophy cup is kept on the tooth for more than a few seconds.

**Step 13: Irrigation of sulcus and teeth**

The gingival sulcus is a prime place for left over debris to accumulate after a thorough dental prophylaxis or periodontal therapy has been performed. If this debris is allowed to stay in the sulcus it will act as an irritant and source of further inflammation or possibly even a periodontal abscess in the future.1,3 Potential debris is dental calculus, cellular debris, prophy paste and plaque containing harmful bacteria. We must gently lavage this debris out of the sulcus either by using the three-way syringe on our dental machines to use air and water together to rinse all of the prophy paste and debris from the crowns and sulcus. In addition to this, we may choose to utilize a 6-12 cc syringe filled with a 0.12% chlorhexidine gluconate oral solution and rinse the sulcus around each tooth completely with a 22–28g blunt tip needle or cannula.1,2

**Step 14: Post treatment/cleaning photographs**

These digital images along with images of the dental radiographs if applicable can be shared with the client along with the pre-treatment photos to further illustrate the remarkable difference that dental prophylaxis, periodontal therapy or more advanced dental treatment can make for their pet. These can be printed out in color for the client to take home, shared with the client via e-mail or sent to a specialist for their evaluation if necessary to help facilitate future treatment and care. Photos and radiographs also help us to follow visual changes in the patient’s dental health over time. These serial photographs can really show a client the progression of disease if we neglect homecare or professional cleanings.

**Step 15: Application of dental sealant products or fluoride if indicated: Fluoride foam**

Application of fluoride foam is controversial but may have some benefits to patients, such as decreased tooth sensitivity especially if dentin is exposed on the coronal or root surfaces because it acts to seal exposed dentinal tubules, an anti-plaque and antibacterial effect because it inhibits bacterial metabolism; and it can help the enamel resist decay.1 Cavities in dogs are rare and extremely rare in cats so this may not be a viable reason to apply fluoride in our veterinary patients.1 The down sides to using fluoride are possible toxicity if chronically used in higher than recommended doses and the interference of fluoride with certain restorative, bonding or sealing agents.1,3

If fluoride is applied it should be applied to cleaned, polished, lavaged and dried tooth surfaces. The fluoride foam should be allowed to remain in contact with the enamel or dentin for 3-5 minutes, after that it should be carefully wiped off with dry gauze, do not rinse fluoride foam off with water because it will inactive the fluoride.3
Oravet™sealant
Merial Oravet™ is a non-toxic waxy polymer that is applied to the clean and dry tooth surfaces of both cats and dogs. The professional application is of higher viscosity than the thinner homecare kit. It is the base application for the prevention of dental plaque adherence to the enamel surfaces of the tooth crowns. It should be applied up under the gingival margin on the surfaces of the crown and in the sulcus to prevent plaque from accumulating under the gum line. The manufacturer recommends that the client begin the homecare kit applications two weeks after the initial professional application to keep the thickness of sealant in place on the enamel surfaces.

Sanos®: AllAccem, Inc
Sanos® is a product that was developed to help improve gingival health and prevent periodontal disease by providing a liquid bandage like barrier that when applied to the gingival sulcus stays in place for up to 6 months. It has a V.O.H.C. (Veterinary Oral Healthy Council) label for prevention of plaque and tartar accumulation and it prevents gingival inflammation that may be caused by the plaque bacteria invading under the gingival margin. It is easily applied to clean and dry teeth and gingival sulcular surfaces with the brushes in the kit. It dries quickly and is clear to slightly opaque in color. It is non-toxic and approved for use in both cats and dogs. **Note: If the practitioner plans to use Sanos® on the teeth and gingiva then a fluoride application is not recommended.**

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How to obtain veterinary dental radiographs

When you are first learning how to obtain a radiograph of diagnostic quality it is important to understand the basics of patient, film or digital sensor and primary x-ray beam positioning.

By creating a standard for patient position, sensor position and then the resultant x-ray beam position will become almost standard as well to minimize all of the variables that come into play when getting the angles correct. This creates a method for obtaining dental radiographs that is easy to repeat with each patient.

Remember this formula:

\[ \text{Animal position (A)} + \text{X-ray beam (B)} + \text{Sensor (C)} = \text{Diagnostic image (D)} \]

It is also important to understand how the basic settings on your x-ray unit functions and how to manipulate these settings to obtain the best exposure for that particular patient and teeth to be radiographed.

Each x-ray unit may be a little different however, commonly used modern dental radiographic machines take a lot of the guess work or the necessity of developing a technique chart, out of the process by having a computer aided control panel that has easily set parameters based on the species and tooth to be exposed.

Digital sensors require much less radiation exposure than dental film packets do, so make sure if you are using a digital sensor that you set the exposure time at the appropriate place for a starting point. Slight changes in the exposure time will be made during the whole mouth series when we are x-raying areas with more or less bone and soft tissues since the machine is pre-set at a KVp and MA for dental uses already.

Note

Canine Patients at minimum will need a series of 10 to 23 exposures for a full mouth series, more if the patient is larger or you are using a size 2 digital sensor for large teeth.

Feline Patients at minimum will need a series of eight (8-10) exposures for a full mouth series.

Step 1: Patient positioning: (A)

Positioning of the patient is very important when you are first learning to radiograph oral structures. If you always position the patient the same way when you are obtaining maxillary teeth or conversely mandibular teeth, then the angles that you will use with the primary beam (PID) and the analog dental film, PSP or digital sensor in the mouth, will usually coincide with the patient position.

Placing the patient in ventral recumbency is the best position for all maxillary exposures in the canine and feline patient. Have the patient lie on its chest with the head resting about 3-6 inches above the table top either placed on a 3 x 5 plastic container filled with sand and sealed shut (I recommend a 500mL plastic irrigation saline bottle that has squared sides), this works very well to rest the chin or head of most patients on it to elevate the head up off of the table top surface. The goal here is to make sure that the hard palate is as parallel to the table top surface as possible. Make sure the head is resting as flat as possible on the “container”, the chin should neither be tipped up nor down.

Dorsal recumbency is the preferred position for all mandibular exposures. When you are ready to move the patient to this dorsal position, carefully turn the patient on its back ensuring that you do not twist the endotracheal tube. Try to make sure that the most ventral edges of the mandibles are as close to parallel to the table top surface as possible. This may require that you roll up a small towel and place it comfortably under the patient’s neck to make sure again, that the chin is neither tipped up towards the ceiling or down towards the table top.

Step two: Placement of the digital sensor in the patient’s mouth (C)

The placement of the digital sensor in the mouth is done in a specific way. The flat surface of the sensor is towards the primary beam. The sensor should be placed fully in the mouth with the edge of the sensor at the edge of the crowns in many cases; the cord from the sensor should always be directed toward the front of the mouth and should come out of the mouth towards the nose of the patient in between the mandibular and maxillary incisors.

Step three: X-ray beam angles (B)

When we are exposing the film, phosphor plate or digital sensor to the x-ray beam we want the resultant image to be a true representation of the root and crown structures size and dimensions. Incorrect angulations of the primary beam will distort the image.
much as our shadow is distorted on the ground when the sun “primary beam” is too high overhead or too low towards the horizon. When the primary beam is bisecting the vertical axis of the tooth root or as in the case of the sun beam and our upright body at just the right angle the resultant “shadow” that is cast on the ground (from our body) or on the film, PSP plate or sensor from the tooth structures is just the same height as the tooth (person’s body) in question.

Place the digital sensor in the patient’s mouth at the area to be radiographed with the edge of the sensor at the edge of the crown(s); most of the sensor will be inside the patient’s mouth. We are trying to project the roots onto the sensor so we need plenty of room in which to do that. The sensor will lay from palate to crown naturally, no need to make the sensor flat or parallel to the palate.

Obtaining dental radiographs in the most efficient and quickest way possible is both in the best interest of the patient and the dental provider. This author prefers to start with the maxillary incisors, move on to both maxillary canine views, and obtain all of the pre-molars and molars on one maxillary quadrant and then move on to the opposite maxillary quadrant. Then the patient is rotated to dorsal recumbency; the mandibular canines and incisors are obtained together if possible and then the side views of the mandibular canines and the first and second pre-molars on each side of the rostral mandible in the dog, then the remaining mandibular pre-molars and molars are obtained on each side respectively to finish the whole mouth series on the canine patient. This technique minimizes the changing of the vertical angle of the x-ray beam as much as possible as each exposure is obtained. The feline patient whole mouth series follows the same progression with fewer exposures due to the smaller mouth and fewer teeth to x-ray.

Vertical angle: The angle that can be dialed in on most machines, this controls the length of the tooth as it appears on the resulting digital image.

Horizontal Rotation: This is the movement of the x-ray tube head in a horizontal direction around the patients head. 0 degrees is pointing at the midline of the head from the nose, 90 degrees is pointing at the midline of the head exactly perpendicular to the midline of the head. All other angles are more or less than those two horizontal rotations. Example: 30 degrees, 70 degrees, 110 degrees horizontal rotation.

When exposing the maxillary incisors you will need to adjust the vertical beam to 70 degrees, the cone (PID) of the x-ray unit will fit down right over the patient’s nose in many cases for this exposure. Horizontally the beam will be rotated to point at the midline of the patient’s head at 0 degrees.

Always keep in mind that when you get to the maxillary canine tooth roots that they are at a more horizontal angle and very far back in the patient’s mouth compared to the maxillary incisors. You will need to change the angle of the vertical beam to avoid foreshortening of these roots to 60 degrees. You must take two separate exposures at a horizontal rotation to each side of the face at 70 degrees, this will result in an image of each maxillary canine tooth because you cannot obtain one view and see both root apices clearly due to the probable superimposition of the pre-molar teeth on the roots of the maxillary canine teeth.

All maxillary pre-molars and molars can be obtained with a vertical angle of 45 degrees and horizontal rotation of the beam from 90 degrees for the ‘05’06’07, to 110 degrees horizontal for the ‘08’09’10.

The mandibular canines and incisors can both be viewed in one exposure unless the crowns are desired and then two individual exposures may be required. A nearly parallel technique can be used with the primary beam oriented directly above the tooth roots and the sensor parallel to the roots and the ventral edges of the mandibles and the PID is at a vertical angle of 75-80 degrees and horizontal rotation of 0 degrees.

When exposing only the mandibular incisors, pull the sensor more rostral in the patients’ mouth with the edge of the sensor at the edge of the most coronal aspect of the crowns, again the primary beam will be at 70 degrees vertical and 0 degrees horizontal.

In the feline patient, the zygomatic arch of the maxilla can be superimposed over the maxillary pre-molars, by decreasing the vertical angle to 40 degrees and rotating the beam horizontally to about 80 degrees, just slightly less than the 90 degree mark you will find that the zygomatic arch appears to be more like a ghost over the pre-molar teeth and much easier to interpret.

**Parallel technique**

This is the simplest technique in veterinary dental radiology and is commonly used for the mandibular pre-molar and molarteeth307, 308,309,407,408,409 in the cat and the 407, 408,409,410,411,308,309,310,311 teeth in the dog. The digital sensor is placed in the oral cavity with the patient in dorsal recumbency. The sensor is as close to parallel to the tooth/teeth roots as possible. This allows us to focus the primary beam at a more perpendicular angle directed right through the bone/teeth at the sensor and get an image that closely represents the true size and dimensions of the structures without elongation or foreshortening.

By adjusting the angle of the primary beam slightly up (the patient is in dorsal recumbency) over the mandibular bones at 40 degrees and slightly caudally or distally in a modified oblique position you will have much success in obtaining all of the roots on your mandibular exposures in the feline patients. You should have teeth 307,308,309 in one exposure and teeth 407,408,409 in the other exposure for each mandibular quadrant.

Some more difficult exposures to obtain such as the 310,311 or 410,411 molars in dogs require a similar adjustment to the primary beam at 10 degrees with a distal tube shift to 100 degrees horizontal rotation, when you can only push the sensor so far back in the patients’ mouth due to limitations caused by bony structures or soft tissues. It is very important that the sensor follow the mandibular bones caudally so that the resulting image is strait and the last molar tooth is visible.

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S.L.O.B. rule
Whenever we are obtaining exposures of teeth with multiple root apices we need to be able to differentiate one root from another root. Superimposition of one root on top of another root hinders our ability to make diagnostic decisions for that tooth.

There is a rule that helps us to obtain a radiograph of a tooth such as the maxillary fourth pre-molars #108 and 208 in the cat and dog and to shift the image such that the mesial-buccal root and the palatal root are no longer superimposed upon one another.

Same Lingual Opposite Buccal means that when we shift the primary beam from being at a direct angle focused on one tooth to an oblique position going through the tooth/roots to the sensor, the palatal tooth root will follow the shift of the primary beam. The palatal tooth root can be described as lingual since it is more toward the tongue, so that is why the word “lingual” is used in this rule.

The most common method is to take the primary beam and shift it to 110 degrees caudally or distally. The resultant image will show the distal root where it is in a caudal location, the palatal root will now be in the middle and the mesial/buccal root will be the most rostral on the sensor’s resulting image. Conversely if the beam is shifted horizontally to 70 degrees rostrally then the resultant image will show the palatal root in the most rostral position, the mesial/buccal root in the middle and the distal root will be superimposed over the first molar position.

Keeping the patient in a constant position while obtaining all of the maxillary views with a standard setting for the vertical x-ray beam and ensuring that the sensor is in the correct position in the patient's mouth to accept the image that we are projecting toward it is a very simple and repeatable concept. Check to make sure the patient is in the same position with every exposure, and then setting the patient into a standard position in dorsal recumbency for the mandibular views will greatly speed up the efficiency and accuracy of obtaining diagnostic dental radiographs.

Diagnostic image (D)
What is a diagnostic image?
There are some basic requirements for our images of dental structures to be diagnostic. For every image obtained ask yourself these questions.

1. Did I get the tooth or teeth desired on this image?
2. Did I get 100% of the root structures of these teeth on the image?
3. Did I get at least 3mm of bone visible around each apex of each root on the image?
4. Did I get at least 3mm of crown structures beyond the horizontal margin of alveolar bone?
5. Is the image the correct length? Did I elongate or foreshorten the tooth structures?
6. Is the exposure correct? Is the image too dark or too light?
There are several tests that can be used to check the anesthesia machine and rebreathing systems for leaks, some of them test different parts of the machine and others only test for 1 or 2 components. Below is a list of most commonly used leak tests.

1. **Anesthesia machine tests**
   These tests can identify leaks in the anesthesia machine (flowmeter, vaporizer, machine tubing…) but do NOT test the breathing system components (breathing tubes, reservoir bag, unidirectional valves, canister…).

   **a. Negative pressure test or universal test**
   You will need a squeeze bulb leak tester (Fig. 1). This can be bought or easily made using a sphygmomanometer bulb and reversing the air inlet valve in the bulb. When reversed, the valve will pull air from the anesthesia machine creating a negative pressure (see below step-by-step procedure).
   The bulb is then connected to a short tubing with a 15-mm connector (can use an endotracheal tube adaptor) at the other end.
   - Make sure the O2 flowmeter is turned off. If the anesthesia machine has a minimum mandatory flow, close/disconnect the O2 source.
   - Disconnect the fresh gas line and connector from the common gas outlet (you will not test the breathing system components with this test!)
   - Connect the 15-mm connector to the common gas outlet of the anesthesia machine.
   - Squeeze the bulb several times, until it stays collapsed.
   - If the bulb stays collapsed for 10 seconds, there is no leak.
   - If the bulb inflates, there is a leak.
   - Repeat these steps with the vaporizer on.

   **Figure 1. Squeeze bulb leak tester connected to the common gas outlet**

   **b. Positive pressure test**
   This test can only be used for machines that don’t have a minimum mandatory flow. The pressure used during this procedure CANNOT increase beyond the prescribed limits (see below step-by-step procedure), since there is only little room for compression in the machine tubing and high pressures can damage flowmeters and other components.
   - Connect a pressure gauge manometer to the common gas outlet. You can use the manometer from a sphygmomanometer (Fig. 2).
   - Slowly open the flowmeter until the manometer reads 30 cmH2O (22 mmHg).
   - Turn flowmeter off.
   - If the indicator of the manometer stays at 30 cmH2O, the machine passes the test.
   - If the indicator moves back to a lower pressure, there is a leak.
   - To quantify the leak slowly turn on the flowmeter until the indicator of the manometer stays still at 30 cmH2O.
   - The flow of O2 that allows to maintain this pressure represents the leak.
   - If this leak is 50 ml/min or less, the machine still passes the test.

   **Figure 2. Pressure gauge manometer connected to the common gas outlet**

   **c. Fresh gas line occlusion**
   - Set O2 flow at 50 ml/min.
   - Kink the fresh gas line.
   - The flowmeter indicator should move downward (no leak)
   - If the flowmeter indicator doesn’t move, the machine does not pass the test.

2. **Combination of breathing and machine leak tests**
   **a. Retrograde fill test**
   - Close the APL valve and the patient port of the breathing system using your hand.
   - Fill the reservoir bag using high O2 flow by opening the flowmeter or using the flush valve.
   - Pressurize the system to 30 cmH2O (pressure gauge manometer).
• Turn the flowmeter of is used it to fill the reservoir bag and pressurize the system.
• If the indicator of the manometer stays at 30 cmH2O, the machine passes the test.
• If the indicator moves back to a lower pressure, there is a leak.
• To quantify the leak slowly turn on the flowmeter until the indicator of the manometer stays still at 30 cmH2O.
• The flow of O2 that allows to maintain this pressure represents the leak.
• If this leak is 350 ml/min or less, the machine still passes the test.
• To test for leaks in the vaporizer, repeat these steps with the vaporizer on.
• To release the pressure open the APL valve and do not remove your hand from the patient port. Reasons:
  • You will also test that the APL is working
  • You won’t release inhalant in the room (remember you test the machine with the vaporizer on as well)
  • You will prevent a quick drop of pressure in the anesthesia machine (better if this occur gradually)
  • Dust from the CO2 absorbents will not go into the rebreathing corrugated tubes and, potentially, into the patient’s airway.

When a leak is suspected, the components of the machine and the breathing system should be checked, following the route of gas travel. A leak can be located by placing some alcohol and the hands and moving them over the components while the O2 is flowing. Alternatively, soapy water can be sprayed over the components while the O2 is flowing. Bubbles from the soapy water will reveal the leak (and you also cleaned the anesthesia machine!).

b. Squeeze bulb test
• Make sure the O2 flowmeter is turned off. If the anesthesia machine has a minimum mandatory flow, close/disconnect the O2 source.
• Remove the reservoir bag and connect a suction bulb with a 22-mm connector to the reservoir bag mount.
• Close the APL valve and the patient port of the breathing system using your hand.
• Squeeze the bulb repeatedly until the pressure reaches 50 cmH2O.
• If the pressure drops from 50 cmH2O to 30 cmH2O in 30 seconds or longer, the leak is acceptable.

3. Unidirectional valve tests
These tests only check for competency of the unidirectional valves (inspiratory and expiratory valves). The rebreathing tubes can be removed before performing these tests.

a. Valve tester
You will need a bulb with a 22-mm female connector for this test.

Inspiratory valve
• Compress the bulb and connect it to the inspiratory port.
• The bulb should immediately reinflate.
• When you compress the bulb (still connected to the inspiratory port), you should meet firm resistance.

Expiratory valve
• Connect the bulb (inflated) to the expiratory port
• Squeeze the bulb.
• The bulb should collapse easily and should remain deflated.

b. Pressure decline method
You will need a second reservoir bag to preform this test.
• Place one reservoir bag on the reservoir bag mount.
• Place the second bag on the inspiratory port.
• Close the APL valve.
• Pressurize the system to 30 cmH2O using the O2 flush.
• If the reservoir bag on the mount remains inflated, the expiratory valve is competent.
• Now open the APL valve.
• If the reservoir bag on the inspiratory port remains inflated, the inspiratory valve is competent.
Marijuana is formed from the dried leaves and tops of the hemp plant (Cannabis sativa) (Svienska 2008). Marijuana has been a part of recreational, religious and medical activities of a variety of cultures for over 5000 years (Krietzer 2009; Burns 2006). Indeed, it was among the most commonly prescribed medications in the United States Pharmacopeia until declared illegal in the 1930s. It subsequently has been declared a controlled substance, Class I: No currently accepted medical use and a high potential for abuse. However, particularly with the legalization of medical marijuana in several states, this classification clearly no longer applies and Schedule II status is being promoted by advocates (High potential for abuse, but less than Schedule 1, with sever pycologocial or physical dependence; considered dangerous, but significant clinical indication). The potential efficacy of marijuana for control of pain has led to a passage of laws allowing medical use in several states. This, in turn, has stimulated a flurry of scientific activity in an attempt to provide evidence for medical use of marijuana. Not surprisingly, pet owners have also been engaged in the conversation, with a potentially legitimate reason for administering marijuana. Not surprisingly, however, most of the scientific information generated as evidence is intended to support human, rather than veterinary use. To understand the allure of marijuana, and specifically if its promise of relief from what ails our pets is hype or hope, one must understand the plant.

Marijuana ingredients
Marijuana is a pharmacologically (and toxicologically) diverse herb. Cannabis contains at least 480 unique compounds, with their presence varying with the plant product. Plant products include, in addition to marijuana, hashish and hashish oil, formed from the resin secreted by the plant. It is important to note that the amount of any one compound in the hemp plant can vary markedly, depending on the plant part. The most well known of the compounds in the hemp plant are the cannabinoids, a term used to refer to a terpenephonic compounds. The discovery of cannabinoids led to the recognition of the endocannabinoid system with endogenous cannabinoids. Since their discovery, both by pharmaceutical companies and substance abusers have synthesized synthetic compounds. “Phytocannabinoids” is thus used to refer to those occurring in the plant whereas “endocannabinoids” refers to endogenous and synthetic chemicals. Endocannabinoids also appear to be important as neuroprotectants (e.g., antioxidants, inhibition of calcium influx and excessive glutamate production), for example, that associated with CNS ischemia or hypoxia, or the presence of neurotoxicants. These effects appear to be mediated predominantly by CB1 (located particularly in the dorsal horn of the spinal cord) although CB2 also plays a role, depending on the tissue (Svienska 2008). Cannabinoids also inhibit neuroinflammation (see therapeutic indications).

Close to 70 phytocannabinoids, divided into 10 classes, have been identified in the hemp plant, and particularly marijuana. Table 1 lists those associated with presumed therapeutic use (Brenneisen Ch. 2). Among the cannabinoid compounds found in marijuana, THC is the most pharmacologically and toxicologically relevant, and the most understood. It is THC that is responsible for most of the natural effects of the Cannabis plant. It acts by binding to the CB-1 receptor. CBD is the next “best” phytocannabinoid. In addition to its anxiolytic effects, it also reduces unpleasant side effects, primary due to potent inhibition of cytochrome P450 3A11 which otherwise would metabolize THC to much more potent psychoactive compounds.

In addition to the cannabinoids, marijuana contains approximately 140 different terpenoids which are responsible for its scent. The terpenoids yielded from a marijuana plant depend on the type of Cannabis (based on drug or fiber content), the part of the plant, its sex and age, whether or not it is cultivated in or outdoors, when it is harvested and the conditions at harvest, and how it is dried and stored. The serotonergic effects of marijuana (5-HT1A and 2A) may reflect the impact of these essential oils, contributing to analgesia and mood modification. Other components in the plant include nitrogen containing compounds (n = 70: alkaloids, amines); carbohydrates, including common monosacharides (n=13: fructose, glucose, mannose), selected disaccharides (sucrose, maltose), and several polysaccharides (eg, cellulose, pectin) as well as several sugar alcohols (n = 12; mannitol, sorbitol, glycerol). A number of flavonoids also are present (n=23); among them, apigenin has a wide variety of effects, including interaction with benzodiazepine receptors, resulting in an anxiolytic effect. Other ingredients include fatty acids (n=33) and others.

The target: Cannabinoid receptors
The endocannabinoid system is comprised of eicosanoid cannabinoid [CB; protein g coupled, negative to adenylyl cyclase] receptors [CBr], their endogenous ligands and the enzymes responsible for their synthesis and degradation. This system as a known contributor to physiology has been recognized for only about 25 years old. In general, the system contributes to homeostasis (Relax, Eat, Sleep, Forget and Protect;; McParland 2014 At least two CBr have been identified in many species, including the dog. CB1r occurs in the brain but also occurs in some peripheral tissues (cardiovascular, reproductive, gastrointestinal). They are responsible, in part, for central and peripheral regulation of food intake, fat accumulation and lipid and glucose metabolism. The dopaminergic reward pathway is stimulated by CB1 receptors, motivating eating, smoking and substance abuse. CB2r are located principally on immune
cells, but this includes microglia. CB2 also is located on neurons where it may be associated with cell differentiation (Svizenska 2008). In the CNS, CBr are suggested to influence neurotransmitter release. At least 5 endogenous cannabinoids have been described, with anandamide (CB1 and 2 agonist, but higher affinity for CB1) being the most thoroughly studied. It is synthesized by postsynaptic neurons, acting as a retrograde messenger to influence neurotransmitter, and particularly GABA, release. It is extremely unstable, being rapidly hydrolyzed to ethanolamine (an antimistamine) and arachidonic acid. Cannabinoids are able to disrupt short-term memory, impair cognition and time perception, alter mood while enhancing body awareness, discoordination, sleepiness, and reduce attention focus and the ability to “filter” irrelevant information.

As with many CNS active drugs, marijuana is associated with both tolerance (higher concentration needed to impart a similar pharmacologic effect) and withdrawal (a clinical syndrome of nervousness, tension, restlessness, sleep disturbance and anxiety). However, the long elimination half-life of the most active ingredient, THC (and others) appears to preclude a clear cut abstinence syndrome (Svizenska 2008). As with other addictive agents, laboratory rodents have been demonstrated to self medicate, suggesting an addictive component. It is important to note that although interaction with cannabinoid receptors is unique among plants to hemp, other receptors are also targeted (as noted above: benzodiazepines, serotonin, others). Cannabinoid deficiency has been linked as an etiology of many illnesses: (“eCB deficiency syndrome”) as an etiology in migraine, fibromyalgia, irritable bowel syndrome, psychological disorders, and others (McParland 2014).

Cannabinoid receptors have been studied in a limited fashion in dogs. Initial studies focused on relevance to humans and provide evidence that dogs may react with unique behaviors.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Proposed Therapeutic Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBGA (cannabigerolic acid)</td>
<td>Antibiotic</td>
</tr>
<tr>
<td>CBG (cannabigerol)</td>
<td>Antibiotic, antifungal, Antinflammatory, Analgesic</td>
</tr>
<tr>
<td>CBC (cannabichromene)</td>
<td>Antibiotic, antifungal, Antinflammatory, Analgesic</td>
</tr>
<tr>
<td>CBDA (Cannabidiolic acid)</td>
<td>Antibiotic</td>
</tr>
<tr>
<td>CBD (Cannabidiol)</td>
<td>Anxiolytic, antipsychotic, analgesic, anti-inflammatory, antioxident, antispasmodic</td>
</tr>
<tr>
<td>CBN (Cannabinol)</td>
<td>Sedative, antibiotic, anticonvulsant, anti-inflammatory</td>
</tr>
<tr>
<td>THC (delta-9-tetrahydrocannabinol; delta-8 to a lesser degree)</td>
<td>Euphoriant, Analgesic, Anti-inflammatory, Antioxidant, Antiemetic</td>
</tr>
<tr>
<td>THCV</td>
<td>Analgesic, euphoriant</td>
</tr>
</tbody>
</table>

**Medicinal marijuana (?)**

The proposed indications for medical marijuana have included, but are not limited to behavioral, sleep and gastrointestinal disorders, neuroprotection, antispasmodic but prokinetic, anorexia, nausea, glaucoma, diabetes, immunosuppression, malaria, anti-inflammatory and, of course, pain (Table 1, Izzo 2009). However, other potential indications have included A proposed advantage of medical marijuana compared to a single drug (e.g., dronabinol, a synthetic THC [Marinol®]), iis the multiple compounds contained in the plant. Two advantages are offered: 1. The compounds might act synergistically (a “synergistic” shotgun) to provide an enhanced desired pharmacologic effect while 2. at the same time, mitigating (one compound acting on another) undesirable effects. However, evidence for a synergistic benefit is lacking based on the lack of differences when THC is consumed as marijuana, versus Marinol® (humans). (Brenneisen 200X). Presumably, because marijuana contains so much THC, it may not be the most effective portion of the plant and it may contribute to more side effects (hence the question mark for this section; see also Marijuana and pets). Note that some plants may be designed to contain more or less of a specific target compound.

**Pain and inflammation/Immunomodulation**

The capacity for cannabinoids to control pain is among the most studied responses. They are effective in both acute (phasic) and chronic (tonic) pain. They peripherally and centrally modulate processing of nociceptive signals. They act as antihyperalgesics. CBD has demonstrated efficacy in experimental models; the effects also appear to involve transient receptor potentials (Izzo 2009). CBD also influences T-cells, causing a generalized immunosuppressive effect. A number of mechanisms of immunomodulation have been proposed, including altered interleukin or tumor necrosis factor production or release, neutrophil migration, production of specific antibodies, etc. Arthritis and psoriasis are among the chronic inflammatory diseases in humans for which CBD has demonstrated or is suggested to have some potential efficacy.
Epilepsy
Experimentally, CBD attenuates experimentally-induced seizures in animals; this may reflect reduced calcium fluxes (Izzo 2009). THCV also has been associated with some anticonvulsant effects by virtue of its inhibitory effects on CB1.

Anxiolytic
These effects have been demonstrated in healthy human volunteers (Izzo 2009). CBD exerts benzodiazepine independent effects, possibly by activating post synaptic 5-HT1A receptors.

Neuroprotection
CBD is an antioxidant and as such has been proposed for treatment of Alzheimer’s disease, Parkinson’s disease and Huntington’s disease. Restoration of calcium homeostasis may prevent apoptosis (Izzo 2009). In rodents, CBD reverses brain damage associated with ischemia.

Anti-Emesis/appetite suppression
Again, CBD has been demonstrated in animal models to be effective for the control of vomiting otherwise not responsive to 5-HT-3 antagonists. THCV and synthetic CB1 antagonists decrease food intake.

Diabetes mellitus
CBD inhibits development of diabetes in non-obese diabetic mice, including ameliorating clinical signs of disease. This appears to reflect, in part, control of pancreatic inflammation, but also reduction of oxidative stress in target tissues (eg, retina).

Bone formation
A number of cannabinoiods (essentially all in Table 1) stimulate mesenchymal stem cells responsible for bone formation and fracture healing. CBD also controls bone resorption, reducing bone loss (Izzo, 2009).

Cancer
A number of the cannabinoids (all in Table 1) have antiproliferative-anti apoptotic effects in a number of tumor cell lines. The National Cancer Institute has a link describing ongoing studies. [http://www.cancer.gov/about-cancer/treatment/cam/patient/cannabis-pdq](http://www.cancer.gov/about-cancer/treatment/cam/patient/cannabis-pdq)

Antimicrobial: CBC and CBG have demonstrated potent antibacterial effects towards selected microbes, including methicillin resistance staphylococci (MIC of 0.5 to 2 mcg/ml).
Finding evidence to support either the negative or positive effects of cannabis can be difficult because such information is often tainted with emotionally-mediated opinion. PRO-CON ([http://medicalmarijuana.procon.org/view.resource.php?resourceID=000881](http://medicalmarijuana.procon.org/view.resource.php?resourceID=000881)) is a useful site that provides links to evidence using a categorical approach, as well as information on approval status among the states.

Designer cannabinoids
Several approaches are currently underway to bring cannabinoids to the medical arena. Hybrids typically of *C. indica* or *C. sativa* are developed with the intent of generating specific combination of properties designed for a specific purpose. [http://www.leafly.com/hybrida](http://www.leafly.com/hybrida) is a website that delineates over 550 different strains, each with a differing combination of attributes.

Approved products:
Several products are undergoing regulatory approval either in the United States or other countries. In general, these products are either concentrated forms of a single cannabinoid, or a synthetic variation of one with THC and CBD the primary compounds. In the US, Dronabinol (THC) is undergoing approval as an appetite stimulant for AIDS or cancer patients and Nabilone (THC-like) for control of vomiting in patients, reducing bone loss (Izzo, 2009). nabiximol is a combination of THC and CBP (1:1) undergoing approval for treatment of spasticity associated with multiple sclerosis and epilidx is a synthetic CBD analogue undergoing phase 1 clinical trials for treatment of pediatric epilepsy.

Synthetic Cannabinoids. An increasing problematic issue is the synthesis of cannabinoids. Modification of an R group on the cannabinoids that does not alter the psychotropic effects results in a compound that is not in the list of illegal drugs. Such products are sold in a variety of stores as “non-illegal substances” under names such as “spice” and other names. The DEA has passed emergency laws that are intended to make illegal the sale of any compound that is based on modification of cannabinoids. However, testing of such products is difficult because of the ease with which chemical modifications are made.

Regulatory considerations
In 1937, as the prohibition on alcohol ended, rather than focus on the potential benefits of the cannabis plants, the US government chose to prohibit it. In 1996, California ended this prohibition with the Compassionate Use Act which provided for the use of medical marijuana. Many states have followed suit, with two states legalizing marijuana for recreational use. [http://www.governing.com/gov-data/state-marijuana-laws-map-medical-recreational.html](http://www.governing.com/gov-data/state-marijuana-laws-map-medical-recreational.html) Currently, at least 24 (PRO-CON). States have approved marijuana in some form. According to NORML ([http://norml.org/states](http://norml.org/states)), a site dedicated to law reformation, 34 states have some type of conditional use, 15 states of decriminalized use, 14 states of medical marijuana laws. However, throughout the US cannabis is a controlled 1 substance meaning it has a high risk of abuse potential and no recognized medical benefit. Cannabidiol, the major cannabinoid other than THC often cited for medical use also falls under the same category; potentially, sale of products containing less than 0.3% CBD is allowed, although this was not confirmed by the DEA. 10 different pharmaceutical *cannabis* products (including synthetic) are undergoing some level of approval ([http://medicalmarijuana.procon.org/view.resource.php?resourceID=000883](http://medicalmarijuana.procon.org/view.resource.php?resourceID=000883)) which begs the question regarding medical benefit.
Marijuana and pets
Regulatory issues regarding the use of medical marijuana in pets are unclear and likely to remain as such for some time. Legalization in states has yet to include veterinary medicine. As such, most of the information surrounding marijuana and pets is from a toxicologic standpoint. THC is among the compounds cited as a toxicologic hazard in detection (police) dogs (Llera 2008). It is the most common drug to which detection ogs are exposed. Both dogs and cats may become intoxicated with smoke inhalation as well as ingestion of food containing marijuana (or hashish). It is absorbed rapidly following either oral or inhalant administration with clinical signs evident within 30 to 60 minutes of ingestion, although one reference (Osweiler 2008) indicates onset as long as 12 hours after exposure. Cannabinoids of medical significance appear to undergo first pass metabolism and as such, the risk of toxicity with inhalant products is much greater. The implication for medical use is that oral administration may not be cost effective. The drug is eliminated by hepatic metabolism and biliary excretion with elimination being complete in 5 days in dogs; duration of toxicity ranges from 30 minutes to 3 days, but 18-24 is the average. Enterohepatic circulation contributes to the prolonged half-life. The most common signs of toxicity following ingestion in dogs include tachycardia, hypotension, depression, ataxia, vomiting (inducing emesis is not recommended in clinically depressed dogs because of the risk of aspiration), altered behavior, bradycardia, hypersalivation, weakness, hypothermia and seizures. Legalization of medical or recreation marijuana among the states is likely to be associated with an increased incidence of toxicity, with a 4 fold increase cited in one study (Meola 2012). Treatment is largely supportive, with sedation with benzodiazepines or phenothiazines as needed. Antiemetic therapy may be indicated.

Among the approaches that veterinarians can take regarding the use of medical marijuana in animals is the use of “legal” (“non-illegal”) hemp-based products. For example, commercially available dietary supplement purportedly consisting primarily of hemp stem are being marketed for dogs. Because the stem contains very little THC but a high proportion of CBD and other non-psycotropic cannabinoids, as well as flavonoids, terpenoids and other potentially beneficial compounds, product claims include effective analgesia without psychotropic effects. While such a product is more appealing than marijuana as an analgesic, neither data supporting efficacy nor safety nor quality assurance data is thus far available. No data exists regarding the efficacy of any portion of the hemp plant as an analgesic, or for other therapeutic indications in companion animals.

References
This presentation will start by discussing the origins of physical therapy and rehabilitation.

- **Human Physical Therapy**
  - Treating the soldiers of World War I (1914-1918)

- **Equine Rehab**
  - 1960’s

- **Equine and Canine Rehab**
  - Mainstream in Europe and UK by 1980’s
  - University of Tennessee - 1998
  - Canine Rehabilitation Institute - 2003
  - American College of Veterinary Sports Medicine and Rehabilitation - 2010

We will then discuss the who, what, when, where, why and how of rehab, including how to incorporate it into your practices.

**Who can practice rehab?**

Each practitioner must check with the individual state practice acts to determine what level of training is necessary to practice on animals. Veterinarians, licensed/registered veterinary technicians, physical therapists may all be eligible to work with animals pending the state. Additional training is necessary to understand the disease processes, modalities, manual techniques and manual therapies that are essential to proper rehab.

This training can be accomplished through certification programs at the Univ of Tennessee (utcaninerhab.com) or the Canine Rehab Institute, or the Healing Oasis. Additionally there are veterinary sports medicine and rehabilitation residencies (VSMR.org) for veterinarians and a VTS for Rehab being developed (APRVT.org).

**Who needs rehab?**

Dogs, cats, horses, goats, swans, all animals. The focus of this talk will be on canine and feline patients. From that subset, identifying patients with orthopedic (OA, CCL, etc), neurologic (IVDD, FCE, Degen Myelopathy), or obesity, sporting dogs, law enforcement dogs can all benefit from rehabilitation.

**What’s involved in rehab?**

Training, reading (textbooks, journal articles) a working knowledge base of veterinary medicine and good communication are involved in having a successful rehab program. Some items you may already have in your clinic. (NSAIDs, chondroprotectants, additional pain medications, ice packs, warm compresses, towels, LASER, microwave, bedding. Additionally items such as hydrocollators, goniometers, gulluck tape measures, cavaletti rails, underwater treadmill, land treadmill, balance equipment may be needed.

**What am I looking for in my rehab eval?**

A full physical exam must be done, along with medical record review. The rehab eval has a particular focus on the orthopedic and neurologic systems. A gait assessment is done, along with a standing and recumbent physical exam and palpation.

Equipment such as stance analyzers, dynamic gait analysis, force plate and digital thermal imaging can also be used in the initial assessment. Measurements of flexion/extension (goniometry) and girth measurements of the limbs should also be done.

Additional diagnostics such as CBC, Chem, UA, thyroid may be needed. Imaging becomes very important with rehab, and can include sedated radiographs, MSK ultrasound, CT and MRI.

**What are the goals of rehab?**

- To limit pain
- To return to normal function where possible
- Reduce recovery times
- 3 phases
  - Control pain
  - Improve strength
  - Maintain/return to function
What are the modalities used in rehab?

1. Thermotherapy – The use of hot and cold. This can be accomplished with hot packs, cold packs, cold compression systems. It is the author’s preference to never use electric heating pads since the risk of thermal injury can occur.
   a. Benefits of heat: Vasodilation, pain relief, increase blood flow, warm up tissue before stretching,
   b. Benefits of cold: Vasocostriction, decrease blood flow, anti-inflammatory
2. Neither should be used over cancer or pregnancy. Caution should be used over metal implants.
3. Therapeutic ultrasound – the use of sound waves to heat deeper tissues than what can be reached with warm compresses. These are especially helpful in large dogs, or areas such as quadriceps contracture, fibrotic (gracilis) myopathy and other large tissues that need to be heated and then stretched.
4. Electrical stimulation – can be broken down to NeuroMuscular Electrical Stim (NMES) and TransCutaneous Electrical Stim (TENS). NMES is used to mimic muscle contracture and TENS is used to provide short term analgesia.
5. LASER – Light Amplification by Stimulated Emission of Radiation. The appropriate therapeutic (not cutting) laser device can work on a cellular level to activate cytokines and aid in cellular healing and provide analgesia. It is important to always use safety goggles for both the team members and the patient when using laser.
6. Therapeutic exercises – working with cavaletti rails, inflatable balls, discs, peanuts to prepare a patient for returning to function and focusing on core strength are very important. This becomes similar to occupational therapy in the human end. Simple exercises such as sit to stands, weight shifting and limb unloading can allow the rehab therapist to strengthen the patient for a proper return to function
7. Land treadmills – Can be useful devices for providing exercise. Small and medium dogs will work well on a human machine, but larger dogs will benefit from a canine treadmill. This is due to stride length and length of the belt. Having the dog walk on an incline will help build up the pelvic limbs.
8. Underwater treadmills – Can be used as both a diagnostic and therapeutic tool. The buoyancy of water will allow severely paretic animals to utilize their limbs. There are also studies showing the benefit of underwater treadmill therapy for reducing obesity in dogs. With water at the level of the hock, there is a 9% reduction in perceived body weight, a 15% reduction with water at the stifle, and 62% reduction when at the greater trochanter. The non-slick, safe, contained surface an underwater treadmill provides is superior to walking in ponds, lakes or swimming in pools, in the author’s opinion.
9. Carts, orthoses and prostheses can all provide valuable mobility and independence. Over the counter and custom options are available for all of these. Proper consultation with professionals trained in this area is recommended.
10. Other modalities can include disease modifying OA agents, hyaluronic acid, regenerative medicine (platelet rich plasma, stem cell), shockwave therapy, surgery (minimally invasive when possible) acupuncture, herbal therapy, massage, joint mobilizations and chiropractic care can all be considered for a rehab patient. Many of these require extensive training to be proficient at.
11. Nutrition is also important in rehab. There are technician training programs through the food companies (Hills, Purina) and also a VTS in nutrition. Consultation with a boarded veterinary nutritionist for challenging cases is recommended.

When are you finding rehab patients?

In all exams that you do. Any patients on long term OA meds, those patients with obesity, IVDD, FCE can all benefit. Doing a full physical examination on every patient will yield more patients for the rehab service. Annual exams, finding joint effusion, muscle wasting and painful areas can start conversations about diagnostic workups and rehab therapy. It is very important to know your normal, so that you know what is abnormal. Studies have shown up to 20% of all dogs have arthritis. That along with obesity and neurological conditions provides an ample supply of patients that could benefit from rehab.

In the author’s practice, he sets aside 60-90 minutes for initial consults, and 30 minutes for recheck exams. Rehabilitation sessions will last 60-90 minutes, and will be 2-3x a week pending the diagnosis. The rehab sessions are usually with licensed veterinary technicians with certification in rehab. Owners can stay for sessions or drop off to run other errands.

The majority of patients seen in the author’s experience will benefit from outpatient therapy and “homework” – written and demonstrated instructions for exercises to do when not at the clinic. Some patients will need inpatient therapy (large breed paraparetic or tetraparetic patients as an example) until they can be properly cared for in a home setting.

Where do we do rehab?

A brief discussion of utilizing appropriate space for consults, therapeutic exercises and and other modalities will be discussed.
Why and how?
A big picture approach will be discussed. The benefits of rehab to the patient, client, clinic and practitioner will be discussed.
If time allows, 2 case studies will be briefly presented.

Selected references
Bockstahler B, Levine D, Millis D, Essential Facts of Physiotherapy in Dogs and Cats: Rehabilitation and Pain Management, BE VetVerlag, Germany, 2004
Adrenal function tests

1. Three tests used to diagnose hyperadrenocorticism.

A. ACTH stimulation test

1. Look for exaggerated cortisol response to ACTH.

2. See protocols at the end of this discussion.

3. Diagnostic in 85% of pituitary-dependent cases (PDH)

4. Diagnostic in 70% of adrenal tumors (AT)

5. Overall accuracy 80-85%

6. A suppressed response to ACTH in animals with clinical signs of hyperadrenocorticism suggests iatrogenic disease.

B. Low-dose dexamethasone suppression test

1. Low doses of dexamethasone inhibit ACTH release from the pituitary via negative feedback and decrease plasma cortisol concentrations in normal dogs.

2. Dogs with Cushing’s are more resistant to steroid suppression. Therefore, lack of suppression following dexamethasone = hyperadrenocorticism.

3. Diagnostic in 95% of PDH

4. Diagnostic in 100% of AT

5. Overall 90-95%

6. May also be used to distinguish PDH from AT (see below)

7. See protocols

C. Urine cortisol/creatinine ratio

1. Assessment of cortisol production and excretion rate.

2. Sensitivity of this test is greater than that of the LDDS (some animals with clinical signs of hyperadrenocorticism may have normal LDDS response tests but elevated urine cortisol to creatinine ratios). Used as a screening test.

3. Test is easy to perform.

4. As with all adrenal function tests, elevated results may occur in animals with non-adrenal disease.

5. Positive tests confirmed with a LDDS.

6. Must be performed on urine obtained at home, preferably in the AM
2. Tests to differentiate PDH from AT (performed after confirming diagnosis of hyperadrenocorticism).

A. High-dose dexamethasone suppression test

1. With PDH, a high dose of dexamethasone results in a decrease in ACTH release from the pituitary and a decrease in plasma cortisol.

2. With AT, the tumor secretes cortisol autonomously thereby suppressing ACTH production. With low ACTH concentrations already present, dexamethasone has no effect on plasma cortisol.

3. 70% of patients with PDH suppress plasma cortisol to less than 50% of the pre-treatment value.

4. 100% of patients with AT do not suppress.

5. Therefore: Suppression = PDH; Lack of suppression = Inconclusive

6. See protocol

B. Endogenous ACTH concentration

1. PDH: Levels normal or high

2. AT: Levels low to undetectable

3. Contact lab regarding sample handling and collection. Use of the preservative (Aprotinin) allows for greater utilization of this test.

4. Excellent method to differentiate PDH from AT.

**Testing protocols**
These are suggested protocols that are used in the evaluation of patients with hyperadrenocorticism. You must use the protocol and normal values from the laboratory to whom you are submitting samples to properly evaluate endocrine tests.

1. ACTH Stimulation Test

   A. Synthetic ACTH (Cortrosyn) 5 ug/kg IV; collect serum at 0 and 1 hour, or

   B. ACTH gel 2.2 U/kg IM; collect serum at 0 and 2 hours.

   C. Hyperadrenocorticism if post-cortisol > 20 ug/dl (530 nmol/L)

2. Low-Dose Dexamethasone Suppression Test

   A. 8 A.m: Baseline serum cortisol. Administer 0.01 mg/kg dexamethasone sodium phosphate (0.015 mg/kg dexamethasone) IV.

   B. 12 p.m: Collect 4 hour post-dexamethasone cortisol.

   C. 4 p.m: Collect 8 hour post-dexamethasone cortisol.

   D. In normal animals cortisol suppresses to less than 1.0 ug/dl (27.5 mmol/L) at 8 hours.

   E. 50% or greater suppression at either 4 or 8 hours together with lack of suppresion at 8 hours is diagnostic for PDH and additional tests are not necessary.

3. Urine Cortisol/Creatinine Ratio
A. First morning urine sample is preferred. Sample should be obtained at home. Ideally collected daily for three days and pooled. Requires 1 – 2 mls.

B. Stable at room temperature or refrigerated for 3 days.

C. A normal result effectively rules-out hyperadrenocorticism, an abnormal result should be confirmed with a LDDS or ACTH stimulation test.

**Differentiating PDH From AT**

1. **Low-Dose Dexamethasone Suppression Test**
   
   A. See above.

2. **High-Dose Dexamethasone Suppression Test**
   
   A. 8 a.m: Obtain serum cortisol. Administer 0.1 mg/kg dexamethasone sodium phosphate (0.15 mg/kg dexamethasone) IV.

   B. 4 p.m: Collect post-dexamethasone cortisol.

   C. Suppression defined as greater than a 50% reduction of cortisol.

   D. Suppression = PDH, non-suppression = Inconclusive

3. **Endogenous ACTH Concentration**
   
   A. Check with lab on sample collection and handling.

   B. Normal: 20-100 pg/ml (4.4-22.0 pmol/L)

   C. PDH: 40-500 pg /ml (8.8-110 pmol/L)

   D. AT: < 20 pg/ml (<4.4 pmol/L)

**Diagnosis of hypothyroidism**

A. Basal T4 concentration

   1. As for all endocrine testing, check with the laboratory for normal values and to see if a given assay is validated for the species you are evaluating.

   2. In general, normal basal T4 levels support euthyroidism, but low levels do not confirm hypothyroidism as many factors affect basal T4 levels.

   3. A low T4 indicates the need for further testing (see below).

B. Basal T3 concentrations

   1. Basal levels of little use in discriminating normal from hypothyroid as:

   A. Vast majority of T3 is intracellular.

   B. The majority of T3 produced by peripheral deiodination of T4.

   C. Factors causing low T4 and T3 in euthyroid animals
Hourly fluctuations

Fast over 48 hours

Concurrent illness

Hyperadrenocorticism

Medications: Glucocorticoids, valium, anticonvulsants, propranolol, many others.

Aging

Factors causing increased T4 and T3 in euthyroid animals

Obesity

Hourly fluctuations

Estrus, pregnancy

Medications: Estrogen, progesterone

Antithyroid antibodies

Free T4

Recently, determination of free T4 (fT4) by equilibrium dialysis, has been shown to correlate very well with results of TSH stimulation testing in the diagnosis of canine hypothyroidism. Evaluation of fT4 allows us to assess the biologically active fraction of thyroid hormone and has been shown to be much less affected by non-thyroidal factors (medications, concurrent illness, binding abnormalities, etc). The term "sick euthyroidism" is often used to describe the effect of these various non-thyroidal factors on decreasing TT4 concentrations in the face of normal thyroid function. Although a number of fT4 assays are commercially available, only those that employ a dialysis step are valid in the dog and cat.

Canine TSH Assay

Recently, an advance in the diagnostic approach to hypothyroidism was achieved with the advent of a reliable assay for canine TSH (cTSH). A kit for cTSH (Diagnostic Products Corporation; DPC Inc) is now available and should help in our approach to the patient with suspected hypothyroidism. A cTSH together with a free T4 by dialysis should provide the most relevant information with respect to thyroid function. A patient with hypothyroidism should have an elevated cTSH in conjunction with a decreased fT4. However, with the current cTSH assay, up to 25% of patients with confirmed hypothyroidism have a cTSH concentration within the normal range.

Thyroid Panel (fT4 and cTSH)

cTSH Reference Range : 0.0 - 0.45 ng/ml

fT4ED Reference Range: 11 - 43 pmol/L

Antithyroglobulin and anti-T3 and anti-T4 autoantibody testing:

The presence of antithyroglobulin antibodies indicates the presence of lymphocytic thyroiditis. Occasionally, these animals may also have anti-T3 and anti-T4 (rare) autoantibodies. The presence of thyroiditis does not equal a diagnosis of hypothyroidism. Animals with thyroiditis likely will become hypothyroid in the future but the decision on whether to supplement with thyroid hormone should be based on the presence of clinical signs and abnormal function tests (low TT4, low fT4ED and an elevated cTSH level). Animals with thyroiditis should not be used for breeding and this test in now included as part of the OFA thyroid registry. The OFA thyroid panel consists of a TT4, fT4ED, cTSH and antithyroglobulin antibody. To receive a registry number animals must be at least 1 year of age and have normal test results.
Diagnosis of hyperthyroidism


B. May be able to palpate a thyroid nodule before the T4 is elevated. Recheck T4 every 3 – 6 months or when signs occur.

C. Occasionally cats with hyperthyroidism may have a T4 in the normal range at the time of sampling. This is especially true in cats with mild hyperthyroidism. A second sample may be needed in those cats with strong clinical evidence of thyrotoxicosis. The second sample should be taken a few days to weeks later, as more pronounced fluctuations in thyroid hormone levels occur over days rather than hours. Nonthyroidal illness may also result in highnormal serum T4 concentrations even in the face of hyperthyroidism. Following correction of the underlying illness or discontinuation of medications, T4 levels will increase into the hyperthyroid range.

In animals in which hyperthyroidism is suspected, but the basal T4 levels are consistently normal, four additional tests can be considered.

1. T3 Suppression Test:

   A. Basis of the Test: The normal pituitarythyroid axis will be suppressed following supplementation with T3. A decrease in TSH concentration will lead to a decrease in T4 levels.

   B. Performing the Test
   
   1. Determine basal T4 level.
   
   2. Administer T3 (25 ug) every 8 hours for two days, giving the last dose on the morning of day 3.
   
   3. Determine T3 and T4 concentrations 4 hours following the last dose of T3.
   
   4. Normal cats:

       A. T4 levels suppress greater than 50% from pretreatment value.

2. TRH Stimulation Test:

   A. Basis of the Test: TRH is the hypothalamic peptide that regulates TSH release from the pituitary. TSH response to TRH is blunted in patients with hyperthyroidism.

   B. Performing the Test:

   1. Obtain basal T4 level.
   
   2. Administer 0.1 mg/kg TRH IV.
   
   3. Obtain 4 hour post TRH T4.
   
   4. Normal cats:

       A. Twofold rise in T4 post TRH

       B. Hyperthyroid cats have minimal to no increase in T4.

3. Free T4

   A. In cats where the TT4 is in the upper 50% of the basal resting range, an elevated fT4ED in the face of clinical signs is highly predictive of hyperthyroidism. Use of fT4ED should not be used as the initial screening test as some euthyroid senior cats have have elevated fT4ED. Due to the simplicity of the test, fT4ED should be the first line test in diagnosing cats with hormonally occult (normal TT4) hyperthyroidism.

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4. Imaging

Technetium scans may be helpful in hormonally borderline cases where bilateral uptake is clearly increased or unilateral disease is present.

**Diagnosis of hypercalcemia**

**Diagnostic Approach to Hypercalcemia**

A. Rule-out non-parathyroid malignancy and other secondary causes before proceeding to surgical exploration of the neck.

B. Adjust Ca for the albumin concentration

C. Rule out history of vitamin D exposure. Phosphorous will usually also be elevated.

D. Good physical exam. Palpate lymph nodes and always do a rectal exam.

E. CBC and biochemistry profile
   1. To help rule out other causes of hypercalcemia.
   2. Most animals with primary hyperparathyroidism will have hypercalcemia with a normal to low phosphorous.

F. Urinalysis

G. Thoracic and abdominal radiographs to R/O mediastinal mass.

H. Use of PTH assay validated for the dog that measures intact PTH in combination with an ionized calcium concentration will differentiate hypercalcemia of malignancy (low PTH) from primary hyperparathyroidism (PTH normal to elevated). Greatly improves the diagnostic approach to hypercalcemia and reduces the cost to the client.

I. Consider lymph node aspirates/biopsy and bone marrow aspirates/biopsy to rule out lymphosarcoma and myeloma.

J. Surgical exploration of the neck.

**Diagnosis of hypocalcemia**

**Differential Diagnosis for Hypocalcemia**

A. Lab error. Always recheck before pursuing further diagnostics.

B. Hypoalbuminemia: The ionized calcium is normal so will not have clinical signs.

C. Chronic renal failure: Decreased vitamin D synthesis.

D. Acute renal failure (ethylene glycol): Metabolites of ethylene glycol complex with calcium.

E. Puerperal tetany (eclampsia).

F. Hypomagnesemia: Blunted PTH secretion.
G. Pseudohypoparathyroidism: Defect with PTH receptor or post-receptor abnormality. PTH serum concentration is increased.

H. Vitamin D deficiency.

I. Intestinal malabsorptive diseases: Decreased absorption of calcium and vitamin D.

J. Medications: EDTA, anticonvulsants, citrate.

K. Calcitonin producing thyroid tumor (rare).

L. Phosphate containing enemas (Cats and small dogs).
Feral, or free-roaming, domestic cats are one of the top threats to biodiversity world-wide. In addition, feral cats present a persistent and nearly ubiquitous public health threat. However, these threats seem to go unrecognized by most people, including some veterinarians. Several management strategies are employed to mitigate the severe impact of feral cats on the environment and on the public health. Any discussion of management strategies and search for better methods of control for these cats typically results in very emotional exchanges. The incredible passion on both sides of these discussions makes arriving at a reasonable solution to mitigate the significant and on-going damage from these cats nearly impossible.

Feral cat populations continue to rise as an effective management strategy for reducing the population and mitigating the impact on sensitive ecology remains elusive. Veterinarians must find a way to continue constructive and professional discourse in search of a better strategy overall.

Summary

1. Feral cats are a source of infectious disease.
2. Feral cats have a significant negative impact on endangered and endemic populations
3. Currently employed management strategies are variably effective at reducing feral cat populations in a reasonable timeframe.
4. Veterinarians should encourage responsible pet ownership, including discouraging the feeding of feral cats.
5. The feeding and maintaining of feral cat colonies is incongruent with a common-sense approach to public health and animal welfare.

References/Suggested reading


Patrick Foley, PhD, Janet E. Foley, DVM, PhD, Julie K. Levy, DVM, PhD, DACVIM, Terry Paik, DVM. Analysis of the impact of trap-neuter-return programs on populations of feral cats. JAVMA December 1, 2005, Vol. 227, No. 11, Pages 1775-1781.


Analgesic poly pharmacy is something pain specialists have been stressing practitioners to use for a while now. What hasn’t been stressed in multi-modal approaches with enough emphasis is complimentary approaches in the forms of rehabilitation, massage, photo/thermal modalities, supplements and nutrition. What can make using other modes of pain management confusing lately with the advent of lasers, heating crystals, wires connected to a battery, so on and so forth is the efficacy of these tools. Below are several non-pharmaceutical approaches which have a brief description of each based on the current human and animal literature that supports and refutes each method where relevant.

Acupuncture/Acupressure: Acupuncture in modern veterinary medicine is used to treat both acute and chronic pain. Acupuncture began in China some thousands of years ago using stone needles. It is believed needle placement can move Qi “Chi” or certain energies around different meridians to help the body heal. From a Western point of view many of the historic points correlate well with specific anatomic locations based on gross and histologic anatomical features such as major nerves, blood vessels or lymphatic vessels. Abundantly innervated locations and regions that have autonomic nervous association are common acupuncture points. Also, many acupuncture points are associated with regions that generate muscular dysfunction and pain, such as myofascial trigger points, musculotendinous junctions and muscle motor points. Histologically speaking features of acupuncture points include infiltration of afferent receptors such as Meissner corpuscles and nociceptors, Golgi-tendon organs, neurvi vasorum, and neuromuscular junctions. It has been shown stimulation of these various anatomical features can stimulate endorphin release with variable lasting effects. Electro-acupuncture is a common adjunct to acupuncture treatments to enhance the treatment outcome and prolong the benefit of the treatment. Acupuncture uses the same acupuncture points, but is performed with pressure rather than needles either by hand or an implement. While acupuncture and similar practices is one of the most studied complimentary form of pain relief, it is also one of the most contentious. For as many studies showing efficacy of acupuncture there are also as many showing no effect. A recent 2013 con editorial published in the human journal Anesthesia & Analgesia concluded; “It is clear from meta-analyses that results of acupuncture trials are variable and inconsistent, even for single conditions. After thousands of trials of acupuncture and hundreds of systematic reviews, arguments continue unabated.”.

TENS (Transcutaneous Electrical Nerve Stimulation) /NMES (Neuromuscular Electrical Stimulation): Both methods use low currents of electricity to stimulate either muscle contraction or interrupt transmission/transduction signals for modulation of pain. NMES in particular can use frequencies high enough to produce muscle contraction and relaxation, essentially “working out” and strengthening the muscle, which is important for rehabilitation and muscle wasting related pain. Moreover, TENS propagates afferent sensory fibers to override pain signals, sometimes referred to as the Gate Control Theory.

Trigger point: The technique is used for alleviates small areas of spasm within muscle. When the spastic nodules are palpated a 20 second ischemic inducing amount of pressure is applied. After the pressure is applied a short rest (~10 seconds) is allowed before reapplying the pressure.

Massage: Massage promotes circulation, lymphatic drainage, tissue movement and will help ease tight or sore muscles. Massaging out pockets of lactic acid within the muscle can also be relieving. Massage also has a emotional component as it aids in the human/animal bond.

Thermal: Cooling treatments decreases the temperature of the soft tissues to a depth of 2 to 4 cm. Techniques for cryotherapy include acupoints, immersion, and icepacks. Cryokinetcs combines cryotherapy with motion which helps facilitate normal movement through muscle pump action to return lymphatic fluid to the vascular system reducing edema. Heat therapy is like cryotherapy in that it provides analgesia and decreased muscle tonicity. Heated thermotherapy increases tissue temperature, blood flow, metabolism, and connective tissue extensibility while aiding in muscle relaxation and reducing stiffness. Caution must be taken as increased circulation can induce edema and inflammation. Heat is indicated for animals with chronic pain, especially pain from muscle spasm and to help with stretching.

Exercise: Exercise promotes circulation and fluidity of joint fluid, which can help prevent stiffness and muscle atrophy. Keeping muscle mass can also help support joints that may be less stable. Natural endogenous endorphin release, such as dynorphin is also released that has powerful pain relieving effects.

Laser: Several different types of lasers are now available in the veterinary market. They are being used for several conditions including pain management. The simplest way to understand the effects of lasers are to think of a plant. A plant by means of photosynthesis uses light to active production of food for the pant and grow. Lasers in animal cells use specific wave-lengths of light to penetrate tissues to active photo sensitive parts of the cell which stimulates cell activity and in theory, normalization of damaged or injured tissues, decreasing inflammation and edema and even reduces healing times.
Platelet Rich Plasma: The use of an animal's own harvested platelets is something derived from the human regenerative medicine movement. Although the science is still inconclusive to discouraging on the topic the basic idea of the technique makes it an easy sell. The healing process is an extremely complex process with several different stages and biochemical clouds infiltrating injured tissues. What PRP is essentially doing is repeating or elevating one of these stages in the healing process by soaking injured cells with platelets, which accelerates the healing process and return to normalcy, and in turn reduces pain and inflammation.

Stem Cells: Like the platelet rich plasma, the use of stem cells is a regenerative medicine technique used to greatly accelerate healing. While platelets can help speed up healing of tissue, stem cells can help completely help regrow lost tissues such as cartilage. Articulating surfaces sans cartilage can be extremely painful, hence re-growing it can be pain relieving. There are a few companies that sell kits to veterinary practitioners for stem cell harvest from fat tissue.

Cannabis: While prescribing and legal hurdles still exist around this option, individual State and ease of acquisition have made this mode for feasible and something owners are inquiring about. There are mounds of research already done and in the process of completion delving deep into the many therapeutic properties on cannabis. For this lecture specifically we will only discuss the pain decreasing effects. The endocannabinoid system is the largest system of receptors, located centrally and peripherally. On of the functions the endocannabinoid system is in pain modulation. By modulating the Ca ion exchange in the presynaptic neuron researchers have appreciated a decrease in release of excitatory neurotransmitters, which ultimately reduces the overall pain response. The other pain relieving component to the endocannabinoid system are its anti-inflammatory effects. Since we know inflammation is pain, a decrease by down regulating inflammatory cytokines and proteins occurs with endocannabinoid receptor expression locally will in turn decrease pain on a different level compared to the previously mentioned Ca ion modulation of neurons.

Turmeric (Curcumin): This is an ancient spice used in South Asian cooking. The most active anti-inflammatory and antioxidant found in whole turmeric, (2-6%) and has had several major scientific studies publishing validating its anti-inflammatory properties, along with a long list of other beneficial effects. Although GI bioavailability is low, dosing and potential side effects are even lower. Topical application has been shown to be more effective in wound healing and inflammation. Curcumin specifically acts on nociceptors less utilized by expressing the transient receptor potential vanilloid channel. The sub population is predominantly expressed in primary sensory neurons with C-fibers and is activated by heat, protons and vanilloids, such as capsaicin and participates in the transduction of mechanical, thermal and chemical stimuli. A recent miniperspective was written by human specialists that essentially debunked a specific compound claimed to be responsible for medicinal effects, however the whole spice, labeled as a dietary supplement, is comprised of many active and semi active components when still may elude scientific understanding. While anecdotal evidence is not ideal, this may be one “less proven” supplement the author feels comfortable sharing in the same breath as CBD.

References available upon request
Becoming an Anesthetic Mixologist
Stephen Cital, RVT, SRA, RLAT, VTS (Laboratory Animal Medicine)
Veterinary Anesthesia Nerds
San Jose, CA

There are literally thousands of combinations of sedatives/tranquilizers, muscle relaxers, neurosteroids, opioids, dissociative agents, paralytics and so on to choose from. Selecting what is safe, practical and even cost efficient is necessary for our patients, keeping in mind the specific signlamnet and health status of our individual patient.

Benzodiazepines are reported to enhance the positive subjective effects of opioids (euphoria) but it is unclear whether the reinforcing effects are additive or synergistic. Either way we see a great MAC sparing effect with the combination of the two medications.

When creating a multimodal anesthetic plan utilizing volatile anesthetic or TIVA we should always consider this formula.

Analgesia + Muscle relaxation + Sedation

Often one of these medication on the equation will have anxiolytic effects as well.

Opioid continuous rate infusions
**Premedication with a mu opioid agonist will provide an effective loading dose for any mu opioid CRI**

**Fentanyl (50mcg/mL or 0.05mg/mL)**
- Commonly used in a CRI as the sole agent or can be combined with ketamine +/- lidocaine.
- A single IV bolus will only last approximately 20-30 minutes.
- Fentanyl has a context sensitive half life. When used as a CRI for greater than 2 hours the drug will start to accumulate in the tissues. Once accumulation has occurred the plasma concentration does not decrease rapidly once the CRI is discontinued. To prevent a prolonged recovery, it may be beneficial to decrease the fentanyl CRI rate and/or make adjustments to the vaporizer about 30-40 minutes prior to the end of surgery. The effects tend to last much longer in cats compared to dogs.
- Extremely high dosages may depress ventilation and cause bradycardia.
- Fentanyl does not require dilution when used in a syringe pump
- An IV bolus (loading dosage) of 1-5mcg/kg should be given prior to the start of the CRI if no other mu agonist opioid has been administered.
- CRI rate (intra-op): 0.1-0.7mcg/kg/min (6-42mcg/kg/hr) **It is recommended to start with 0.1mcg/kg/min and adjust the dosage up as needed depending on patient response to surgical stimulus. If the patient responds to surgical stimulation then it is recommended that a bolus (1-3mcg/kg) be administered and the CRI rate increased in 0.1 increments until no further surgical stimulation occurs.
- CRI rate (post-op): 0.03-0.05mcg/kg/min (2-3mcg/kg/hr)

**Remifentanil (1mg powder)**
- Commonly used alone in a CRI or can be combined with ketamine +/- lidocaine.
- Metabolized by nonspecific plasma esterases to inactive metabolites. This makes remifentanil superior to fentanyl for patients with renal or hepatic dysfunction.
- Rapid onset of action and short duration of action. It must be administered as a CRI because the short duration of action limits the use as a bolus injection.
- It has non-cumulative effects within the body so recovery is rapid after CRI is discontinued.
- Extremely high dosages may cause profound sedation, respiratory depression and bradycardia.
- Supplied as a 1mg powder that must be reconstituted with sterile saline prior to use.
- Dilution: mix 1mg powder in 20mL NaCl → 50mcg/mL or mix 1mg powder in 10mL NaCl → 100mcg/mL
- Loading dosage: 1-5mcg/kg IV should be given prior to the start of the CRI if no other mu agonist opioid has been administered.
- CRI rate: 0.1-0.7 mcg/kg/min

**Hydromorphone (2mg/mL)**
- Can be used alone or in combination with ketamine +/- lidocaine.
- Does not cause histamine release.
- Dilution: add 2mg (1mL) to 9mL NaCl → 0.2mg/mL
- Loading dosage: 0.03-0.05mg/kg IV prior to starting the CRI if no other mu agonist opioid has been administered.
- CRI rate: 0.3-0.8mcg/kg/min (0.02-0.05mg/kg/hr)
Morphine (15mg/mL)
- Commonly used alone or in combination with ketamine +/- lidocaine.
- Caution with use in cats. Morphine CRIs are not commonly administered alone to cats when awake due to the likelihood of causing excitation.
- Morphine is light sensitive. The syringe or fluid bag should be covered when using a morphine CRI long term.
- Dilution: add 15mg (1mL) to 9mL NaCl → 1.5mg/mL or add 30mg (2mL) to 8mL NaCl → 3mg/mL
- Loading dosage: 0.1-0.2mg/kg IV (very slowly) should be given prior to the start of the CRI if no other mu agonist opioid has been administered.
- CRI rate: 2-6mcg/kg/min (0.1-0.3mcg/kg/hr)

Methadone (10mg/mL)
- Can be used alone or in combination with ketamine +/- lidocaine.
- Also acts as an NMDA receptor antagonist to help treat and prevent central sensitization.
- Dilution: add 10mg (1mL) to 9mL NaCl → 1mg/mL
- Loading dosage: 0.1-0.5mg/kg IV prior to starting the CRI if no other mu agonist opioid has been administered.
- CRI rate: 0.05-2mg/kg/hr

Adjunct CRIs for additional pain management
Ketamine (100mg/mL)
- Classified as an NMDA receptor antagonist that effectively blocks central sensitization from occurring in the dorsal horn of the spinal cord and helps prevent hyperalgesia and allodynia.
- Ketamine does not have any direct analgesic effects but it is used as an adjunct to other analgesic drugs such as opioids. It may help improve opioid receptor sensitivity. DO NOT use ketamine as the sole analgesic agent.
- Dosages used for the CRI are given at sub-anesthetic levels so none of the dissociative effects are seen during CRI administration.
- Starting a ketamine CRI prior to a painful stimulus will provide the best means of preventing CNS sensitization but it is still effective in patient’s that present with established pain.
- Loading dosage: 0.5mg/kg IV of ketamine should be given prior to starting the CRI in order to achieve initial therapeutic blood levels. Induction with ketamine/diazepam or Telazol® will provide an effective loading dose.
- CRI rate (intra-op): 10-20mcg/kg/min
- CRI rate (post-op): 2-10mcg/kg/min for at least 24 hours

Lidocaine (20mg/mL)
- MAC sparing and analgesic effects when administered as a CRI intra-op.
- Classified as a sodium channel blocker and a class IB antiarrhythmic.
- Displays free radial scavenging effects which may be helpful at preventing reperfusion injury.
- Acts as an inflammatory modulator by decreasing neutrophil chemotaxis and platelet aggregation.
- Acts as a prokinetic that enhances gut motility and helps prevent ileus.
- NOT recommended for use in cats due to its potential for toxicity. If used, do not exceed a dosage of 10mcg/kg/min and monitor closely for seizure activity and bradycardia.
- Commonly used as a first line treatment for ventricular premature complexes (VPC) or ventricular tachycardia.
- Some brands of lidocaine are sensitive to light. If lidocaine comes in a brown bottle the syringe or fluid bag containing the lidocaine should be covered when used as a CRI long term.
- Loading dosage: 1-2mg/kg IV of lidocaine should be given prior to starting the CRI in order to achieve an appropriate therapeutic level.
- CRI rate: 25-75mcg/kg/min

Dexmedetomidine (500mcg/mL or 100mcg/mL)
- Generally combined with an opioid CRI to enhance analgesia and sedation when an opioid CRI alone is not enough.
- Will greatly reduce MAC of inhalants when used intra-operatively.
- Commonly used during the post-operative period as a treatment for emergence delirium or when the patient would benefit from long term sedation during the post-operative period.
- Can be given in combination with ketamine, lidocaine and opioids
- Cardiovascular effects (significant bradycardia, biphasic effects on blood pressure) will likely be seen during CRI administration. Vital signs should be monitored closely. It is best to avoid a dexmedetomidine CRI if the patient has cardiovascular disease.
- Inhibits antidiuretic hormone (ADH) so an increase in urine production may be seen. The bladder should be expressed prior to recovery if used as an intra-operative CRI.
• Inhibits insulin release so a transitory hyperglycemia may be seen. Avoid a dexmedetomidine CRI if serial glucose values need to be obtained.
• Loading dosage: 0.5-1mcg/kg IV should be given prior to starting the CRI in order to achieve an appropriate therapeutic level.
• CRI rate: 0.5-3mcg/kg/hr

Medetomidine
• Used in the same manner as dexmedetomidine.
• Loading dosage: 1-2mcg/kg IV prior to starting the CRI.
• CRI rate: 1-2mcg/kg/hr


Table 1: Dosages for constant rate infusions (CRIs) used in cats

<table>
<thead>
<tr>
<th>Drug</th>
<th>Loading Dose</th>
<th>CRI dose</th>
<th>Quick Calculation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine (M)*</td>
<td>0.10 mg/kg IM</td>
<td>0.03 mg/kg/hr (0.5 mic/kg/min)</td>
<td>Add 15 mg to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>Cat may need light sedation; can be combined with K &amp;/or L.</td>
</tr>
<tr>
<td>Hydromorphone (H)</td>
<td>0.025 mg/kg IV</td>
<td>0.01 mg/kg/hr</td>
<td>Add 5 mg to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>May cause hyperthermia; can be combined with K &amp;/or L.</td>
</tr>
<tr>
<td>Fentanyl (F)</td>
<td>0.001-0.003 mg/kg IM or IV (1-3 mic/kg IV)</td>
<td>2.5 mic/kg/h (0.03-0.08 mic/kg/m)post-op 5-20 mic/kg/h (0.08-0.3 mic/kg/m intra-op)</td>
<td>For 5 mic/kg/h, add 2.5 mg to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>2.5 mg=50 ml F, remove 50 ml LRS before adding F; can be combined with K &amp;/or L.</td>
</tr>
<tr>
<td>Methadone</td>
<td>0.1-0.2 mg/kg IV</td>
<td>0.12 mg/kg/hr</td>
<td>Add 60 mg to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>MAY cause sedation; can be combined with K &amp;/or L.</td>
</tr>
<tr>
<td>Butorphanol</td>
<td>0.1 mg/kg IV</td>
<td>0.1-0.2 mg/kg/hr</td>
<td>Add 50 mg to 500 ml fluid &amp; run at 1 ml/kg/hr for 0.1 mg/kg/hr</td>
<td>Only moderately potent &amp; has ceiling effect - use as part of multimodal protocol</td>
</tr>
<tr>
<td>Ketamine (K)*</td>
<td>0.25 mg/kg IV (2 -10 mic/kg/min)</td>
<td>0.12-0.6 mg/kg/hr</td>
<td>Add 60 mg to 500 ml fluid &amp; run at 1 ml/kg/hr for 0.12 mg/kg/hr</td>
<td>Generally combined with opioids; may cause dysphoria</td>
</tr>
<tr>
<td>Lidocaine (L)</td>
<td>0.25 mg/kg IV</td>
<td>1.5 mg/kg/hr (25 mic/kg/min)</td>
<td>Add 750 mg to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>750 mg=37.5 ml, remove 37.5 ml LRS before adding L; can be combined with opioid &amp;/or K; Lidocaine MAY be contraindicated in the cat due to cardiovascular effects.</td>
</tr>
<tr>
<td>Medetomidine (Med) or Dexmedetomidine(D)</td>
<td>1-5 mic/kg Med 1-2 mic/kg D Can be IV or IM May not be necessary</td>
<td>0.001-0.004 mg/kg/hr Med (1-4 mic/kg/hr) 0.0005-0.002 mg/kg/hr D</td>
<td>Add 500 mic Med or 250 mic D (0.5 ml of either) to 500 ml fluid and run 1-4 ml/kg/hr</td>
<td>Provides analgesia and light sedation. Excellent addition to opioid CRI, or can be administered as solo drug CRI.</td>
</tr>
<tr>
<td>Morphine* / Ketamine*</td>
<td>M: 0.10 mg/kg IM K: 0.25 mg/kg IV</td>
<td>0.03 mg/kg/hr M &amp; 0.12 mg/kg/hr K</td>
<td>Add 15 mg M &amp; 60mg K to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>Can be administered up to 3 ml/kg/hr but dysphoria MAY occur. Can substitute, F, or methadone for M.</td>
</tr>
<tr>
<td>Morphine / Ketamine / Lidocaine (MLK)</td>
<td>M: 0.10 mg/kg IM K: 0.25 mg/kg IV L: 0.25 mg/kg IV</td>
<td>0.03 mg/kg/hr M, 0.12 mg/kg/hr K; 1.5 mg/kg/hr L</td>
<td>Add 15 mg of M, 60 mg K and 750 mg (or 300 mg) L to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>Can substitute H, F or methadone for M.</td>
</tr>
</tbody>
</table>
Any of the drug amounts in the bag of fluids can be decreased and the fluids administered at a higher rate if necessary. For example, for morphine, ketamine and morphine/ketamine infusions, 7.5 mg of morphine & 30 mg of ketamine can be used and the CRI administered at 2 ml/kg/hr if more fluids are needed.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Loading Dose</th>
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<th>Quick Calculation</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Morphine (M)*</td>
<td>0.5 mg/kg IM (or 0.25 mg/kg SLOWLY IV)</td>
<td>0.12-0.3 mg/kg/hr (2.0 mic/kg/min-3.3mic/kg/min)</td>
<td>Add 60 mg to 500 ml fluid &amp; run at 1 ml/kg/hr for 0.12 mg/kg/hr</td>
<td>MAY cause sedation; can be combined with K &amp;/or L.</td>
</tr>
<tr>
<td>Hydromorphone (H)</td>
<td>0.05-0.1 mg/kg IV</td>
<td>0.01-0.05 mg/kg/hr</td>
<td>Add 5-24 mg to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>MAY cause sedation; can be combined with K &amp;/or L.</td>
</tr>
<tr>
<td>Fentanyl (F)</td>
<td>0.001-0.003 mg/kg IM or IV (1-3 mic/kg IV)</td>
<td>2-10 mic/kg/h (0.03-0.2 mic/kg/m)post-op 3-40 mic/kg/h (0.05-0.7 mic/kg/m intra-op)</td>
<td>For 5 mic/kg/h, add 2.5 mg to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>2.5 mg=50 ml F, remove 50 ml LRS before adding F; can be combined with K &amp;/or L; Intra-op dose can be up to 20-40 mic/kg/h</td>
</tr>
<tr>
<td>Methadone</td>
<td>0.1-0.2 mg/kg IV</td>
<td>0.12 mg/kg/hr</td>
<td>Add 60 mg to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>MAY cause sedation; can be combined with K &amp;/or L.</td>
</tr>
<tr>
<td>Butorphanol</td>
<td>0.1 mg/kg IV</td>
<td>0.1-0.2 mg/kg/hr</td>
<td>Add 50 mg to 500 ml fluid &amp; run at 1 ml/kg/hr for 0.1 mg/kg/hr</td>
<td>Only moderately potent &amp; has ceiling effect - use as part of multimodal protocol</td>
</tr>
<tr>
<td>Ketamine (K)*</td>
<td>0.25 mg/kg IV</td>
<td>0.12-0.6 mg/kg/hr (2-10 mic/kg/min)</td>
<td>Add 60 mg to 500 ml fluid &amp; run at 1 ml/kg/hr for 0.12 mg/kg/hr</td>
<td>Generally combined with opioids; may cause dysphoria; post-op dose may be higher</td>
</tr>
<tr>
<td>Lidocaine (L)</td>
<td>0.5 – 1.0 mg/kg IV</td>
<td>1.5-3.0 mg/kg/hr (25-50 mic/kg/min)</td>
<td>Add 750 mg to 500 ml fluid &amp; run at 1 ml/kg/hr for 25 mic/kg/min</td>
<td>750 mg=37.5 ml, remove 37.5 ml LRS before adding L; can be combined with opioid &amp;/or K.</td>
</tr>
<tr>
<td>Medetomidine (Med)</td>
<td>1-5 mic/kg Med 1-2 mic/kg D Can be IV or IM May not be necessary</td>
<td>0.001-0.004 mg/kg/hr Med (1-4 mic/kg/hr) 0.0005-0.002 mg/kg/hr D</td>
<td>Add 500 mic Med or 250 mic D (0.5 ml of either) to 500 ml fluid and run 1-4 mls/kg/hr</td>
<td>Provides analgesia and light sedation. Excellent addition to opioid CRI, or can be administered as solo drug CRI.</td>
</tr>
<tr>
<td>Morphine* / Ketamine*</td>
<td>M: 0.5 mg/kg IM K: 0.25 mg/kg IV</td>
<td>0.12 mg/kg/hr M &amp; 0.12 mg/kg/hr K</td>
<td>Add 60mg M &amp; 60mg K to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>Can be administered up to 3 ml/kg/hr but sedation or dysphoria MAY occur. Can substitute H, F or methadone for M</td>
</tr>
<tr>
<td>Morphine / Ketamine / Lidocaine (MLK)</td>
<td>M: 0.5 mg/kg IM K: 0.25 mg/kg IV L: 0.5 mg/kg IV</td>
<td>0.12 mg/kg/hr M, 0.12 mg/kg/hr K; 1.5 mg/kg/hr L</td>
<td>Add 60 mg of M, 60 mg K and 750 mg L to 500 ml fluid &amp; run at 1 ml/kg/hr</td>
<td>Can substitute H, F or methadone for M. Dr. Muir’s dose is 3.3 mic/kg/min M, 50 mic/kg/min L; 10 mic/kg/min K.</td>
</tr>
</tbody>
</table>

*Any of the drug amounts in the bag of fluids can be decreased and the fluids administered at a higher rate if necessary. For example, for morphine, ketamine and morphine/ketamine infusions, 30 mg of morphine & 30 mg of ketamine can be used and the CRI administered at 2 ml/kg/hr if more fluids are needed.
Common Myths in Pain Management
Stephen Cital, RVT, SRA, RLAT, VTS (Laboratory Animal Medicine)
Veterinary Anesthesia Nerds
San Jose, CA

There are probably a million myths or misunderstandings I encounter as a pain specialist when reading posts on forums or speaking to colleagues. I hope to present some of the common beliefs encountered that will clear up those myths based on clinical studies.

If an animal is premedicated with butorphanol, does this mean that using another full mu opioid will be ineffective?
This is debatable as studies show conflicting results. Traditionally we thought giving an agonist-anatagonist would be counterproductive when later giving a full mu opioid. We now know we can get several responses that is likely species, type of pain, age and even sex dependent. We have studies in animals and humans that include no change in analgesic effects when the two are combined, an analgesic reduction when the two are combined and even an improvement when the two are combined. In general, because of the highly variable outcomes of these studies and the “unknowns”, it is more practical and ethical to give a full mu opioid rather than risk a painful patient, or consider a butorphanol constant rate infusion for animal suffering from visceral pain, such as pancreatitis.

Butorphanol is labeled for mild to moderate pain so we use it for most surgeries
There are few surgeries I would label as mild to moderately painful as pain perception is highly variable to each individual, just as the surgeons tissue handing technique, which with poor technique has also been associated to more painful recoveries post operatively in humans than expected, is also variable and subjective. We also must question its duration of analgesic effect, as effects are questionable when used alone. Butorphanol has a strong affinity for the mu receptor but does not necessarily activate the receptor, causing analgesia. We have studies that support analgesic effects last less than 60 minutes in some studies and 3-7 hours in others. What is also important to understand is for either study the mu receptor is not fully activated, making butorphanol a poor analgesic for a majority of surgical patients.

If I use butorphanol prior to an epidural morphine will be the epidural be ineffective?
Epidural morphine takes 60 minutes for effect. We are also placing the medication directly at the site of action and will outweigh any butorphanol competition. Rather, just don’t use butorphanol.

Does the use of ketamine in the premedication of cats or dogs result in any analgesic effects?
Most definitively. Ketamine is now well decrived in the literature for being a potent NMDA agonist and helps control windup. Ketamine can also be used at micro doses, with subclinical effects to alleviate windup concern and reduce MAC. Ketamine can be used to reduce opioid burden and offer a multimodal approach.

If I don’t expect pain during an anesthetic even is there any reason to premedicate the animal?
Yes. The main advantage of premedication is reduction in the dose of induction and maintenance volatile anesthetics or IV CRI of an induction agents (TIVA), with expected reduction in negative effects. Premedication will also reduce the total cost of anesthesia. We must also be careful with what is considered “non-painful”. Example: It is often misconstrued that endoscopy may be non painful or only slightly uncomfortable. However, human reports suggest a heartburn like pain after lengthy endoscopy procedure, likely due to the operator making repeated paces with the scope and hitting the esophageal wall. However, some opioids may increase sphincter tone (morphine).

Should opioid induced bradycardia be treated?
Yes. Depending on the severity of the bradycardia and in particular for anesthetized patients, vagal-induced bradycardia (as a result of opioid administration) will have a corrective effect on CO. Depressive inhalant effects may add to the negative effect of low heart rate. Hypovolemic patients will likely not improve from catecholamine correction and volumes should be managed in the typical manner. A heart rate of 80-120 bpm in cats and 60-80 bpm in dogs (related to patient size) is worth treating. Bradycardia is less detrimental in the awake animal following opioid administration.

Should I wait to give pain medications until after a neurologic exam, if my patient is not presenting for a neurological problem or is overtly neurological?
NO! This excuse is long over used. Practitioners likely have a opioid they are familiar with in regards to its effects on animals. These effects should be considered during a neurological exam. A patient in severe pain will also not present as neurotypical.
Is there any benefit to the addition of acepromazine or other sedative to an opioid given as premedication in a patient in pain?
Yes, if the detrimental effects from acepromazine or other sedative are acceptable. Sedation and central nervous system depression can intensify the effect from an analgesic, which may allow you to give less of the analgesic. Anxiety and exhaustion are also a large components of the pain experience and alleviating either pharmacologically will better the experience.

Opioids are not safe in critical patients
Absolutely false. Not using opioids or other effective analgesics in a critical patient is not safe. A reduction in doing may be needed for more critical cases and if concern arises they can be reversed. Pain causes a cascade of catecholamine release which can worsen the patients state.

Buprenorphine has a ceiling effect
More current receptor theory and human studies show this in not true, rather there is a ceiling effect on respiratory depression

Buprenorphine will compete with other stronger opioids if given at the same time or within the half-life period
Not so much. More evidence is showing that this partial agonist can play nicely with full mu opioids.

Buprenorphine is not as good as hydromorphone or other “bigger” opioids
Buprenorphine with appropriate dosing (much higher than typically prescribed doses) can be as potent as hydromorphone. There is even some evidence of an anti-inflammatory component to buprenorphine.

Tramadol works?
In cats, yes. Really well in fact. In dogs, unless you have the IV version, not so much. We have plenty of evidence so support oral tramadol is likely providing minimal to no analgesia in dogs. While this tends to be a point of contention with some practitioners, the science is in. What is likely interpreted as “pain relief” is likely the SSRI effects tramadol has. This means the animal is essentially happily in pain.

Can opioids act peripherally?
Absolutely. There is evidence that opioid receptors are far more dispersed outside of the supra spinal and spinal area than previously thought. This is why the addition of opioids to local block solutions can dramatically prolong the duration.
**Analgesia in the avian species**

Pain in birds serves its purpose the same way it does in all species, to provoke a response by the animal to remove itself from the stimulus. Avian pain pathophysiology is slightly different from mammals. Although largely similar to mammals, the main difference comes from the organization of the forebrain of bird’s verses mammals and the ascending nociceptive system. Birds have more kappa receptors in general. However, among bird species there are varied amounts of kappa opioid receptors located in the forebrain. This explains the varied response to mu agonists compared to mammals. It is now accepted birds perceive pain similarly to that in mammals. As prey species birds are masters of pain disguise and will have one of two responses to pain, a “fight and flight” response or “Withdrawal/conservation” response.

Bird experts have thought that chronic pain is more associated with the “Withdrawal/conservation” responses, commonly seen in practice compared to the “fight or flight” response associated with sudden and unexpected pain stimuli. Birds, like other species, have adrenal stimulation under stress with a subsequent release of corticosterone, which has an adverse effect on both the immune system and wound healing. A bird’s stress level is even more exaggerated when in a small cage and its inability to feel that it can fly or get away. Therefore, it is imperative to keep the patient in a quiet, light-regulated environment far away from visible predatory species or other stressors.

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One of the advances in veterinary pain management is the use of transdermal patches that deliver analgesia through the skin. In amphibians this has always been the case. Common anesthetic practices include anesthesia administration through the skin and thus is the same with analgesics. Common routes used in reptiles can also be used in amphibians.

**Analgesia in exotic small mammals**

Pain management in these species is similar to that in the cat and dog with the exception of handling and restraint as well as dosing. Dosing ranges vary from text to text with ever changing research into efficacy of drugs and dosages thus far described. It is imperative for the reader to constantly be researching the newest most supported methods in pain management for whatever species one is working with. The recent publication of the mouse, rabbit and rat facial pain-scoring chart is a crucial addition to any exotics practitioners’ library.

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Rabbits are common pets and used extensively in the laboratory setting. In the laboratory setting, rabbits are often used as epidural and intrathecal models, and thusly this is a form of analgesia that can be utilized in these species. Signs of pain in these species mirror that of rodents, with the addition of hair plucking or ileus. Ileus can be intensified by the addition of opioids. Lagomorphs tend to be a sensitive species to chemicals of any sort, including analgesics. Fortunately more species-specific research is being performed finding
more definitive dosing and relying less on extrapolation. One of the most recent studies published found previous meloxicam doses may be not as effective as once thought. The study highlights the importance of constant and relevant research into pharmacokinetics for all species.

Insectivore analgesia lacks a thorough research and practitioners are urged to investigate analgesia protocols for these species as more information becomes published. It is common practice to extrapolate doses of pain medications from rodent models. One published dose of buprenorphine is available at 0.01-0.03mg/kg SC q12hr for hedgehogs.

Much like insectivores very limited published data is available for marsupials and their 260 represented species in the world. In general marsupials tend to need higher doses of anesthetics and presumably analgesics for unknown reasons.
Local and Regional Nerve Blocks; Why Feel Anything?

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Local and regional (L&RA) anesthesia is the technique of applying or infiltrating tissues with a sodium channel blocking agent (most common in veterinary medicine: lidocaine, bupivacaine, ropivicaine) to completely numb a specific area. We can literally take an animal in severe pain, such as broken ribs, and make them comfortable again within minutes. There are several adverse effects of continued pain, many of which delay healing and impact the patient psychologically. Local and regional blocking techniques are one of the few techniques we have to completely stop pain signaling to the spinal cord, further reducing sensitization, which in the worst-case scenario could lead to neuropathic pain. Local and regional blocking used for the anesthetized patient also shows a decrease in mobility and mortality and decrease complication in the post-operative period. There are multiple terms used for differing techniques of L&RA.

**Topical or Surface Anesthesia** is using sodium channel blocking agents in creams or solutions on the skin or mucous membrane providing some relief. Unfortunately, many of the agents we use are not readily absorbed through the skin surface unless left on for quite some time prior. The use of lidocaine patches over wounds or incisions has also been described but has not been found to alleviate the need for other analgesic medications.

**Local Infiltration** is a less precise means of infiltrating tissue with a blocking agent to achieve pain sensation loss. Basically, where the surgeon plans to incise or tissues will be manipulated in a way that causes discomfort the local blocking agent should be used. There are many studies on the efficacy of using this technique for any stable surgical patient. The efficacy of this technique has even found its way into the Pain Management Guidelines published by AAHA.

**Regional or Nerve Blocking** techniques are a bit more precise using anatomical landmarks, palpation or devices to infiltrate the blocking solution within millimeters of a nerve. A good knowledge of the nervous system anatomy is desirable before implementing such techniques. It is important we are not piercing the actual nerve or infiltrating the nerve, like commonly done during leg amputations. More recent research has shown the infiltration of the nerve, stretching the fibers can sensitive the remaining nerve component adversely.

**Neuraxial Anesthesia** is the technique of infiltrating blocking agents in the epidural space. This is a very effective technique for essentially anything on the caudal half of the animal and can be useful for such conditions as pancreatitis or thoracotomies when using opioids instead of a blocking agent.

There are a few basic tools one will need for local blocks.

- Basic tools include: A variety of hypodermic and spinal needle gauges and lengths, preferably luer lock syringes. Red rubber catheters with male end adapters for infiltration or pre-made wound infusion catheters.
- For more advanced techniques: A nerve stimulator and ultrasound
- There are a few techniques in veterinary medicine used in practice to reduce the sting of blocking agents, as they are usually a weak base. Adding sodium bicarbonate to the blocking agent does alkalinize the agent for a less dramatic sting in awake patients. When adding sodium bicarbonate, the mixologist should keep in mind some proportional ratios as adding too much can cause precipitation and decrease efficacy. A 1:3 part sodium bicarbonate to 3 parts blocking agent solution is usually safe and still effective. If the patient is anesthetized you may forgo this technique altogether. If you need a greater volume of the blocking agent and have not added sodium bicarbonate you can add regular saline to the blocking agent at no greater ration than 1:1 or efficacy will be compromised. There is some evidence that adding saline to the mixture will better facilitate tissue distribution of the blocking agents.

The technique of mixing two different local blocking agents, having one agent with a quicker onset (Lidocaine) and one with a longer onset and lasting effect (bupivacaine), has largely been via summation. There is a larger body of evidence that shows when mixing the two agents the bupivacaine may be washed out of the system before any real beneficial effects. One more practical strategy is to provide the initial 60-90 minutes of anesthesia using a less irritating agent (lidocaine) and then re-inject the anesthetized tissue with bupivacaine to provide analgesia well into the postoperative period.

Several adjunctive agents added to local blocking agents have been described and are a favorite technique of the author. Micro doses of opioids (0.005mg/kg buprenorphine or 0.01mg/kg morphine), steroids, and dexmedetomidine (0.25mcg/kg) can drastically prolonged the effects of local blocks from a couple of hours to 24-48 hours. Another more recent option is NOCITA by Aratana. This is a liposomal bupivacaine solution that lasts for 72 hours. Although labeled of canine CCL repair and feline fracture repair at this time the author has used it in many other procedures such as hemilaminectomies, general incision closures, dental work and much more. A poster describing the use of the human form of the medication showed analgesic effects last up to 96 hours in mice.

With the insertion of a needle into any tissue we can expect some risk and possible complications. From the needle insertion aspect, we can cause mechanical trauma to several different types of tissue depending on where you are inserting. Most commonly
with peripheral blocking techniques we may see nerve injury. This occurs as the needle pierces through the nerve instead of adjacent to the nerve.

We can also cause trauma to the nerve by what is termed injection pressure. This is the rate at which the operator of delivering the blocking agent either intra or perineural. We can also see nerve injury what using advanced tools such as a nerve stimulator for electrolocation. In general, if the operator is near the nerve and feels resistance during injection of insertion, like going into a different type of tissue, they should stop and re-adjust the needle placement. Typical compilations from these types of injuries usually manifest 48 hours after the injury as motor loss, the patient biting or scratching at the site from a tingling sensation or injury to the tissue over time form chronic numbness and lack of self-awareness to injury.

Other complications we may see include neurotoxicity. Although evidence has shown that the efficacy of blocking agents (and other medications) used in epidurals with preservatives is the same the preservatives like EDTA has been associated with severe back pain in canine and human studies.

References available upon request. Please email the author for a copy of the slides for needle insertion sites and techniques at www.stpehencital.com

Bupivacaine body cavity analgesia protocol

Usage

This treatment is to provide local analgesia for the thoracic and abdominal cavities.

Supplies needed

- Bupivacaine 5mg/ml
- 0.9% NaCl
- Sodium Bicarbonate 8.4%
- Sterile syringe
- Sterile needle

Procedure

1. Draw up 1.5mg/kg Bupivacaine, dilute with three parts 0.9%NaCl.
2. Then add 1 part of Sodium Bicarbonate 8.4% to 9 parts Bupivacaine/0.9% NaCl solution.
3. (Take your total volume in mls of Bupivacaine/0.9% NaCl solution and divide by 9.)
4. Aspirate the tube per protocol prior to instilling the analgesia solution.
5. This is a per animal dose. If the patient has bilateral chest tubes, divide the dose among them.
6. Infuse the solution slowly over 1-2 minutes.
7. This solution should remain in the pleural space for at least 30 minutes.
8. Aspirate the chest tube per protocol.
   This treatment should be repeated every 4 hours, as needed for analgesia.
9. The total dose of Bupivacaine should not exceed 9mg/kg/day.
   Please document on the treatment sheet the volume instilled and aspirated.

Please note

- Higher doses of Bupivacaine may cause signs referable to:
- Neurologic signs
- Altered mentation, tremors, seizures
- Cardiovascular signs
- Myocardial depression, arrhythmias, hypotension
- Some patients may experience stinging when the Bupivacaine solution is administered, so use caution.
- **Do not use in cats**
- **Do not use for pericardectomy patients**
**Analgesia in the avian species**

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Sites for analgesia delivery vary from specie to specie and feasibility depending on muscle mass for IM injections, vascular access for IV injections and availability of SC space.

Rabbits are common pets and used extensively in the laboratory setting. In the laboratory setting, rabbits are often used as epidural and intrathecal models, and thusly this is a form of analgesia that can be utilized in these species. Signs of pain in these species mirror that of rodents, with the addition of hair plucking or ileus. Ileus can be intensified by the addition of opioids. Lagomorphs tend to be a sensitive species to chemicals of any sort, including analgesics. Fortunately more species-specific research is being performed finding
more definitive dosing and relying less on extrapolation. One of the most recent studies published found previous meloxicam doses may be not as effective as once thought. The study highlights the importance of constant and relevant research into pharmacokinetics for all species.

Insectivore analgesia lacks a thorough research and practitioners are urged to investigate analgesia protocols for these species as more information becomes published. It is common practice to extrapolate doses of pain medications from rodent models. One published dose of buprenorphine is available at 0.01-0.03mg/kg SC q12hr for hedgehogs.

Much like insectivores very limited published data is available for marsupials and their 260 represented species in the world. In general marsupials tend to need higher doses of anesthetics and presumably analgesics for unknown reasons.
What to Do with Lumps and Bumps: Why Wait? Aspirate!
Sue Ettinger, DVM, DACVIM
Dr. Sue Cancer Vet PLLC
Tarrytown, NY

What is “See something, do something. Why wait? Aspirate. Dr. Sue Cancer Vet?”

“See Something, Do Something” (SSDS) is a lumps and bumps cancer awareness program that provides guidelines for evaluating superficial masses in dogs and cats. We hope these guidelines to increase client awareness will promote early cancer detection and diagnosis, as well as early surgical intervention. In veterinary medicine, most skin and subcutaneous tumors can be cured with surgery alone if diagnosed early when tumors are small.

- See Something: If a skin mass is the size of a pea (1 cm) and has been there 1 month,
- Do Something: Aspirate or biopsy, and treat appropriately!

Why do we need SSDS?
It is well documented that cytologic and histologic evaluations are important diagnostic tools in veterinary oncology and that obtaining a preliminary diagnosis optimizes treatment planning. It is also recommended to evaluate masses that are growing, changing in appearance, or irritating to the patient. At this time, no specific guidelines exist for determining when to aspirate or biopsy or when to monitor canine and feline skin and subcutaneous masses.

Without standard of care guidelines, superficial masses may be monitored for too long. This can negatively impact our patient’s prognosis as well as limit their treatment options. Larger tumors that are diagnosed later may require more advanced treatments. Surgical excision of larger masses may result in less than adequate surgical margins (narrow or incomplete), leading to recurrence and additional costly therapy (second more aggressive local surgery, radiation therapy and/or chemotherapy).

With significant time delays and prolonged monitoring, there may be no reasonable surgical treatment options to remove large advanced tumors. These are often the most frustrating and heartbreaking cases.

Why diagnose early?
Obtaining a definitive diagnosis with cytology or biopsy early and before excision will lead to improved patient outcomes for superficial masses. When smaller, superficial tumors are detected early, surgery is likely curative - especially benign lesions and tumors that are only locally invasive with a low probability of metastasis. If tumors are removed with complete surgical margins, the prognosis is often good with no additional treatments needed.

- Visual monitoring is not enough.
- Pet owners need to be aware of the “pea” size requirement to have masses evaluated
- Veterinarians must measure and document the size of the mass in order to compare growth.
- If > 1 cm (or size of large pea) and present for a month, the mass should be aspirated or biopsied.
- Knowing the tumor type prior to the FIRST surgery will increase success of a curative-intent surgery.

What are the most common tumors?
Primary skin and subcutaneous tumors are common in dogs and cats. While the overall incidence in dogs and cats is difficult to determine, approximately 25 to 43% of biopsies submitted in dogs and cats are of the skin. Of submitted samples, 20 to 40% are reported to be malignant.

The most common malignant skin tumors in dogs are mast cell tumors (MCT) (10-17%), soft tissue sarcomas (including fibrosarcomas [2-6%], malignant nerve sheath tumors [4-7%]), and squamous cell carcinomas (2-6%). The most common benign canine skin and subcutaneous benign tumors include lipomas (8%), histiocytomas (8-12%), perianal gland adenomas (8-12%), sebaceous gland adenomas/hyperplasia (4-6%), trichoepitheliomas (4%), papillomas (3%), and basal cell tumors (4-5%).

In cats, the most common superficial tumors include basal cell tumors (BCT) (15-26%), mast cell tumors (13-21%), squamous cell carcinomas (10-15%), fibrosarcomas (15-17%). These four tumor types make up about 70% of all skin tumors in cats. Sebaceous gland adenomas are much less common (2-4%). If BCT are excluded, the percentage of malignant skin tumors in cats is higher than dogs, with studies reporting 70 to 80%.

Is visual monitoring acceptable?
Even the most experienced veterinarian or oncologist cannot look at or palpate a mass and know whether it is malignant or not. Cancer is a cellular diagnosis! It is always recommended to evaluate masses that are growing, changing in appearance, or irritating to the patient. But these guidelines are not enough. All skin and SQ masses that are >1 cm and have been present for 1 month should be aspirated for cytologic evaluation. Biopsy is indicated if cytology does not provide a diagnosis.

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Methods of diagnosis

Aspirate and cytology

Fine needle aspiration (FNA) and cytology provide a diagnosis for many skin and SQ masses, especially those that that exfoliate well. FNA is useful to distinguish neoplasia from inflammation. Cellular morphology may also allow for the determination of benign or malignant phenotype. FNA is useful for identifying benign masses including lipomas and sebaceous adenomas. For malignant tumors, cytology provides information that assists in formulating diagnostic and treatment plans.

The advantages of cytology include: minimally invasive approach, low risk, low cost procedure, and results are available more quickly than biopsy results. The disadvantages of cytology are that it may be non-diagnostic or equivocal. This may be due to a small number of cells in the sample, poor exfoliation of the cells, or poor sample quality. If the sample is non-diagnostic or equivocal, histopathological confirmation may be required for definitive diagnosis.

Unless the sample is comprised exclusively of only fat, clear cystic fluid, or acellular debris, the sample should be submitted to a trained cytopathologist. WHEN IN DOUBT, SEND IT OUT. Including an adequate history helps the pathologist in diagnostic accuracy.

Biopsy

If cytology is non-diagnostic, a pre-treatment biopsy is recommended PRIOR to complete tumor removal. The pre-treatment biopsy will determine the optimal treatment plan.

The role of excisional biopsy is controversial, even among oncologic surgeons. A practical recommendation for non-diagnostic cytology and the lesion fits in an 8 mm punch biopsy, then PUNCH IT OUT. If the mass is larger than an 8 mm punch biopsy, an incisional biopsy (wedge, tru-cut, punch) is required for diagnostic confirmation.

It is tempting to remove the mass right away. An excisional biopsy establishes a diagnosis and removes the tumor at the same time. However it is not recommended for undiagnosed skin and superficial masses. Malignant tumors often require 2 to 3 cm margins. When an excisional biopsy (or debulking surgery) leads to incomplete margins for malignant tumors, more treatment, more morbidity, and more expense ensue. Thus removing the mass entirely is not recommended without a cellular diagnosis prior to definitive excision. Surgical approaches vary with different tumor types. Research confirms that the first surgery is the best chance for a cure.

Staging diagnostics are often indicated prior to curative intent surgery. Consultation with a veterinary oncologist is recommended.

After the aspirate/biopsy

If the mass is benign

Benign tumors may not need to be removed. A variety of factors, including mass location should be considered. Surgery should be recommended when a benign tumor is causing pain, irritation, bleeding, or infection. Surgery should also be recommended if an increase in growth would prevent a surgery in the future.

Alternatively, if removing the tumor requires a complicated surgery (i.e. near a joint, on the distal limb with minimal surrounding tissue for reconstruction) or the pet has other pre-existing issues, you and the pet owner may make an educated decision as to whether proceeding to surgical removal is warranted. PETS WITH MASSES NOT REMOVED SHOULD BE MONITORED (via measurement) BY THE VETERINARIAN EVERY 3 TO 6 MONTHS.

If surgery is performed, most benign masses require smaller surgeries, as wide margins are typically not needed.

If the mass is malignant

If the aspirate/biopsy reveals malignancy, consult with a veterinary oncologist for appropriate staging recommendations. For malignant tumors, the first surgery should be a wide excisional surgery.

If wide excisional surgery is not possible due to the size or anatomic location of the mass, consultation with an oncologist or board-certified surgeon is indicated. Surgeons may be able to perform specialized surgeries such as axial pattern flaps to remove the tumor completely.

Debulking (cytoreductive) surgery may not be recommended, as this will not obtain margins, and additional post-operative treatments such as radiation will be required to prevent recurrence. In some cases, cytoreductive surgery may be performed for palliation, or with an understanding that adjunctive therapy such as radiation therapy will follow the procedure.

After surgery

- Review the histopathology report – tumor type, grade, vascular and lymphatic invasion.
- Consult with a veterinary oncologist for additional therapeutic considerations for malignant tumors.
- Assess the QUANTITY of surgical margins in consideration of tumor type and biologic behavior. (One mm margins for a malignant tumor may be called “clean” on a biopsy report, but size of margins must be considered in light of tumor histology.)
- If margins are inadequate, recommend adjunctive treatment before tumor recurrence for optimum patient outcome. Post-operative options include scar revision (second surgery), radiation to prevent regrowth, or chemotherapy which may slow recurrence in some cases.
• It is important to consult a board certified surgeon before attempting scar revision.
• Monitor for local tumor recurrence and metastasis as indicated by the histologic diagnosis and margin assessment.

**Recurrence and monitoring**

Patients with reported complete surgical margins can potentially suffer tumor recurrence due to microscopic cancer extension that is not seen in the evaluated sections. Therefore, it is essential to monitor for local regrowth, and to recruit the pet owner to monitor the surgical scar as well, to identify early relapse.

For malignant tumors with wide, clean margins and low metastatic potential, follow-up rechecks are recommended every two to three months after the surgery for as much as one year of follow up. Early detection is key to addressing recurrence and metastasis to ensure the highest possible chance of success.

**Owners are encouraged to check their pets regularly at home for new masses**

- Owners should check their pet monthly for superficial masses by noting their location and size.
- Create a “body map” with size and location of superficial masses recorded, along with fine needle aspiration cytology results. This body map can serve as an objective medical record document and owner guide to follow masses longitudinally, and to allow for identification of new masses over time.
- All masses should be aspirated and submitted for cytology. Masses that do not need cytologic assessment include lipomas, cysts, and those containing acellular debris.
- If cytology is non-diagnostic, discuss repeating the aspirate, or proceeding to biopsy.
- **Know the tumor type prior to surgery. The first surgery is your patient’s best chance for cure.**

**Surgery may be all that is needed**

We all must be proactive to advocate for early cancer detection. Visual monitoring of superficial masses is not enough.  Obtaining a definitive diagnosis via either cytology or biopsy early and before excision will lead to improved patient outcomes for superficial masses. Surgery is likely curative for the majority of these cases, especially for benign masses and those locally invasive malignancies that are non-metastatic. **If tumors are detected and removed earlier – when they are small and with clean margins**, the prognosis is often good and the patient may not require additional therapy.

- See Something: When a skin mass is the size of a pea (1 cm) and has been present for 1 month,
- Do Something: Aspirate or biopsy, and treat appropriately!


**References/suggested reading**

The Little Things to Make Euthanasia Better in Clinics
Mary Gardner, DVM
Lap of Love Veterinary Hospice
Bandon, OR

The euthanasia appointment is one of the most emotionally challenging appointments for the entire staff (and owner). This lecture will go over all aspects of the appointment including how to handle the initial phone call, discussing the processing, handling payment, technical aspects of euthanasia and body care.

Being good at death
We are not taught to be good at death. No one taught me how to walk into an exam room for a euthanasia, what to say to a crying teenager, or whether or not to hug the old man that just lost the last piece of his late wife. I received no direct guidance about the proper verbal and non verbal techniques that make this “most difficult appointment” just a bit easier on everyone, including myself. And from our numerous discussions with new grads, it’s a common theme; about 75% of veterinarians graduate without ever administering the life-ending medication. It’s no wonder why our lectures are packed at conferences and why our hospice practice has more requests for externs than we can handle. We simply weren’t taught the intricacies of death, and as the only medical profession licensed to euthanize, we have an incredible privilege and responsibility to handle this procedure properly.

Euthanasia
If there is one thing to think about when approaching the euthanasia appointment, it’s “What would I do for my own family’s pet?” This involves not only you, but your immediate nonveterinary family as well. What could you do to help the ones you love through the process? Now make sure that is the minimum standard of service and care you give each of your patients and their caregivers! Here are some tips to put this into practice:
The entire euthanasia process can be broken down into 4 stages:

Setting up the euthanasia appointment
• Be the first to say the “E” word. Clients hate to be the first ones to bring up “euthanasia.” They think you will judge them for not caring about their pet or that you will be mad at them for giving up too early. Be the first to say it. And even if they’re upset at you for the suggestion, at 2:00 am when they’re stressed because their dog is pacing all night or their spouse is yelling at them because their elderly cat has peed outside the litter box for the third time that day, they will know that you gave them permission to think about the next step.
• Making the appointment: How your support team handles this initial contact with the client is crucial. It took the owner a lot of nerve and emotion to call; many feel that they are making the appointment to kill their best friend. Guilt, worry, anxiety, sorrow are just a few of the ingredients in their emotional cocktail. The receptionist should have nothing else on their mind but assisting that client. They should not be put on hold, the receptionist should not be checking out another client at the same time, and if at all possible, background noise should be kept to a minimum. Most importantly, empathy must be conveyed; I’m so sorry you’re facing this. Do not be scared to show them some emotion, they want to know that you care.

During the appointment
• The Arrival: When the time for the appointment comes, everyone in the clinic should be prepared. The paperwork should be ready, dated, and IN the room. The room itself should be set up properly and one person should be prepared to assist the client. Meet the family at their car prepared to help them into the clinic. Even holding the door open while the owner manages the cat carrier is a huge help to the client. And of course, shuttle them to the room immediately.
• Paperwork is best completed at this time before reality sets in with the family. Again, emotions will only get deeper from here, not lighter!
• The Space. The room itself is very important. Regardless if it’s a separate comfort room or a regular exam room, you must do your best to make it as warm and comfortable as possible (it should not be the ‘cold sterile” environment owner’s dread).
• The veterinarian should go into the room and preferably not leave again until the pet has passed unless the owner requests time alone. Go in with sedation and euthanasia already pulled up in syringes in your pocket, or given to your technician. Speak to the client and make a visual assessment of the pet. Do not pass judgement or appear to be uncomfortable with the decision unless you are certain you will not euthanize. Your discomfort will leave a family with guilt for years.
• When explaining the euthanasia process, it is important to give the owner peace of mind that it is a gentle process. Explain that euthanasia means “good death” and that the medication is an overdose of anesthesia, in which they go to sleep and don’t wake back up.
• Offer them some time alone with their pet. If they want time alone, hand them the 'ringer' portion of a wireless doorbell. Have the 'bell' portion in the treatment room or give it to the technician assigned to the case. That way the owner does not have to leave the pet to find someone when they’re ready. The human animal bond should never be broken. Generally people do request a few minutes alone, but it’s usually a very short amount of time.

• **The Procedure:** Intra-muscular or subcutaneous sedation is crucial for the client’s experience and we are always discouraged to learn how many do not sedate pets before euthanasia, or provide only IV sedation (in which their pet rapidly goes from consciousness to unconsciousness, appearing dead). Having 5 minutes for the pet to slowly relax gives the owner time to watch their pet get comfortable. Many times I hear “I haven’t seen him this calm and relaxed in months!” We call this “secondary sedation of the owner.”

• When it comes time for the final medication, ask the owner “Max is ready, are you?” Never proceed without them fully knowing what is about to happen. They should also know that their pet will pass in 30-60 seconds. All too often owners do not realize it occurs as fast as it does. Whether you use an indwelling catheter, butterfly catheter, or straight needle, do your best to stay out of the way of the owner. Let them hold their pet and instruct them to “keep talking to her, she can hear you.” Giving them something to do keeps their focus off you and this surreal moment for them.

• After administration, listen for the heart and remain silent unless the owner speaks. This is an important moment and must be honored.

• Stay present in the room for a few minutes as you gather the syringe and supplies. Watch for agonal breath(s), twitching, or any other movements, which generally happens within 1-5 minutes post mortem. Since we do not recommend warning about all these side-effects before, this is the time to explain them if/when they occur.

**Memorial items**

• The paw print is the most traditional and cherished memorial item, even more than cremains sometimes! Every pet owner should be given one at the time of the appointment and given to the owner to take home that day (at no charge!). With air dry clay like Crayola Model Magic, this is inexpensive and takes very little time. Many clinics make the paw print after the clients leave but you are missing a huge opportunity to make the owners feel a little bit of joy at such a devastating moment.

**Body care**

• Never allow the owner leave their deceased pet alone. If they need time alone after the euthanasia, allow them that time and hand them the wireless doorbell again. This way, a technician can come back into the room as they leave.

• Know your crematory well. Understand how they do things and be confident they are providing the level of service your client’s deserve.

If there’s one thing we can tell you to improve your end of life care for pets and their families, it’s to provide the best from the get-go. Provide the kind of care that exceeds the expectations of 95% of the population out there. Do not cater to the 5% of people that are irregular.

The euthanasia appointment should not be the end of the client relationship, it should be the beginning of the next relationship you have with them! And remember, if it were your own pet, what would you do?
What are the best antibiotics for urinary tract infections?
Most urinary tract infections are caused by ascending bacteria such as E. coli, Staph and Strep organisms. Short courses (7 – 10 days) of amoxicillin or trimethoprim-sulfa are probably the best and safest drugs to use. Using amoxicillin first, and for most simple UTIs, will help prevent antimicrobial resistance.

What are the exceptions to using these common antimicrobials?
Recurrent infections and infections that extend to the kidneys, prostate or blood stream require longer term and more specific treatments. Treatment for 3 – 6 weeks is required for these complicated infections. Fluroquinolones are the best choices for penetrating the kidneys and the prostate gland in male dogs.

Asymptomatic UTIs do not necessarily need to be treated. Subclinical infections are common in dogs with other diseases or with abnormalities of the urinary tract. Most clinicians now recommend waiting for symptoms to initiate treatment, unless there is a high risk of the infection ascending to the kidneys or into the bloodstream. Determining this degree of risk can be tricky though.

Are there any treatments that help with sterile cystitis?
In cats, a sterile, inflammatory cystitis is common and is considered idiopathic (Feline Idiopathic Cystitis or Feline Interstitial Cystitis). FIC is characterized by occasional episodes of hematuria, pollakiuria, and inappropriate urination that are not associated with bacterial infection and are self-limiting in nature. However, a subset of affected cats have more refractory disease, with signs that recur multiple times during a given year or, less commonly, persist for longer than 7 days.

**Short-term symptomatic relief** can be used for 2 to 5 days during acute flare-ups to minimize discomfort and shorten the hematuric phase. Signs will resolve spontaneously in approximately 85% of affected cats within a few days.

- **Analgesics.** For acute flare-ups of lower urinary tract signs, short-term analgesic treatments may be useful to reduce the discomfort. Opioids also have some anti-inflammatory effects that may be beneficial in this setting.
- **Alpha adrenergic antagonism?** (Phenoxybenzamine or prazosin) Agents that may relax urethral musculature also have been recommended to facilitate urination in dysuric cats and to alleviate functional urethral obstruction in postobstructed cats.
- **Non-steroidal anti-inflammatory agents?** Nonsteroidal anti-inflammatory agents have also been recommended for analgesic and anti-inflammatory effects.

**Long term strategies**
Although not exactly medications, dietary and environmental strategies (including Feli-way) are usually recommended to increase water intake and reduce stress. Pharmacologic agents may be added only if the cat still experiences frequent recurrences. The effects of these mediations may take weeks to months to be fully realized; treatment is indefinite to lifelong.

- **Anti-anxiety medication.** Amitriptyline is an antianxiety drug that also has effects on the bladder muscle, inflammation and bladder pain. It has been studied for both acute non-obstructive episodes and for longer term usage in cats. Other tricyclic antidepressants or SSRIs (like Prozac) may be useful in cats as well; in the author’s experience, clomipramine is better tolerated by cats than amitriptyline. The drug should be given daily for several months to assess effectiveness. For cats in which amitriptyline is indicated, a starting dosage of 5 mg/cat every 24 hours is empirically recommended; the dose is adjusted to effect a mild calming behavior in the cat, which is usually achieved with dosages of 2.5 to 12.5 mg/cat per day. The dose of clomipramine is approximately 0.5 mg/kg/day. Others prefer fluoxetine (0.5-1.0 mg/kg PO q24h). If ineffective, these medications should be slowly tapered instead of withdrawn abruptly.
- **Glycosaminoglycans.** Pentosan polysulfate (PPS, Elmiron) is a synthetic polysaccharide that augments the glycosaminoglycan (GAG) layer of the urinary bladder. This protein layer attracts water molecules and creates a protective barrier on the inside bladder wall. Orally administered PPS has resulted in good long-term responses (>6 to 12 months) in some women with IC and may be effective in reducing clinical episodes in cats with recurrent or chronic idiopathic disease. GAG have not proven more effective than placebo in two trials in cats, however. The currently recommended oral dosage for cats is 8 mg/kg (usually 50 mg/cat) PO q 12 hours. An injectable protocol includes PPS (3 mg/kg) administered subcutaneously on days 1, 2, 5 and 10.
- **Glucosamine and chondroitin sulfate** are the building blocks for formation of glycosaminoglycans. Anecdotally these nutritional supplements have been helpful in some cats with chronic disease but have not led to dramatic results in clinical trials.
What are the advantages and disadvantages of medications for incontinence in dogs?

Most incontinent dogs are spayed females who have weak structure and function of the urethra, allowing urine leakage between urinations. Treatments are directed at the smooth muscle in the urethra, the alpha receptors that favor muscle contraction, and the surrounding collagen and other supporting structures.

Reproductive hormones

**Estrogen** administration enhances urethral closure function primarily by increasing the number and responsiveness of alpha receptors in urethral smooth muscle. Estrogen also has effects on urethral mucosa, submucosal blood flow and density of peri-urethral collagen. All of these effects help the urethral surface stay moist and healthy and create a sealed outflow tract.

- **Diethylstilbestrol** (0.1-1.0 mg/dog q 24 h for 5-7 days followed by once or twice weekly administration) has been utilized for some time with reasonable safety and efficacy. The drug is usually obtained from compounding pharmacies.
- **Estriol** has become a favored estrogen product in Europe and is available in the US (Incurin, Merck). Improved to excellent responses were obtained in about 80% of treated dogs in a large group studied in western Europe. Product information for Incurin report improvement or continence in 99% of treated dogs by six weeks of treatment. The starting dose is 2 mg/dog estriol per day for a week, then the dose was reduced at weekly intervals to the minimal effective dose (typically 0.5 - 2.0 mg/dog given daily or every other day). Adverse effects were rare, but included signs of estrus at the initial estriol dose, which resolved in all but one dog after dose reduction.
- **Premarin**, a conjugated estrogen extracted from pregnant mare urine, is sometimes prescribed because it is readily available for women. Maintenance dosages range from 0.625 mg to 1.25 mg per dog, administered PO every 12 – 72 hrs. In some dogs, administration every 4 to 7 days is effective.
- **Adverse effects** are rare at maintenance doses but can include signs of estrus, behavioral changes and hair loss. Bone marrow suppression is very unlikely with usual doses of these types of estrogens.

**Sympathomimetic (Alpha) agonists**

- Available sympathomimetic agents have an indirect and nonselective stimulatory effect on the urethral alpha receptors. Sympathomimetic agents can be used in male or female dogs and in dogs for whom reproductive hormones are not advised or not tolerated. Typically, alpha agonist agents are so reliable that they can be used for short trial periods to confirm your diagnosis.
- Excellent responses have been observed in most dogs treated with **phenylpropanolamine (PPA, 1.5 mg/kg PO q 12 – 24 h)**, with 90% or greater responding in small studies.
- Frequency of PPA administration required for continence varies from one to three times daily. Some dogs may have acceptable continence with once daily (or less frequent) administration. Although we have previously recommended starting with a high frequency, then tapering down to the minimally effective dose and frequency, an opposite approach may be reasonable in dogs with mild incontinence.
- **Ephedrine and pseudoephedrine** are alternative alpha agonists with similar effects on urethral function. Their clinical use increases during periods when PPA is difficult to obtain. Dogs are a bit more likely to have adverse effects with pseudoephedrine treatment as opposed to PPA, including changes in appetite and behavior.
- **Adverse effects** are fairly rare in treated patients. Most commonly, dogs exhibit other sympathomimetic responses (agitation, panting, tachycardia) although central effects are possible (anorexia, unusual behavior, aggression). Typically, these effects resolve with reduced dosage or frequency although occasional dogs will not tolerate the drug. Systemic hypertension is theoretically possible, so blood pressure should be monitored. Sympathomimetic agents should be avoided or used with careful monitoring in patients with cardiac disease, renal disease or other uncontrolled hypertensive disease.
Table 1. Comparison of alpha agonists and reproductive hormones for management of urinary incontinence in dogs

<table>
<thead>
<tr>
<th></th>
<th>Alpha Agonists</th>
<th>Estrogens</th>
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<tbody>
<tr>
<td>Effectiveness</td>
<td>75 - 90% excellent results</td>
<td>40 - 65% excellent results (DES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80-90% improved (estriol)</td>
</tr>
<tr>
<td>Indications</td>
<td>Males or females, dogs or cats</td>
<td>Female dogs</td>
</tr>
<tr>
<td></td>
<td>Poor response to estrogen</td>
<td>Combination with alpha agonists</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recurrent UTI or vaginitis?</td>
</tr>
<tr>
<td>Administration frequency</td>
<td>q 12 - 24 hrs; note tolerance may develop with higher frequency</td>
<td>q 1 - 14 days, depending on preparation</td>
</tr>
<tr>
<td>Residual effects</td>
<td>Short</td>
<td>Possibly prolonged</td>
</tr>
<tr>
<td>Adverse effects</td>
<td>Hyperactivity</td>
<td>Behavioral change</td>
</tr>
<tr>
<td></td>
<td>Hypertension</td>
<td>Estrus/swollen vulva</td>
</tr>
<tr>
<td></td>
<td>Anorexia, weight loss</td>
<td>Exacerbation of immune-mediated disease?</td>
</tr>
<tr>
<td></td>
<td>Hypertension?</td>
<td>Bone marrow toxicity? (very rare)</td>
</tr>
</tbody>
</table>

What if we actually need to relax the urethra instead of making it tighter?

Sometimes we see male cats or male dogs with a functional obstruction of the urethra. It’s easiest to think of this as a type of urethralspasm, although the urethra may simply not open when it’s supposed to. Urethralspasm is a challenging complication of feline obstruction. During recovery, blocked cats maybe doing well but still not be able to urinate. Short term administration of smooth muscle relaxants (prazosin, usually 0.25 mg once or twice daily), striated muscle relaxants (diazepam) and/or analgesics (NSAIDs, Opioids) can be somewhat helpful. Diazepam may transiently aid bladder expression in some cats. Some evidence exists that amitryptiline will relax the feline urethra too. All of these drugs have potential adverse effects.

On the other hand, weak bladder contractions (bladder or detrusor atony) are also possible following urinary obstruction and bladder overdistension. Recovery of normal detrusor function will be enhanced by preventing excessive detrusor stretch or strain in the days following relief of the obstruction. Atony can be managed with manual bladder expression if urethral resistance is low and expression is not difficult or painful. Manual expression of urine, especially in the face of any increased outlet resistance, can create further bladder wall trauma and may delay return to normal function. A cat whose bladder remains larger than a golf ball following a voiding attempt may require placement of an indwelling catheter for a variable period of time (usually 1-3 days) to maintain a small bladder size. Cholinergic drugs like betanechol can also be useful in the recovery of acute detrusor atony; however urethral outlet resistance must be lowered (typically with prazosin and/or diazepam) before introducing betanechol.

“Tincture of time” is the most reliable treatment for urethralspasm or bladder atony; however the urinary bladder must be kept small with urinary catheterization or gentle manual expression in the meantime.

Can we do anything to help bladder and prostate tumors besides aggressive surgeries or chemotherapy?

The most common tumors of the bladder or prostate are carcinomas, either a transitional cell carcinoma or adenocarcinoma. Although multimodal treatments for bladder and prostate carcinomas extend survival in some patients, many clients are unwilling or unable to try aggressive treatments. The response to aggressive treatments is not really dramatic either. Fortunately, simple medical treatment can buy good quality time for many dogs and cats.

In most cases, chemotherapy with piroxicam is used to reduce clinical signs and modestly prolong survival. Piroxicam (0.3 mg/kg/day PO) is a NSAID with additional antineoplastic activity. The anti-tumor effect may be due to immunomodulation (blocked COX 2 expression) or direct activity on tumor receptors. It is most effective against urinary bladder transitional cell carcinomas. Concurrent antacids (H2 blockers or omeprazole) or misoprostol (prostaglandin) are administered to protect the gastrointestinal tract. Complete or partial remission is seen in some dogs (about 30%), with survival times of approximately 6 months. Many treated dogs do well for a year or more. Similar results have been observed with Deracoxib (Deramaxx 3 mg/kgPO q 24 hrs).
Nutritional assessment and strategies for feeding hospitalized pets and those with chronic inappetence will be discussed by a board-certified veterinary nutritionist. Strategies for ensuring adequate calorie intake will be discussed. Strategies to increase owner adherence to prescribed nutritional plans will also be discussed. Case examples will be included to illustrate tips and strategies.

**Terms useful for nutritional assessment of pets**

- **Anorexia:** Complete loss of appetite, where a pet is not eating or ingesting any calories.
- **Hyporexia:** Decreased appetite where a pet is eating, but not enough to meet their daily calorie requirements (at least resting energy requirements, RER).
- **Dysrexia:** Change in food preferences, where a pet is eating, but not appropriate food (e.g., an unbalanced diet or foods not appropriate for a specific medical condition).
- **Body condition score:** Assessment of a pet’s fat stores only. Ideal body condition is described as ribs that are palpable without excess fat covering (tip: ribs should be no more padded than the back of your hand).
- **Muscle condition score:** Assessment of a pet’s muscle by palpation of spine, skull, scapulae, and ileal wings.

*Note: Non-branded charts of condition scoring can be found in the nutrition toolkit developed by the World Small Animal Veterinary Association (WSAVA), available at: http://www.wsava.org/nutrition-toolkit.*

**Chart of resting energy requirements for cats and dogs**

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<th>Weight (kg)</th>
<th>RER (kcal/day)</th>
<th>Weight (kg)</th>
<th>RER (kcal/day)</th>
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Assessing risk of malnutrition

Assessing risk of malnutrition can alert the healthcare team when to intervene for a pet and consider additional nutritional support. During normal weight loss, the body of a healthy pet will adapt to calorie restriction and break down fat. However, when a pet has a medical illness, if calorie, and especially protein, needs are not met, the body will not adapt. Instead, pets will break down their own muscles to meet their nutrient needs and cause muscle wasting. Body condition scoring, muscle condition scoring, and assessing the risk for malnutrition is critical in pets not meeting their calorie or nutrient needs.

- Low risk: Previously healthy pets with no conditions that would increase protein loss (e.g., protein-losing enteropathy), who have been hyporexic or anorexic for 3 days or less. Examples would be elective surgery or a trauma.
- Moderate risk: Non-debilitated pets with conditions that increase protein loss, who have been hyporexic or anorexic for 3-4 days. Examples would be septic patients or a foreign body removal that required intestinal resection.
- High risk: Debilitated pets with chronic conditions that have experienced muscle loss, weight loss, have higher than normal nutrient needs (e.g., puppies or kittens), or have been hyporexic or anorexic for 4 or more days.

Note: For pets that are hospitalized, always assess the duration of hyporexia or anorexia including time at home before hospitalization!

Nutritional intervention

Strategies and the level of invasiveness for nutritional intervention differs depending on the risk of malnutrition for each pet.

Medical strategies

Assess current medications: Many medications may cause nausea or inappetence, including pain medications (e.g., opioids) and antibiotics. If temporary use in a low risk pet, this may not be a concern. However, pets that require nausea-inducing medications long term or who are already at high risk of malnutrition may need to be switched to alternate dosing or alternate medications. If palatability is a factor, some medications can be compounded with tasty flavors at compounding pharmacies, or topical/injectable options may be available, for example, injectable antibiotics such as cefovecin sodium.

Anti-nausea medications: For pets without alternatives for nausea-inducing medications, or for pets with chronic disease conditions that contribute to nausea, supportive medications can be used to counteract these effects, for example, maropitant citrate.

Appetite stimulants: Appetite stimulants are best used in low risk patients who have ‘forgotten’ their appetite and need a jump start. The effects of many of these medications are short term. Be cautious of pets who eat voraciously for one meal after receiving an appetite stimulant, but then return to hyporexia or anorexia within 12-24 hours. Examples of medications include: diazepam, cyproheptadine, and mirtazapine. One new medication on the market, capromorelin, has potential long term applications, though further clinical studies are warranted.

Feeding strategies

Coax feeding: Coax feeding should only be attempted in pets that are at low risk of malnutrition and the goal should be to minimize stress and make feeding an enjoyable experience. If pets are hospitalized, providing the owners a private and quiet room to feed their pet, especially cats, can minimize stress and encourage eating.

Consider diet history: A full dietary history is crucial to knowing food preferences for each pet (e.g., dry, wet, flavor, texture, etc.) and offering them foods that are familiar to them. There are many foods available now in stew forms, pate, loaf, shredded, chunks, with dried chicken bits, and in various shapes like doughnuts, stars, pyramids, etc. Ask owners to keep a diary of their pet’s preferences, which can be useful to guide diet selection if needed.

Food aversion: Altering food temperature can also be helpful – for those with nausea, placing food in a refrigerator may reduce smells that induce nausea and make food more palatable. For pets with food aversions, using new dishes each time or disposable dishes can reduce the chance of them smelling traces of an old food that they are averse to.

Disguise pet food: Likewise, some pets get excited about eating ‘human’ meals, and selecting one ‘human plate’ that is put on the table and then given to the dog or cat with their meal on it can make pets think they are getting a special treat. Similarly, putting regular kibble into an empty treat pouch or bag can also make pets think they are getting a special treat as it has the same smells and sounds of treats they like.

Rotating foods: Many chronic conditions can cause a cyclical appetite, meaning that food preferences and appetite can change over time, but may only be temporary. Keeping a journal of pet preferences can be especially helpful in these situations. Just because a pet refused a food once does not mean they may not like that food again later. We often will give pet owners a list of appropriate foods that they can rotate between if their pet has a change in appetite, or encourage palatability enhancers to disguise foods and flavors (see below).
Home-cooked diet options: If there are no commercial diets appropriate for a pet’s medical condition that they will eat, home-cooking can be an alternative option. This is also common in pets who have been fed table scraps long term and find it hard to then switch back to a commercial diet. Pets should ONLY be fed home-cooked diet recipes that have been formulated by a board-certified veterinary nutritionist (see www.acvn.org). Many studies have shown recipes online or in books are not complete and balanced and may cause nutrient deficiencies.

Palatability enhancers
Palatability enhancers can be used with caution in pets, keeping in mind altered nutrient needs of pets with medical conditions and calories content to not unbalance the diet. Reserving 10% of the pet’s total calorie intake for treats or palatability enhancers lowers risk of unbalancing the diet. Some popular palatability enhancers include shredded chicken breast (200 kcal/cup) for pets without protein restrictions, homemade chicken broth (store-bought is usually high in sodium and frequently contains onion or garlic), low fat and no salt added cottage cheese (200 kcal/cup), and honey or maple syrup (60 kcal/tablespoon), which is especially helpful for dogs with kidney disease or liver disease. Note: cats do not have taste receptors for ‘sweet’ foods and sugary items are not as effective as a palatability enhancer.

Medication administration strategies
Avoid putting medications, especially those with bitter taste, directly into pet foods as it may unintentionally cause a food aversion or affect appetite. An alternate low fat, low protein, low sodium option is to use banana (1/4 inch slice = 15 kcal), or melons (1 melon ball = 10 kcal) to give medications. Always ask owners what they are using for medication administration as it is not commonly included in diet histories (owners don’t think of this as ‘food’).

Behavioral strategies
In some situations, particularly pets with chronic diseases, owners can become very invested in their pet’s eating habits and become anxious over how much their pets are eating. This anxiety can spill over to their pet, who may not understand why his owner gets very upset at mealtimes. Pets then sometimes associate eating or mealt ime with something wrong or upsetting. This can be seen where pets eat normally when pet sitters are involved or a family member leaves the household temporarily. Have owners explain mealtime in detail and ask about all family members and other pets, who sometimes may also contribute to stressful mealtimes if there is fighting over food bowls. Anxious owners can leave food in timed automatic feeders, or place the food and their pet in a quiet, separate room in their house where the pet is left alone to eat. Alternatively, for social pets, talking to them in a soft soothing voice and petting them while they eat may encourage appetite and make mealtime more enjoyable.

Assisted feeding
Once a pet has become moderate or high risk (hyporexic or anorexic for 3 or more days) and previous strategies have been unsuccessful, a nutritional intervention plan should be developed to provide adequate nutrition long term. Assisted feeding can include a variety of short term or long term enteral or parenteral options. Enteral options (feeding tubes) are always preferred if tolerated as intestinal cells can atrophy without direct nutrition through ingested food. The WSAVA Nutrition Toolkit not only has easy-to-use calorie charts, but also provides example feeding orders, monitoring templates, and a helpful flow chart for how to intervene nutritionally for each pet.

Long term feeding tubes can be overwhelming to some owners, especially in pets who are dysrexic, and eating to meet their calorie needs, but not willing to eat foods that are appropriate for their medical condition (e.g., a dog with protein-losing nephropathy that will only eat beef or chicken). The Tufts Clinical Nutrition Service has a website with frequently asked questions for pet owners who are considering a feeding tube or have had a feeding tube recommended to them (http://vetnutrition.tufts.edu/about-feeding-tubes/). The most popular questions are included here:

Why should a feeding tube be placed in my pet?
Feeding tubes allow us to provide pets with nutritional support when they either cannot or will not eat enough to support their nutritional requirements. Feeding tubes also permit us to feed pets the optimal diet for their disease(s) if they will not eat it voluntarily. For many diseases, such as kidney disease, an optimal diet can greatly increase survival time as well as quality of life. Additionally, feeding tubes offer a great route for administering some medications and additional water supplementation when necessary.

Can’t we just wait to see if my pet will eat soon?
A feeding tube has been recommended because your pet has already had a decreased appetite for at least a few days and is anticipated that he or she will continue to have insufficient food intake. Inadequate nutrition (starvation) can have detrimental effects on many organ systems and increases complications and mortality. Feeding tubes can be a great safety net to have in place if needed.
How are feeding tubes placed?
The two most commonly used tubes for at-home care include esophagostomy tubes (E-tubes) and gastrostomy tubes (G-tubes or PEG-tubes). Both types of tubes are placed under general anesthesia. The E-tube is placed directly into the esophagus while the G-tube is placed directly into the stomach (either surgically or with endoscopic guidance). Both tubes are usually extremely well-tolerated by pets.

What kind of maintenance does a feeding tube require?
Pets are usually fed three to four times daily with a feeding tube. Usually the diet will consist of a slurry made up of a specific canned food that has been blended with a specific amount of water. The tube site (where the tube exits the skin) will need to be checked twice daily and some simple bandage care is required.

Can my pet still eat and drink with a feeding tube?
Yes! Your pet will still be able to eat and drink with a feeding tube in place. This means that as he/she begins to eat on his/her own, the amount of food being given via the feeding tube may be decreased accordingly. Once your pet is eating enough to maintain his/her body weight, the feeding tube may be removed (under veterinary supervision).

How long will the tube stay in place?
Tubes are typically left in place until your pet has been eating well for at least one week. If necessary, E-tubes and G-tubes can be maintained for weeks to months with appropriate care.

Summary
Assessing each pet for their risk of malnutrition will help guide the type and level of nutritional intervention needed to meet nutrient and calorie goals.

General pet nutrition resources
- American College of Veterinary Nutrition (ACVN) Website: www.acvn.org
- Resources for pet owners, veterinarians, and a listing of all board-certified veterinary nutritionists.
- World Small Animal Veterinary Association Nutrition Toolkit: www.wsava.org/nutrition-toolkit
  - Note that this site has resources for pet owners and for veterinarians on pet nutrition topics.
- Tufts Clinical Nutrition Service Petfoodology Website: www.petfoodology.org
- University website created by board-certified veterinary nutritionists with frequently updated blogs on pet nutrition.
Prevention of problem behaviors is easier than treatment. Problem behaviors in cats are often associated with the stress of other cats in the house or outside the home. In order to decrease social tension in multi cat households, provide core areas for each cat, increase vertical living space, and prevent exposure to outside cats. When introducing a new cat to a resident cat, it should be a gradual process.

There are pros and cons to confining the cat indoors versus allowing access to outside. The indoor environment is not as enriching or stimulating. However, the indoor environment is safer. Through management and environmental enrichment, indoor cats can be given alternative activities to allow for mental and physical stimulation.

Environmental enrichment
Implementing routine play sessions with the owner in the morning and evening provides for routine interactions. Cats enjoy playing with toys that encourage pouncing and stalking (predatory sequence). Feather toys on the end of a pole, small stuffed toys and balls encourage exercise and positive interactions with the owners. Any type of direct play with human hands should be avoided as it can promote inappropriate play and result in potential injury to humans through accidental scratches and bites.

Cats are natural grazers and they are designed to eat small amounts of food at frequent intervals. Food puzzle toys can help to prevent obesity in cats as there is more activity involved in the feeding process and they provide great mental stimulation. Food puzzle toys also allow for exploration and discovery.

Hiding food and treats around the house in small dishes or cups promotes exploratory behavior and appeases the cat’s natural desire to search for food. Although not a toy, some cats enjoy the option of having indoor grass available. Most are easily grown indoors and are made up of either wheat or oat grasses. Offering fresh grass can prevent cats from eating house plants while providing roughage to their diet.

Providing exploratory outlets through a variety of interactive toys will help to appease the cat’s curiosity. Interactive homemade toys can provide cats with hours of entertainment. A cardboard box with holes for the cat’s paws and toys dangling from sisal rope is an easy to make homemade toy that most cats will appreciate. Sisal rope is a durable rope made from plant fiber. It is often used for scratching posts for cats. These toys can be inexpensively made to entertain boarding felines and sent home with the owners at pick up.

Secure outdoor enclosures and fences are available to allow cats to have exposure to the outdoor environment within a confined area. Most are designed to not only keep the pet cat in the yard but also prevent other feline intruders from entering the yard. For safety supervision by the owner is recommended during controlled outdoor exposure. Acclimatizing a kitten to wearing a cat harness can also allow the owner to manage the cat outside; thus allowing for more exploration. Adult cats that have not had previous exposure to outside, may never be comfortable or enjoy being outside regardless of the owners’ best effort. Instead the owner can focus on making indoors as enriching as possible.

The first veterinary visit
One of the first items that should be addressed during the first veterinary visit is teaching the kitten to become comfortable with the type of handling needed to keep it healthy and well-groomed throughout its life. This will also make procedures run smoothly and save staff time by creating a relaxed and cooperative patient in the clinic. The first kitten appointment is the ideal time to prepare kittens for physical exams, venipuncture, teeth cleaning, ear cleaning and pedicures. Not only in kitten hood but even in adult cats, it is imperative that technicians avoid mishandling patients regardless of their behavior. The goal always should be to create a positive association with the examination process that can follow the pet through the rest of his life. Rough or forceful handling methods teach fear and mistrust and often result in a difficult to handle cat. It also sets a poor example for owners to follow and could be considered malpractice.

By taking a few extra minutes during the first appointments, the kitten will be able to acclimate to the environment. Utilizing treats or canned kitten food during the examination and vaccination process, the kitten will likely be so distracted she does not even notice. This is also creating a positive memory for the kitten.
Prevention topics

Play biting and scratching

The motivation of this behavior is play and attention. It is a normal behavior of cats. They interact and explore their world with their feet and mouth. The consequence of the behavior is attention from the human. To prevent and manage this behavior, it is necessary to avoid playing with the cat with your hands, to provide appropriate toys, and schedule play time. Proactively provide the kitten with appropriate outlets for this behavior. If proactive measures are unsuccessful and the cat begins to mouth or scratch the owner, the owner should be advised to immediately stand up and look away briefly, and then ask the cat to sit and redirect the cat to an appropriate toy. Alternately, send the cat to a desired perch or resting place and reward. Avoid punishment (squirt bottles, verbal reprimands) because it creates fear and distrust and does not appease the cat’s motivation to play.

Destructive scratching

The motivation for this behavior is it is a normal marking behavior. It is self-reinforcing and consequently, it cannot be ignored. Prevent the behavior by providing an appropriate outlet. Keep the cat’s nails trimmed. If the cat is scratching an inappropriate object, interrupt the behavior, call the cat away, reward, and redirect to an appropriate area. It may also be necessary to prevent access to the object or make the object aversive to the cat.

Handling

Prevention is so important. Teaching the cat to tolerate restraint and handling at an early age is much easier than treating a cat that is aggressive with handling. With time cats quickly figure out that being held still or manipulated usually means something unpleasant is going to happen. The cat is restrained to have its nails trimmed, to be given a vaccine, and to blood drawn. The cat needs to have a learning history of being restrained and have only pleasant things happen. Use tasty treats or a feather on a string as a reward to desensitize and counter condition the cat to handling. If the cat becomes frightened and aggressive, avoid punishment. Verbally reprimanding the cat may inhibit its behavior, but it does not make the situation any more pleasant for the cat, or client.

Crate training

Most cats know that the cat carrier means, “We are going to the Vet!” To prevent this negative association, use the crate at all times. Make it a comfortable resting spot for the cat. Hide treats in the kennel and feed special meals in the kennel.

Obedience training

Cats can learn just as many tricks as dogs. Finding the right motivator can sometimes be a challenge. Small treats, a lick of tuna juice, or a feather on a string are potential rewards. Teaching the cat to come when called and to sit on cue can easily be facilitated with minimal effort. Positive reinforcement training provides mental stimulation for the cat and is a way for us to redirect undesirable behaviors.

Integrating a kitten to a multi-cat household

Integrating a new cat to a multi-cat household can be stressful for the new cat as well as the resident cats. In order to provide for the most harmonious integration possible, it is best to take a proactive approach and systematically provide for a gradual introduction. Although the process may seem tedious, it often can progress quickly. However, if owners decide to “just see what happens,” a negative initial introduction could result in a much longer acclimation process or even worse, an inability for the cats to cohabitate.

The kitten or new cat should be set up in one room. The room should have all necessary resources, including a litter box, scratching station, food, water, bedding and toys. It is also a good idea to include a large multilevel cat cage. The kitten should be provided with numerous opportunities to interact and play with the owner throughout the day. For the first few days the new cat should be kept confined in a room. This will give the resident cats the opportunity to become accustomed to the new cat’s scent through a closed door. The procedure can be helped along by exchanging bedding between the animals. The scents of the cats can also be mixed by allowing the new cat to explore other parts of the house while confining the resident cats to a room. Another method to mix the scents of the cats is called artificial allomarking; a small towel can be rubbed on one cat, then the other, then again the first one, then the second one, etc. This helps to “mix” the odors and makes a communal scent between the cats.

Ideally the resident cats and the new cat should become acclimated to their own individual multilevel cat cage. This will aide in the visual introductions of the cats. All cats should be managed in their cage for a special meal time twice a day. Alternatives to the multilevel cat cage are either a travel carrier or a harness and leash. However, all the cats must be comfortable with the confinement method or harness prior to starting the introduction process.

Start at a distance that the cats can see each other but are not dissuaded from eating their special meal (the furthest distance possible for the layout of the house is best). Each day move the cages a foot closer, until they can be next to each other while eating. Once this has been accomplished, if the resident cats are not overly interested in the new cat, the owner may consider keeping the new cat in the cat cage for supervised periods of time (if using a travel carrier, place the carrier up on a table or elevated surface) while allowing the resident cats to be loose in the room. This will help to facilitate habituation to the presence of each other. The next step would be to allow the new cat to be loose in the room and the resident cats to be confined to their cat cage. Once it has been determined that amicable interactions are occurring between the cats and they are relaxed in each other’s presence, supervised periods of time loose together can be allowed.

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If any direct staring, hissing, growling, or other threats are observed, a towel should be placed over the cage to interrupt the threat and the cats should be separated. Aggressive responses should be dealt with by ending the session and waiting 24-48 hours before attempting again. With the next session increase the distance between the cats and progress more gradually. Ideally, avoid all negative experiences while introducing the cats. Slower is actually faster because negative experiences will be remembered and will take time to overcome. Pheromone products such as Feliway® may also be useful if the resident cats or the new cat are stressed during the process. The entire process may take 2-6 weeks to accomplish new introductions depending on the individual cats. A quick progression of the same techniques can be used when re-introducing cats after one of the household cats has had a visit to the veterinary clinic. The cat that remained home will often reject the returning cat. Simply mixing their scents and doing a controlled special meal time and gradual introduction over a few hours can be effective in preventing a long lasting negative re-introduction.

Resources
Prevention is Easier than Treatment!
The Importance of Preventive Behavioral Service

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Undesirable behavior in pets results in a weakened human-animal bond. Behavior concerns are the number one cause for pet relinquishment. Forty percent of pets were relinquished to shelters for behavior issues.¹ The number one behavior reason in one study for relinquishment was house soiling in both dogs and cats.² Through preventive behavior services, we can educate clients on proper techniques for addressing normal behavior challenges in their pets. Thus, keeping pets in their homes, saving lives, and retaining a patient. The prevention of behavior issues is easier than the treatment of them.

An overview of several preventive services that can be offered within the hospital and implemented by or with the assistance of the veterinary technician or other trained professional will be discussed. These services include: pet selection counseling, puppy socialization classes, kitten classes, fun visits, private training or behavior modification sessions, (behavioral) wellness visits.

**Pet selection counseling**

Pet selection counseling is the first defense against preventing behavior problems and the first offense in influencing a strong human animal bond. Educating and preparing the prospective pet owner are the primary goals of this service. Misconceptions can be discovered and addressed. Not only will the new pet owner be better prepared but they can also set their new companion up for success.

**Puppy socialization classes**

In a true puppy socialization class, puppies should be in their socialization period. A good puppy socialization class will provide a safe environment for exploration and exposure to a variety of stimuli in a controlled and positive manner. The main focus at this age is not on manners training but on creating positive experiences for the puppy and teaching puppy owners appropriate and humane techniques for addressing normal puppy behavior. The benefits of puppy socialization classes include:

**Preventing behavior problems**

- Decreasing pet relinquishment
- Bonding the client to the puppy and your facility
- Educating puppy owners on normal canine development and humane training techniques
- Acclimating puppies to handling and routine veterinary procedures
- Providing a controlled and safe environment for exploration
- Allowing for early intervention for high risk puppies
- Facilitating all puppies reaching their full potential

A good resource regarding the importance of puppy classes is available at [www.avsabonline.org](http://www.avsabonline.org) under position statements.

**Kitten classes**

Kittens attending a class should be under 14 weeks of age. The benefits of offering Kitten Classes in your hospital include:

**Creating a strong bond between the owner and the kitten as well as your hospital**

- Educating owners regarding normal feline development and behavior
- Coaching owners on responsible cat ownership and management
- Providing a safe and controlled environment for exposure and desensitization to veterinary procedures
- Identifying and preventing behavior problems

**Fun and victory visits**

A fun visit refers to the pet visiting your hospital just for fun. No procedures are performed. Kitten and puppy classes in your hospital are fun visits. However, once the dog/cat has graduated from the class, it is equally as important that they continue to return to your hospital for good experiences. This helps build a positive emotional response and memories with your facility. This is generally considered a complimentary service, when it is a preventive. Victory visits involve a veterinary team member assisting with desensitization to gentle control and medical treatments or with changing an already established fear of the veterinary office. Victory visits are a service that should be charged and is considered a private training/behavior modification session.

**Private training and behavior modification sessions**

Private training and behavior modification sessions are scheduled appointments with a qualified team member to address manners and preventive training. Generally, behavior modification implies the treatment of an already existing fear or anxiety. Pending the situation, this may require a veterinary behavioral diagnosis and treatment plan prior to addressing. However, if preventively
addressing a mild apprehension, such as avoidance of the nail trimmers, a behavior modification session to coach owners on how to appropriately condition a dog or cat to nail trimming would be considered preventive.

**(Behavioral) preventive care visits**

You are already doing preventive care visits! Incorporating behavior questions into the history taking is imperative. Clients are not always forthcoming with behavioral concerns. They may be embarrassed that their cat is peeing on the carpet or that their 1-year-old dog is chewing the couch when home only. By screening for common behavior concerns, we can identify situations early before irreparable damage to the human animal bond has been done. Consider adding a specific preventive care visit for dogs and cats that are between 9-12 months of age, to address behavior concerns that have developed since the routine puppy and kitten examination series. The majority of pets are relinquished to shelters between 5 months and 3 years of age (dogs 47.4% and cats 40.3%) and have been owned between 7 months and 1 year (dogs 37.1% and cats 30.2%).³ This is a time we often do not see them in the veterinary hospital. By reaching out and suggesting a behavioral checkup during this time, early intervention can be provided.

**References**


**Resources**

American Veterinary Society of Animal Behavior (AVSAB) [www.avsabonline.com](http://www.avsabonline.com)

Society of Veterinary Behavior Technicians (SVBT) [www.svbt.org](http://www.svbt.org)

Puppy Start Right Instructors Course [www.puppystartright.com](http://www.puppystartright.com)


Canine and Feline Behavior for Veterinary Technicians and Nurses. Co-editors Julie Shaw and Debbie Martin
Being able to assist clients by providing appropriate recommendations for species specific behaviors, is a vital skill for all technicians to possess. Providing outdated or inappropriate recommendations could result in further damage to the human-animal bond, relinquishment, and even euthanasia.

After reviewing a brief explanation of learning theory, a step by step behavior solution model will be analyzed. We will put problem prevention and behavior solutions into action with some common normal canine behaviors. Understanding that there is a difference between a training problem and a behavior disorder is crucial to providing guidance to our veterinary clients. A training problem can be defined as a normal behavior of the pet/species that humans find undesirable. In contrast, a behavior disorder occurs when the pet suffers from an underlying emotional disorder, unrelated to training. Behavior disorders, as well as training problems, can be detrimental to the human-animal bond and compromise the welfare of the pet and/or the owner. The focus on this presentation will be to provide attendees with the knowledge and skills to provide behavior solutions to normal training issues and behaviors of puppies and dogs.

Learning theory
Thorndike’s Law of Effect states: behaviors that have a pleasant consequence will increase in frequency and behaviors that have an unpleasant consequence will decrease in frequency. Anything that increases the likelihood of a behavior occurring again is considered a reinforcement. If it decreases the frequency it is considered a punishment. Reinforcement and punishment can be further broken down to positive (adding something) and negative (removal of something). Positive punishment can be defined as adding something aversive to decrease future behavior. Positive reinforcement is adding something desired to increase future behavior. Negative punishment is withdrawing something desired to decrease future behavior. Negative reinforcement is withdrawing something aversive to increase future behavior. With training, any species of animal, but especially companion animals, focusing on rewarding desirable behaviors (Positive Reinforcement) and ignoring (extinction) or removing reinforcement (negative punishment) if necessary, are generally the most humane training techniques. Our training focus is heavy on positive reinforcement. Negative punishment (removal of reinforcement) may be utilized but rarely is it necessary if the environment is managed well to help the animal be successful.

Problems with aversives
Although aversives can be used to inhibit behavior or change behavior, it is riddled with problems. Examples of positive punishment (and negative reinforcement depending how they are used) are correction based training collars (pinch collars, choke chains, electric collars) and verbal or physical reprimands. Positive punishment inhibits learning, reduces creativity, and induces fear, anxiety and conflict. It is difficult to apply consistently and is inappropriate for puppies/kittens, pets with behavior problems, teaching new behaviors, or appeasing the pet’s underlying motivation.

In order to use positive punishment effectively, it should be applied every time the behavior occurs, within a half second of the behavior beginning, at a proper intensity, and not be associated with the owner. It is difficult to meet all these criteria. Reasons to avoid positive punishment are that it does not teach the pet what to do, the trainer is focused on bad behaviors, it does not appease the pet’s underlying motivation for the behavior, and it often damages the human-animal bond. It has also been associated with owner-directed aggression.1

Characteristics of dogs and successful “pet parents” or trainers
The two most influential books for me that changed my perspective on dogs and training are The Culture Clash, by Jean Donaldson and Don’t Shoot the Dog, by Karen Pryor. In The Culture Clash Ms. Donaldson discusses the characteristics of dogs. The list below of general dog characteristics has been modified from The Culture Clash (James and Kenneth Publishers, 1996).

- Dogs are amoral. They do not know right from wrong. They know safe and unsafe. For example, it is safe to get into the trash when people are absent but unsafe when they are present.
- Dogs are opportunistic and self-centered. It is about what is in it for them.
- Dogs are social. Therefore they make good companions.
- Dogs are constantly learning from their actions. Learned behaviors may be appropriate or inappropriate for human counterparts. So even when we are not actively training they are still learning. Evaluate their behavior from a learning perspective.
- Dogs explore the world with their mouths. They lack thumbs. Everything is a potential chew toy.

To be a successful ‘pet parent’ there are some simple rules to follow:
1. Be fair; understand the pet’s perspective. Pets are amoral, opportunistic, self-centered, highly social (dogs), constantly learning, and everything is a chew toy!

2. Be a good teacher. Control what the pet learns through management and supervision. Guide them into making the right decisions. Don’t waste time telling the pet what not to do. Instead, teach him the correct behavior. Set the pet up to succeed.

3. Clearly communicate to the pet when he is performing the correct behavior. Catch him doing things right and reward him for it. A high occurrence of positive reinforcement will help your pet learn quickly.

4. Be consistent. Inconsistency and unpredictability cause fear and anxiety which can be a precursor to behavioral problems. Set the rules of the house and make interactions predictable and consistent.

5. Be your pet’s advocate. He can’t speak for himself.

Meeting the social, physical, and exploratory needs of the dog
Maintaining a schedule and routine with puppies and adult dogs makes their lives more consistent and predictable. Ideally, all dogs should be meal fed twice a day (very young or small puppies may require 3 times a day initially), walked off the property twice a day for 10-20 minutes, and trained using positive reinforcement twice a day for 5-10 minutes. The pet owner should incorporate play with training. A variety of toys should be available to the dog and the toys should be rotated, so it appears that there are always “new” toys. Providing an appropriate outlet for exploratory behavior, such as “sniff” walks and food exploratory activities, provides for mental stimulation. If dogs are not provided scheduled/routine outlets to meet their social, physical, and exploratory needs, they will often find less desirable ways, from the owner’s point of view, to meet those needs.

Behavior solutions model
By following these steps, you can learn to prevent, modify, or decrease unwanted behaviors. The first step in changing behavior is to decide whether this is a normal behavior for the age of the pet and species? Puppies chew things and usually do not come completely house trained. If the undesirable behaviors have a fear, aggression, or anxiety component, then the issue may be a behavior disorder rather than a training issue.

ABC’s
Once it is determined that this is a normal behavior, just one the pet parent finds undesirable, then the ABC’s (Antecedent, Behavior, Consequence) of the behavior should be identified. The antecedent sets the occasion for the behavior to occur. Examples might be environmental stimuli (the mail man approaches the house, the owner returns home) or internal (bladder is full, dog is hungry). The behavior is what the pet does in response to the antecedent. The consequence is what happens during or immediately after the behavior, which will then affect whether the behavior will be more or less likely to occur again in the same situation.

Motivation
By looking at the ABC’s of a behavior, we can often determine the motivation, which is step 2. What is the pet getting by performing the behavior? Is the behavior self-reinforcing? In an attempt to simplify things, when using the term self-reinforcing, I actually mean reinforcement by something other than the owner’s attention. The consequence is not under the control of the owner. Am I rewarding the behavior in some way? To simplify motivation think of it in terms of it is either self-reinforcing (reinforced by something other than human attention) or reinforced by human interaction (or socially motivated).

Management/Prevention
Once the ABC’s and motivation have been determined, the ability to prevent or manage the behavior should be explored. Step 3 is can you prevent or manage the behavior in a humane way? For example: can you supervise your puppy or confine him so the majority of eliminations are only on a preferred substrate (outside)? Can you prevent the dog’s access to the front door, where he sees and hears the mailperson every day? Can we control or avoid the antecedents?

Management and controlling what the dog learns is important to prevent the learning of undesirable behaviors. Puppy owners should puppy proof the house, use baby gates, an exercise pen, and/or a crate to help manage the new puppy and set him up for success.

Also, proactively reinforcing the dog for desired behavior rather than being reactive to undesirable behavior, helps the dog learn quickly what behaviors are desired by the owner. This takes some training of the person, because in general we all tend to be more reactive than proactive. Management and prevention include being proactive and reinforcing desired behaviors, controlling the antecedents, and supervision.
Solve it!
If the behavior cannot be prevented or managed (or our management system has failed), then we have to proceed to step 4: Solve it! There are two options depending on the motivation; Ignore the behavior or Response substitution. If the motivation and consequence has been socially motivated for human attention, the behavior should be ignored if possible. Behaviors that are not self-reinforcing or rewarding to the pet will cease to occur if ignored (i.e. no reinforcement is provided). If the reward for the behavior is human attention, i.e. he jumps on you and you push him away, he nudges you and you pet him, he barks and you toss a toy, it is likely that ignoring the pet in these situations will cause the learned behavior to cease. Ignoring means; not looking at, talking to, or touching the pet at these times. Initially, the attention getting behavior will worsen because in the past it has resulted in a desired consequence, but if you continue to ignore the behavior it theoretically should extinguish. However, the implementation of extinction can be difficult for owners to implement and can produce stress or frustration for the animal. Ignoring (avoiding reinforcing) generally works best if it is not a long-established behavior. It is also important to recognize that the emergence of numerous undesirable behaviors, may reflect a lack of adequate social, physical, and exploratory outlets for the dog. Rather than using extinction, the owner can instead proactively (before the dog does the undesirable behavior) direct the dog to a desired behavior that can be reinforced.

Behaviors that are self-reinforcing cannot be ignored. For example; to the dog, barking at the mailperson at the door makes the mailperson leave and it works every time. Some socially motivated behaviors may also not be able to be ignored and allowed to extinguish. For these behaviors, it may be necessary to use response substitution:

1. **Interrupt the behavior** by getting the pet’s attention. Clap your hands or call the pet’s name in an upbeat tone of voice. The interrupter should not be frightening, an indicator of impending punishment, or be given in a negative tone. The use of “Ah-Ah” or “No” should be avoided.
2. Give your pet a cue for an alternate appropriate behavior that has been previously taught to the dog with positive reinforcement training. The alternate behavior should be incompatible with the undesirable one. For example, if your dog is barking at the mail person, clap your hands or call the dog’s name (upbeat, calm tone) and ask him to come and sit. You may gently prompt the appropriate behavior with a flat collar and leash if necessary. Ideally, be proactive, get the dog’s attention before he is already in full swing of the undesirable behavior. If you hear the mailman approaching, proactively call your dog to you and reinforce with a treat. Keep him busy with play or training until the mailman leaves.
3. **Reinforce** your pet for the appropriate behavior with a food treat or other high value reinforcer. You may keep the pet busy with a food stuffed toy or several different behaviors (sits and downs) or redirect him to an appropriate activity.

**Problem solving in action**
Even after setting up an ideal environment for learning with appropriate management and a consistent routine, there will still be normal behaviors that a canine will exhibit that may be problematic for canine parents. Through interactive discussion with the audience, some common canine behaviors will be examined and the prevention and problem solving model will be applied.

**Conclusion**
By understanding normal canine characteristics and recommending to our clients appropriate humane techniques for addressing undesirable behaviors, we can enrich the relationships canine parents have with their dogs and enhance the human-animal bond.

**References**

**Resources**
Choosing the right rebreathing bag and tubes for your patient

Tidal volume is the volume of air inhaled and exhaled during each breath. Tidal volume is often estimated at 10-15mL/kg of lean body weight. Rebreathing bag size should be 3 to 5 times tidal volume. Remember to round up on the size of your rebreathing bag. For example a 20kg dog would have a tidal volume of approx. 300mL, so if we calculated $5 \times 300 = 1500mL$ which we would round up to 2L.

When to use the rebreather vs. non-rebreather

Non-rebreathing circuits depend on high oxygen flow to remove exhaled carbon dioxide from the circuit between breaths. The decision to select a non-rebreathing circuit is often made by the weight of the animal with many clinics using a non-rebreather system for any patient weighing less than 10kg, but it is actually a decision that the patient is too small to overcome the resistance of a rebreathing circuit.

Calculating O2 flow rates

There is no universal agreement as to the proper flow rate for the various anesthesia breathing systems. The AAHA recommended flow rate of 200ml/kg/min for non-rebreathing systems is generally accepted as appropriate. That flow rate is 33 times more oxygen than is needed to meet a patient’s metabolic oxygen consumption each minute, but that high flow rate assures the patient will not rebreathe any of its exhaled carbon dioxide. The flow rate for rebreathing systems traditionally falls within 20 – 40ml/kg/min, most often settling at 30ml/kg/min.

Leak test the anesthesia machine

Before any anesthetic event it is important for you (the awesome technician anesthetist!) to do a leak check to ensure the system can properly deliver anesthetic gas and oxygen as well as properly remove CO2 and anesthetic waste gases.

- With the correct anesthesia hoses and reservoir bag attached to the anesthesia machine, ensure that the machine is correctly connected to your oxygen source and waste gas scavenging system.
- Close the pop-off valve or occlude the quick release valve. The pop off valve prevents the inadvertent buildup of pressure in the system, and should remain open except during positive pressure ventilation.
- Occlude the end of the anesthetic delivery hose with your thumb or palm of your hand.
- Fill the system by using the oxygen flush valve, fill the reservoir bag until the pressure manometer reads 20cmH2O, then stop. You can also turn on the flow of oxygen to fill the reservoir bag until the pressure reaches 20cmH2O.
- Hold pressure in the bag by continuing to occlude the end of the anesthetic delivery hose.
- Watch the pressure manometer—it should remain steady at 20cmH2O for at least five seconds.
- Open the pop-off valve to relieve the pressure in the system.

If the anesthesia machine failed the leak test, check the anesthesia delivery hose and reservoir bag for holes, and the scavenging/CO2 scavenging system for leaks. Another common location for leaks is the connection and housing for the absorber assembly, which contains the absorbent for CO2. Soda lime granules on the gaskets can sometimes prevent a tight seal. Repair or replace components as necessary, then try again until the machine passes the leak test before connecting the patient to the anesthesia machine.

What opioids do and why we love them

Opioids are considered by many to be the prototype analgesic. They have a wide range of analgesic action from ultra-short acting agents such as remifentanil to longer acting agents such as hydromorphone. Their general reversibility makes them especially attractive in higher risk cases. And in some cases they are relatively inexpensive. They are also extremely versatile in that they can be administered via many different routes. Opioids can be given as oral tablets, intermittent injection, constant rate infusion, transdermally, or epidurally.

The effects of opioid analgesics are dependent upon the receptors at which they act. Currently, there are three major classes of opioid receptors recognized within the CNS. They are as follows mu, delta, and kappa. All three classes of opioid receptors produce some level of analgesia. Drugs acting on opioid receptors are also classified as being agonists, partial agonists, mixed agonist/antagonists, and antagonists.
Opioid agonists
These drugs have high affinity for the mu opioid receptors responsible for analgesia and sedation. Opioid Agonists include: Morphine, hydromorphone, oxymorphone, fentanyl, methadone, etc.

Partial Agonists
These drugs by definition are only partially as effective as agonists. This is because its binding with the mu opioid receptor produces an effect that is less pronounced than that of an opioid agonist such as fentanyl. An example of a partial agonist would be buprenorphine.

Mixed agonist/Antagonists
These opioids work by exerting an agonist effect at the kappa receptors being responsible for sedation and some analgesic properties. They also act as an opioid antagonist at mu receptor sites. Agonist/antagonist opioids can include butorphanol and nalbuphine. These drugs can also be used to reverse some of the unwanted side effects of full agonist opioids such as excessive sedation. (Wagner, 2009)

Antagonists
These drugs work to fully antagonize and reverse the effects of opioids at the mu and kappa receptors. Drugs in this category include naloxone and naltrexone. These drugs will cause increased alertness. They will also reverse the analgesic effects of opioids so opioid antagonists should be used with caution in the painful patient.

Local blocks are your friend!
Local blocks are a cheap and easy way to add additional analgesia. Local blocks can be considered for all procedures from dentistry to surgery. Specific local blocks will be discussed in depth during the lecture.

HR & ECG
CATS : under anesthesia HR 120bpm- 250bpm. Small Dogs under anesthesia: 80-140bpm Large Dogs under anesthesia: 50-80bpm. It is important to keep in mind what the heart rate, respiration and /or ECG were on the on PRE-OP exam. Also keep in mind what anesthetic drugs were given, as will they effect HR. The ECG is simply a recording of the electrical activity in the heart. The following are a few important ECG waveforms you should know:

- **Sinus Arrhythmia**: Variation in sinus rhythm related to respiration and resulting from vagal tone inhibition. Heart rate increases with inspiration and decreases with expiration.
- **Sinus Tachycardia**: A regular sinus rhythm with a heart rate above 160 bpm in adult dogs (220 bpm in puppies, 180 bpm in toy breeds, and 140bp in giant breeds) and above 240 bpm in cats.
- **Atrial Tachycardia**: A supraventricular tachycardia where the P wave configuration differs from sinus P waves. The rate is rapid, but the rhythm may be irregular.
- **Atrial Fibrillation**: Numerous unorganized ectopic foci in the atria discharge impulses at very high rates causing uncoordinated activity of the atria and loss of effective muscular propulsive movement. Atrial complexes appear as erratic fibrillatory waves.
- **Ventricular Premature Complexes (VPC’s)**: An ectopic beat originating in the ventricles. You will see no P-wave associated with the QRS complex. This can be a problem because it decreases cardiac output because of decreased filling time for the ventricles. VPC patterns that require special attention are; Bigeminy (when every other beat is a VPC) and pairs or triples of VPC’s.

Blood pressure management
Blood pressure is typically recorded as two numbers, written as a ratio like this: 110/80 mmHg. **Systolic**: The top number, which is also the higher of the two numbers, measures the pressure in the arteries when the heart beats (when the heart muscle contracts).

**Diastolic** is the bottom number, which is also the lower of the two numbers, measures the pressure in the arteries between heartbeats (when the heart muscle is resting between beats and refilling with blood)

Hypotension is one of the most common anesthetic complications; Hypotension is usually defined as mean arterial blood pressure less than 60mmHg or systolic pressure less than 90 mmHg. If blood pressures are too low (hypotension) you can start by decreasing your inhalant anesthetic level if possible. Often when lowering your inhalant, you will need to provide additional sedatives or analgesics to maintain the patient at an acceptable level of anesthesia. Discuss with your doctor an IV bolus of your pre-medicant opioid or benzodiazepine. A second step should be to increase the fluid rate if possible. If the patient has no underlying cardiac issues, consider a quick bolus of 10 ml/kg (5 ml/lb) over 5 minutes. Also, verify proper cuff selection, a cuff that is too large will result in falsely low readings. If the pet is somewhat bradycardic, consider a dose of an anticholinergic such as glycopyrrolate. A next step may involve adding a colloid. Vetstarch (hydroxyethyl starch) is made from natural sources of starch. Vetstarch increases the volume of blood plasma. You can also consider discussing with your attending clinician administering dobutamine or dopamine infusion.

ETCO2 considerations
Capnography indicates how much CO2 is being eliminated from the lungs by measuring exhaled CO2 with a device that senses the CO2 level. It is a sensitive indicator of lung function and may help guide the doctor, nurse, or respiratory therapist to adjust the breathing machine or it may provide an early warning that the lungs are not functioning properly.
Post op patient management

There are many ways that post-op pain can be treated. The most important aspect of managing chronic pain is to work with a multimodal treatment protocol. The principle of multimodal therapy is to use analgesic drugs and physical therapy modalities that target several different steps of the pain pathway, allowing more effective pain control with fewer side effects.

NSAIDs remain the mainstay of therapy for chronically painful patients. Their principal mode of action is to block prostaglandin production by binding and inhibiting cyclooxygenase (COX). The result of this effect is mainly a reduction in inflammation.

Opioids are useful in a variety of painful conditions (though they may have limited effectiveness in some forms of neuropathic pain). Opioids may be particularly useful for chronic pain management, as they are available in oral and transdermal versions.

NMDA receptor antagonists are often used as adjunctive drugs (i.e. in combination with other analgesics) to improve the control of pain. Intense and/or chronic painful stimuli result in changes in the central nervous system’s response to input, leading to an increase of pain intensity. NMDA receptor antagonist drugs help to control and treat this “amplification”. Amantadine is the most commonly used oral NMDA receptor antagonist. It was originally developed as an antiviral compound, and has also been used to treat Parkinson’s disease in humans.

Gabapentin has been used for many forms of pain, though its best application may be for neuropathic pain. Gabapentin is an anti-convulsant medication with significant adjunctive anti-hyperalgesic action. Gabapentin is commonly used in conjunction with opioids for analgesic treatment options in post-amputation patients.

References
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Cats Are Not Small Dogs…and I’ll Show You Why
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As the old saying goes…”cats are not small dogs!” The question remains, what does that really mean? They can both be small. They can both be fluffy. Catch them at the wrong time and they can both bite! But what does it mean when we say, “cats are not small dogs”? What we are referring to is the medical response to disease as we compare our feline and canine patients. Our feline patients have unique physiologic responses to shock, medications, fluid therapy, and even neoplasia as compared to the canine patient. As a result, it is crucial that the veterinary team understands these unique feline characteristics!

Shock and the cardiac response
If you have ever attempted to resuscitate a feline patient in shock, you appreciate that this is a challenge. In shock (or sepsis), as compared to the tachycardic canine patient, the feline patient is often bradycardic. When evaluating these feline patients, it was noted that their compensatory response to shock is blunted. Moreover, they tend to not have the hyperdynamic signs of shock seen in other (canine) species. As compared to the canine patient, shock in our feline patients is commonly decompensatory. These characteristics include normal to bradycardic heart rates, hypothermia (< 98 F), poor peripheral pulses, pale mucous membranes, and mental depression.

Fluid therapy
The blood volume in the dog is approximately 90ml/kg. In comparison, the blood volume in the cat is 60ml/kg. This is an important difference as fluid rates and volumes, notably shock fluid volumes, vary significantly between species. Feline shock doses of crystalloid fluid therapy (10-20ml/kg) are lower than canine shock crystalloid fluid volumes (10-30ml/kg). Our feline patients also appear to be much more sensitive to fluid therapy with the concern for fluid overload, pulmonary edema, and pleural effusion developing.

Stress response-biochemistry panel
While both canine and feline patients can be stressed, the stress response in the cat common leads to (transient) hyperglycemia. This should be recognized and differentiated from diabetes mellitus (historical polyuria, polydipsia, polyphagia, weight loss, glucosuria). If there is a concern for pathologic hyperglycemia, repeat blood glucose levels at a later, less stressful time can be considered. A fructosamine level can also be considered.

Cardiac disease
As compared to the common valvular disease seen in canine patients, feline cardiomyopathy is more commonly hypertrophic, dilated, or restrictive in nature. Although careful auscultation of the heart is required to detect murmurs and gallop rhythms, subclinical heart disease may be missed on auscultation as a murmur is not a hallmark early characteristic of these cardiac conditions. Chest x-rays can be considered in any feline patient, especially older feline patients to look for evidence of cardiac disease including cardiomegaly prior to an echocardiogram.

Blood types
Our canine patients are assessed for the DEA 1.1 antigen prior to transfusion with a universal donor considered to be the DEA 1.1-patient. Cats do not have a universal donor, and more specifically have 3 major blood types: A, B, and AB. Just like B students hate A students in school (humor), cats with type B erythrocytes hate receiving A blood. In fact, in can be fatal! Cats with type B blood have strong, naturally occurring anti-A antibody. Because of the strong possibility of a potentially fatal transfusion reaction, a blood type and cross-match is recommended prior to a feline blood transfusion.

Drug doses and metabolism
Our feline patients metabolize and generally tolerate certain medications differently as compared to their canine counterparts. Cats lack many of the hepatic glucuronyl transferases that are important for drug metabolism, conjugation and excretion. As a result, toxic levels of these drugs or metabolites can accumulate. Medications which we must recognize as unique include (but are not limited to) morphine, chloramphenicol, aspirin, primidone, acetaminophen, phenols, barbiturates, and benzodiazepines.

Nutrition
Cats need to eat! Inappetance and anorexia in our feline patients should be taken seriously. Lack of nutrition for as little as 2-3 days may result in hepatic lipidosis. Lack of nutrition results in catabolism and development hepatic lipidosis. While less concerning with modern nutritional preparations, our feline patients also require taurine and arginine.
Analgesia and pain assessment

Pain assessment in both cats and dogs can be a challenge based on their stoic nature. Cats, if possible, are even more challenging in the author’s experience to assess pain. Cats may be lethargic and reluctant to interact or they may be aggressive. Potential signs of discomfort to consider may include dilated pupils, hyperthermia, inappetence, lethargy, and hiding.

Oncology

Cats have a few unique oncology related differences as compared to their canine counterparts. A lame feline patient should have their digits checked. Swollen, painful digits may be the presenting complaint for cats with primary lung cancer. Commonly known as feline ‘lung-digit syndrome,’ this describes an unusual pattern of metastasis that is seen with various types of primary lung tumors, notably bronchial and bronchioalveolar adenocarcinoma.

Cats may also be more likely to have neoplasia manifest as dermatological disease including thymoma, lymphoma, pancreatic, and liver cancer. This may be primarily neoplastic or dermatologic disease that is paraneoplastic.

Finally, malignancy-associated hypercalcemia in cats is common, seen with squamous cell carcinoma or, to a lesser degree, lymphoma. This differs from the etiology in dogs, in which lymphoma predominates as the underlying cause of paraneoplastic hypercalcemia.

Orthopedics

Anyone who has ever attempted to do an orthopedic examination on a cat understands the challenge of this examination. They are flat-out uncooperative! Rather than a great hands-on examination, the veterinary team member may need to observe and analyze their gait from a distance, such as through the examination door or window. Another option would be to have the owners provide a video of the abnormal behavior for evaluation and analysis.

Seizures

As compared to canine patients, in which idiopathic epilepsy seems to be quite common in dogs ranging from 1-6 years of age, true idiopathic epilepsy in cats is less common. Whether infectious, inflammatory, metabolic, or neoplastic, the veterinary team member should be more concerned when a feline patient presents with a history of seizure behavior. For this case, following initial bloodwork and radiograph evaluation, advanced imaging and CSF analysis should be considered in all seizing cats. Treatment options are similar to dogs, our feline patients should not receive bromide as this may result in a fatal pulmonary disease.

References

At our institution, an abdominal ultrasound is typically the first imaging test performed when perforation of the lower urinary tract is suspected. However, the location of the perforation is almost impossible to determine with ultrasound. As a result, some sort of positive contrast study is usually performed when a uroabdomen or uroretroperitoneum is present. For the urinary bladder or urethra, a cystourethrogram is the best choice. An excretory urogram is necessary to evaluate for trauma to the ureters.

Cystourethrogram
In order to optimize visualization of the lower urinary tract, the descending colon should be evacuated. A lateral radiograph of the caudal abdomen can be used to ensure complete emptying of the descending colon and determine if enemas should be given before anesthetizing the patient. This can be done in conjunction with survey radiographs. Survey radiographs including right and left lateral and ventrodorsal projections are acquired and inspected prior to any contrast study. General anesthesia or sedation with adequate analgesia is required to decrease discomfort of the patient, prevent repeat catheterizations, trauma to the urethra, ease manipulation of the patient and decrease radiation exposure to personnel.

First, the external urethral opening is cleaned and a sterile urinary catheter is passed. A Foley catheter works well as the balloon can be inflated once in the urinary bladder and then moved caudally to tuck into the neck of the bladder, preventing leakage of contrast media around the catheter. The urinary bladder is emptied, the volume noted and samples collected for urinalysis and culture. Water-soluble iodine based contrast media is then slowly infused into the bladder. Typically a 50% dilution is made by mixing 240 mgI/mL – 350 mgI/mL contrast media and sterile water or saline. Barium should never be used in the urinary tract.

A normal bladder holds roughly 5 ml/kg and is the volume that should be drawn up before the procedure begins. As the contrast media is injected, palpate the urinary bladder through the abdomen. Stop injecting if the bladder becomes turgid or if there is rebound on the syringe. The volume of urine that was removed at the beginning of the study can serve as a reference for a safe volume to instill. Acquire a right and left lateral and ventrodorsal radiographic view.

Should a rupture of the urinary bladder fail to be identified, deflate the Foley and slowly retract the catheter from the bladder and into the urethra while simultaneously injecting more contrast media. Multiple right lateral radiographs should be obtained while the catheter is being retracted until the catheter exits the ureteral orifice.

Excretory urography
All animals should be adequately hydrated prior to EU. When possible, a cleansing enema should be performed approximately 2 hours prior to EU. Right lateral and VD survey radiographs are performed prior to administration of intravenous contrast material. To minimize the risk of adverse reactions, the use of non-ionic iodinated contrast media such as iopamidol or iohexol at a dose of 400mg/Iodine per pound body weight is advised. Contrast media should be delivered through a cephalic or other indwelling catheter as extravasation can be irritating to regional tissues. Right lateral and VD radiographs are obtained immediately and then at 5, 10, 20 and 40 minutes after contrast administration.

Care should be taken to closely observe the animal for evidence of an adverse reaction for at least 1 hour after administration of intravenous contrast media of any kind. Adverse reactions are rare in animals but can range in severity from mild (nausea, urticaria) to moderate (vomiting, hypotension, collapse) or severe (cardiac or respiratory failure). Readers are referred elsewhere for a discussion of contrast associated complications and how to perform EU in animals with renal compromise.1

References
It is not a secret that diabetes mellitus is a common endocrinopathy seen in the canine and feline patient. Studies have shown that the frequency of this disease has increased over the years. Defining the type of diabetes, proper treatment and obtaining remission are now reachable goals with feline diabetes mellitus and the veterinary team.

There are two types of diabetes mellitus. Type I is typically seen in dogs and is caused by insulin deficiency due to either destruction or reduced to secretion of insulin by the beta cells in the pancreas. Type II diabetes is typically seen in a cat. It is caused by either insulin resistance or the inability of the beta cells to function normally. It can also be some degree of both dysfunctions in a cat.

Insulin is a hormone is produced in the inslets of Langerhans in the pancreas and is essential for life. Its functions in the body include, to lower the level of glucose in the body, it causes blood glucose, amino acids, and fatty acids that are in the blood to be absorbed into body cells and used for energy. The pancreas is primarily an exocrine gland responsible for the secretion of pancreatic fluid into the digestive tract following a meal. The islets of Langerhans, scattered throughout the pancreas, contains hundreds of thousands of cluster cells. The islets are endocrine tissue which contains four different cell types. The most numerous are beta cells which are responsible for secreting insulin and amylin, followed by the alpha cells which produce glucagon, the delta cells which produce somatostatin and lastly, the gamma cells which produce pancreatic polypeptide. Housed within the cell membrane of the beta cells are channels that detect the presence of glucose. The normal response of the beta cell, based on the channels ability to detect glucose, is to produce/release insulin when an increase in circulating blood glucose is detected to maintain a normal circulating level. So the pancreas is made up of both exocrine and endocrine tissue.

Glucagon aids in metabolism and the use of glucose in the pancreas. It stimulates the liver to convert glycogen, the storage form of glucose, to glucose also stimulating glucogenesis. The end goal of glucagon is to raise the level of blood glucose in the body. Glucagon, produced by the alpha cells of the pancreas, may be thought of as a “counter-signal” to insulin. Simply stated, glucagon is secreted by the pancreas in response to insulin falling below normal levels.

Insulin sensitivity and/or dysfunction beta cells can be the cause. Insulin sensitivity is the inability of insulin to lower blood glucose levels. If insulin sensitivity is lowered the body will need more insulin to meet the same goal as a normal body. Insulin sensitivity is also known as insulin resistance. So, insulin resistance and beta cell dysfunction is type II diabetes.

Risk factors for diabetes mellitus include; obesity, breed, sex, age, medication and lifestyle. Multiple studies have shown that obesity is a huge risk factor due to abnormal hormonal release and inflammatory mechanisms. Male cats are more predisposed but females can also develop diabetes mellitus. If patients are on medications such as glucocorticoids it will put them at risk of developing diabetes mellitus.

So if the body is not functioning correctly, constant hyperglycemia occurs in becomes toxic to the beta cells. This is glucose toxicity and causes further dysfunction. Of glucose levels are closely regulated and glucose toxicity is resolved, diabetic remission can occur.

A CBC, chemistry, urinalysis, and urine culture are recommended to diagnose diabetes mellitus in the canine and feline patient. Hyperglycemia and glucosuria in patient with clinical signs of diabetes mellitus is confirmation of the diagnosis. A blood glucose concentration above 250 to 300 mg/dl is diagnostic and clinical signs are present.

A high-protein, low carbohydrate diet, such as Purina DM, can be helpful in treating diabetes mellitus and can minimize postprandial increases in blood glucose and reduce insulin requirement in some cases. Avoiding high, simple carbohydrate foods such as semi moist foods can make treatment successful. Some cats may not need insulin therapy at the time of diagnosis and only require diet therapy. Those patients should be monitored closely because most will progress to needing insulin. Feeding and insulin administration should always be done at the same time to help eliminate a hypoglycemic episode. Correction of body weight can help reduce insulin resistance and in type II diabetes mellitus, it will improve insulin secretion. In some cases weight control and feeding a proper diet can properly control the blood glucose levels.

In the canine patient nutrition is important as well since almost all canine diabetics are insulin dependent their dietary management will not remove the need for insulin like their feline counterpart. However, nutrition in the canine diabetic can help improve glycemic regulation. A high carbohydrate and fiber diet will minimize postprandial fluxuations of glucose after meals.

**Interesting facts about insulin dosing**

Insulin will be absorbed more quickly in a warmer environmental temperature due to increased peripheral blood supply. Insulin is broken up into categories, they include: short acting insulin, intermediate acting insulin, and long acting insulin. In veterinary medicine, studies show that each patient is different when it comes to duration of action and peak times. This is why it is so important to do in clinic and at home monitoring.
**Intermediate acting insulin**
Protamine zinc insulin, PZ I, is composed of a mixture of beef and pork insulin. In the feline patient PZI has previously been indicated as long-acting insulin but a study showed that they can be used every 12 hours at 0.25-0.5 U/kg for adequate control of diabetes mellitus. (7)

**Long acting insulin**
Glargine insulin, Lantus, is a human insulin that is marketed a long acting, peak less insulin. The duration of action is typically 18 to 24 hours with a peak at around 7 hours. The dose used is 0.25-0.5 units/kg every 12 hours. This dose can be changed on an individual basis by the veterinarian based on home and in clinic monitoring. Some studies have shown that newly diagnosed cats on Glargine insulin have a higher probability of remission and better glycemic control than patients on PZI insulin by day 17 of treatment.

Detemir or Levemir is a long acting human insulin that can be used in cats with diabetes mellitus. Detemir can be used in cats at the same recommendations as glargine.

**Remission**
Diabetic remission is achievable in the feline patient. The individual’s therapy should be tailored with permission as the therapeutic goal. It has been shown that remission rates can be as high as 90%. If remission for the individual is not achievable, control of clinical signs (polyuria, polydipsia and weight loss) along with glycemic control should be obtained. Close monitoring at home and at the clinic, insulin therapy and proper diet will achieve the goal of remission. All patients can come out of remission at any point. Concurrent infection and other systemic illnesses will make remission harder to achieve.

Frequent visits to the clinic for glucose curves or home monitoring is important. After starting therapy, glucose levels may need to be checked daily with weekly complete glucose curves at home or at the hospital. Glucose curves should last 12 hours and be checked and recorded every 3 to 4 hours.

**Monitoring**
Complete glucose curves when adjusting insulin doses can be as often as every seven days. Order compliance and attention to detail is important to help monitor the progress or decline of the patient. Frequent exams to monitor progress and ensure no concurrence illnesses will help keep the patient in good health. Lab work such as, CBC, biochemistry panel, urinalysis and urine culture may need to be performed with exams if indicated. Fructosamine can be used if the patient is stressed or if the glucose curve results do not match the client’s history. The fructosamine is a blood glucose average over the past 2 to 3 weeks. This number is only an average and does not indicate the severity of daily fluctuations so therefore it should not be used to adjust insulin doses.

**Home care**
Home care for the feline diabetic patient is very important. The technician will play a huge role in client education and helping the clients become accustomed to home care for their diabetic cat. Insulin administration, dosing of insulin, buying insulin syringes, buying a glucometer, clinical signs of hyperglycemia and hypoglycemia, proper diet and home monitoring are the main topics of client education. The clients keeping a journal of eating and drinking habits, glucose readings and dosage administration will help them communicate with the veterinary staff on recheck visits. The technician will need to teach clients how to give insulin injections and choose proper locations for blood glucose checks. If the patient is in need of a new diet or a weight loss program, the technician will need to educate them of proper feeding protocols.

**References are available upon request.**
How to Handle Multiple Emergencies
Paula Plummer, LVT, VTS (ECC, SAIM)
Texas A&M University
College Station, TX

The definition of “Triage” is the following, to the art and practice of being able to assess patients rapidly and sort them accordingly to
the urgency of treatment required. Management of multiple emergencies is always a challenge to the complete staff of a veterinary
clinic. It is very important to be able to assess or “triage” a patient accurately and quickly in these situations. Developing a process in
the clinic is a must. All support staff should know their roles with emergencies and be comfortable with them. Role playing and drills
are important before this arises so each person can practice their skills. A receptionist should know how to give clear directions to the
clinic and ask appropriate questions when the owner calls the clinic to pass on pertaining information to the doctor and technician.

Taking a quick scan of the room when you enter will help direct you to which patient needs assessing first. Immediate recognition
of a life threatening emergency is the key to successful treatment. Always treat the patient with the most life threatening condition
first. As a technician taking a brief but direct history is essential as you assess the patient. Asking the owner the following questions
are a good start for the history and a complete history can be taken after the patient is stable, what happened to your pet? How long
ago did this happen? Does your pet have any known allergies? Has the pet had any past medical problems? Is your pet on any
medications? If yes, what dose and when was the last dose given?

A patient that is having a seizure is more critical than a patient that hasn’t been eating for 5 days. A patient that has been hit by a
car and is standing in the lobby with abducted elbows needs medical attention before the cat that is straining in the litter box. As you
can see all of these conditions need medical attention and it is your duty as a technician to triage the patients appropriately.

Patient assessment
(The following section is adapted from the author’s contribution in writing from the VSPN Notebook ®, A CRASH PLAN)

A - Airway
  ● Evaluate if the patient has a patent airway
  ● Is there any type of foreign body or obstruction?
    ○ Use the “finger sweep” method and/or suction to evaluate an obstruction of the airway
    ○ Use caution if patient is conscious
    ○ When an upper airway foreign body is present, it is necessary to perform an emergency tracheotomy

B – Breathing
Is the patient breathing?
  ● No- intubate immediately and start life saving measures
    ○ First, breathe 2 large breaths for the patient with 100% oxygen
    ○ Then, breathe 8-10 bpm for the patient with 100% oxygen
  ● Yes- evaluate the patient for dyspnea
    ○ What are the patient’s mucous membrane colors?
    ○ (Refer to C-Circulation for descriptions)
    ○ What is the patient’s pulse oximetry status?
    ○ If below 90%, provide oxygen supplementation.
    ○ What is the patient’s Partial Pressure of Oxygen (PaO2) in the arterial blood?
    ○ An arterial/venous blood gas will need to be drawn and evaluated
    ○ 80-110 mmHg = normal
    ○ >80 mmHg = hypoxic
    ○ >/= 60 = initiate oxygen therapy
    ○ When oxygen concentration is above 21% (room air) the PaO2 values are different. The expected PaO2
      should be 5 times the fraction of inspired oxygen (FiO2). For example if the FiO2 is 40% then a Pa O2 of 200
      mm Hg would be considered normal.
    ○ Venous levels of oxygen will always be lower than arterial.

What is the respiratory rate and pattern?
  ● Normal- dog 15-30 and cat 20-30
  ● Rapid and shallow- also known as choppy or “dys-synchronous” respiratory pattern- pleural space disease
  ● Slow and deep- also known as “Kussmaul” respiration- may indicate metabolic acidosis in patients with diabetic
    ketoacidosis or renal failure
Postures and patterns that indicate dyspnea

- High pitched stridor on inspiration - may indicate an upper airway obstruction, i.e. laryngeal paralysis/edema, foreign body aspiration
- Head Extension- trying to elongate the airway to maximize each breath.
- Abducted Elbows- allowing more movement from the chest cavity to maximize each breath.
- Abdominal Breathing- on expiration abdominal muscles will push the remainder of each breath out if the chest wall is not functioning correctly.
- Cheyne Stokes- normal or hyperventilation followed by periods of apnea or hypoventilation, indicative of a disorder of the central respiratory center.

Auscultation

- Crackles- suggestive of pneumonia, pulmonary edema, pulmonary contusions or fluid overload
- Muffled- suggestive of pleural effusion, pneumothorax or hemothorax
- Wheezes- suggestive of feline bronchitis, obstruction, lower airway disease or feline asthma

C- Circulation/Cardiovascular

What is the patient’s mucous membrane color?

- Pink- normal
- Cyanotic (blue) - lack of oxygen
- Icteric (yellow) - liver disease
- Red- toxins, shock
- Pale Pink- hemorrhage or anemia
- Brown- intravascular hemorrhage or acetaminophen toxicity

What is the patient’s circulation status?

What percent is the patient dehydrated?

- Less than 5%- history of fluid loss but no significant findings on physical exam
- 5%-7%- oral mucous membranes are dry without panting or tachycardia
- 7%-10%- mild to moderate degree of decreased skin turgor, dry oral mucous membranes, tachycardia with normal pulses.
- 10%-12%- moderate to severe degree of decreased skin turgor, dry oral mucous membranes, tachycardia and decreased pulse pressure.
- 12% or greater- severe degree of decreased skin turgor, dry and pale mucous membranes, tachycardia, severely decreased pulse pressure.

What is the patient’s heart rate and rhythm?

- Palpate pulses
  - What is the patient’s pulse quality, and are they synchronous with the heart rate?
    - Pulses should be synchronous with the heart rate
    - Non-synchronous pulses with heart rate can suggest an arrhythmia or obstruction in circulation
  - Perform non-invasive blood pressure
    - Feline normal (mm Hg) - Systolic 100-160, Diastolic 60-90, MAP 80-120.
    - Canine normal (mm Hg) - Systolic 100-160, Diastolic 60-90, MAP 80-120.
  - Perform an electrocardiogram; if any abnormalities are found notify the veterinarian on duty immediately.

Is the patient presenting with a form of shock?

- Hypovolemic Shock- most common form of shock - due to fluid loss of any type (hemorrhage, volume loss or third spacing of fluids)
  - Clinical signs of canine shock- 1st stage (Compensatory Shock) - tachycardia, hyperthermia, hypertension, injected mucous membranes, rapid capillary refill time and normal pulse quality. Second stage (Early Decompensatory Shock)-pale mucous membranes, tachycardia, prolonged capillary refill time, hypotension, hypothermia and dull mentation. Third stage (Late Decompensatory Shock)-pale to cyanotic mucous membranes, bradycardia, severe hypotension, pulses weak or absent, hypothermia, stuporous mentation, organ failure and cardiac arrest.
  - Clinical signs of feline shock- Clinical signs of the 1st stage not generally seen. 2nd stage (Early Decompensatory Stage)-bradycardia, hypothermia and hypotension, weak peripheral pulses, pale mucous membranes, weakness and general collapse. The 3rd stage (Late Decompensatory Shock)-same as canine.
- Cardiogenic Shock- seen in any heart failure that impedes cardiac output, characterized by pump failure and increased central venous pressure
  - Pump failure- due to cardiomyopathy arrhythmias and valvular dysfunction
Clinical signs include: heart murmurs, jugular distention, collapse, rails or crackles noted on thoracic auscultation, systemic hypotension, tachycardia, increased central venous pressure, increased oxygen needs and decreased cardiac output.

- **Distributive Shock** - seen in sepsis, anaphylaxis, neurologic diseases and pharmacologic or toxic reactions
  - Normal phases of hypovolemic shock occur.
- **Traumatic Shock** - seen with extensive tissue trauma
  - Can be seen in conjunction with hypovolemic shock

**Is there any arterial bleeding?**
- Note any external wounds
- Place pressure bandages to any hemorrhaging wounds

**Place a large bore intravenous catheter to administer fluids and necessary medications**

**Institute treatment if hypovolemic or traumatic shock is present**
- Shock doses for crystalloid fluids
  - Canine - 90 ml/kg/hr
  - Feline - 45 ml/kg/hr
- Administration of shock fluids
  - Start with ¼ shock dose over 15 minutes
  - Reassess the patient’s heart rate, respiratory rate, mucous membranes, capillary refill time and non-invasive blood pressure
  - If patient is still dehydrated, start the 2nd, ¼ dose over 15 minutes and reassess
  - Repeat until patient is rehydrated or until “shock dose” is complete

**CPR**

Recognition of a patient in cardio-pulmonary arrest is very important. After recognizing that the patient is not breathing, the first thing to do is to capture an airway. After establishing an airway either by endotracheal intubation or emergency tracheostomy it is important to ventilate for the patient correctly. Ventilate the patient at a rate of 10 breaths/minutes with a tidal volume of 10 ml/kg. The oxygen flow rate should be 150 ml/kg/min.

External chest compressions should be started next by placing your hands over the fourth and fifth rib space. Compressions should displace the chest wall by 25-50%. They should be done at a rate of 80-120 times/min. Most dogs and cats can be in left or right lateral recumbency, if the dog is barrel chested, they should be in dorsal recumbency. If only one team member is present CPCR can still be done, breathing twice then doing 30 chest compressions and repeat cycle until further help arrives. Internal chest compressions should be done in specific situations only, such as with a penetrating thoracic trauma or if the patient is in the operating room.

Monitoring the effectiveness of chest compressions during CPR is essential. This can be done by palpation of pulses in the femoral artery or by applying a Doppler monitor to the eye of the patient and listening for blood flow. If femoral pulses are not palpated or noise heard on the Doppler the technique must be adjusted. Repositioning the patient or changing the person doing compressions are the first things to do with inadequate compressions. Remember maintain blood flow and oxygen to the brain and vital organs is the goal in CPR. The most accurate way to monitor the effectiveness of CPR is end tidal carbon dioxide (ETCO2). The capnograph, which monitors the ETCO2, fits between the end of the endotracheal tube and oxygen source. The ETCO2 will be slightly elevated with effective compressions.

Indications for the use of drugs in CPR are, to control life threatening emergencies, increase heart rate, and to improve myocardial oxygenation. Routes of administration vary with each drug. Common routes include, intratracheal (IT), intracardiac (IC), intravenous (IV), and intraosseous (IO).

There are several cardiac rhythms that are common with CPR. They are the following, ventricular asystole, pulseless electrical activity and ventricular fibrillation. Ventricular asystole is characterized by the absence of both mechanical and electrical activity. Treatment is to use epinephrine and atropine. Pulseless electrical activity is without adequate mechanical activity to cause sufficient cardiac output (pulses). It can be caused by insufficient myocardial oxygenation. Treatment includes Naloxone, epinephrine and atropine. Ventricular fibrillation is when chaotic, disorganized ventricular activity is seen.

No perfusion to the body takes place when this arrhythmia occurs. Treatment includes external defibrillation at a dose of 2 joules/kg. If that dose does not convert the rhythm, it can be increased. If fibrillation does not convert the rhythm, then epinephrine is administered.

Defibrillation is more successful when used early in CPR. It eliminates the arrhythmia by sending an electrical current through the heart. This allows the cardiac cells to depolarize and then repolarize all at the same time then ideally the heart will return to normal function. To defibrillate a patient paddles are used and one paddle is placed on each side of the patient’s chest over the heart. Gel is placed on the paddles before placing them on the patient. The person holding the paddles must yell “clear” to inform all the other team members of what is happening, then making sure no one is touching the patient, they can discharge the defibrillator. If someone
is touching the patient when it is discharged, they WILL be shocked as well. Remember isopropyl alcohol is flammable and metal tables will carry the electrical charge. If the patient is on a metal surface they must be removed before defibrillation occurs. Prolonged life support includes any complications after successful resuscitation. In most cases reoccurrence of cardiopulmonary or respiratory arrest is high within the first four hours. Cerebral resuscitation is a huge concern due to the lack of blood flow to the brain during CPR. During CPR, hypoxia and ischemia occur which leads to cerebral edema.

Monitoring the patient is critical following CPR. Using an EKG to monitor electrical activity of the heart, SPO2 monitor the oxygen status of the patient and supplying oxygen if necessary. Monitor either invasive or non-invasive blood pressures, and regular physical exams including pupillary light responses, motor function and breathing patterns are done frequently to monitor the patient’s cerebral function. Almost always these patients will need oxygen supplementation via an oxygen cage, flow by, or nasal insufflations. The heart will almost always need support in the first 4 hours following successful CPR.

Practicing with a case scenario is a good way to get you ready for that day when more than one emergency comes through the door at the same time. Use the following questions to help guide you through those situations:

- What is most likely wrong with the patients?
- Does one or both of these emergencies have a life threatening condition?
- Which emergency needs medical attention first?
- What do we do with the other emergency for the time being?
- What should we be concerned with for the top priority emergency?
- What should we be concerned with for the other emergency?

References available upon request.
Infectious diseases
Infectious diseases are commonly seen in the ICU. Infectious disease is a disease that can be transmitted by a specific kind of contact. There are many infectious diseases that the feline patient can have. They include; parasite, virus, fungal and bacterial. Written protocols should be in place for infectious disease. Proper personal protective equipment (PPE) should be worn with these patients. It should be mandatory for all personnel to follow that plan. The plan should include what PPE to wear, where to house the patient, how to deal with their wounds (if they have any) and how to clean up after them.

Proper cleaning protocols and adhering to them is a must. The author’s place of employment uses bleach to wipe everything down and then use a steam cleaner and allow surfaces to air dry each time after treating a known multi drug resistant (MDR) patient. Everything that the infected patient comes into contact with must be cleaned properly.

If the patient has open wounds, transporting patients around the hospital in a designated carrier will help eliminate contamination. Also don’t forget to protect patients from nosocomial infections by keeping all wounds and incisions clean, dry and covered at all times when in the hospital.

The veterinary staff wearing gowns, gloves and booties at all times when in contact with the MDR patients and keeping them in a separate ward are common standard protocols for MDR patients. If the patient is considered critical and needs to be in ICU or a fluid ward, proper precautions are made. Proper PPE is worn at all times, they are kept in a cage that is considered a low traffic area, so at our hospital they are kept in the back of the room with an empty cage between them and another patient, just to help establish a barrier. Separate laundry and trash cans are used with MDR labels on them. The laundry is washed separately and the use of laundry detergent with bleach is necessary to properly disinfect the laundry.

A large draped area is placed on the floor in front of their cage so when they need to come out of the cage for exams, treatments they are placed on the draped area and not the floor. That drape is changed at least every 24 hours. If they have open wounds, a designated area should be used to perform examinations and treatments to not contaminate multiple areas of the hospital. Separate instruments, stethoscopes and thermometers are used and kept for these patients. In the author’s place of employment, an infectious patient receives a set of instruments while hospitalized that is used on them and when they leave they are disinfected and sterilized.

Keep visitations with owners to a minimum and the owners have to wear proper PPE when visiting. Separate exam rooms are used for these patients. And doing any procedures with a MDR patient should be done at the end of the day so there is time for proper cleaning protocols to take place and to limit the number of patients being exposed.

These are very serious infections and should not be taken lightly, not only are you protecting the other patients in the hospital but you are protecting yourself. Usually veterinary personnel seek medical advice if they know or think they have been infected by the patient. If you think you have been infected by a MDR patient, seek medical attention, do not hide it. If you are immunosuppressed, it may be a good idea to remove yourself from any high risk situations.

Patient assessment
Assessment of the airway, breathing and circulation when triaging a patient is important. Evaluate if the patient has a patent airway. Obvious foreign body or obstruction can sometimes be seen while approaching the patient. Use the “finger sweep” method and/or suction to evaluate an obstruction of the airway. Use caution if patient is conscious. When an upper airway foreign body is present, it is necessary to perform an emergency tracheotomy.

Assessment of breathing can also be done while approaching the patient. A technician should immediately note if the patient is breathing. If they are not, intubate immediately and start life saving measures and breathe 8-10 bpm for the patient with 100% oxygen. If the patient is breathing, things to consider are “What are the patient’s mucous membrane colors?” (Refer to C-Circulation for descriptions) “What is the patient’s pulse oximetry status?” If below 90%, provide oxygen supplementation. “What is the patient’s Partial Pressure of Oxygen (PaO2) in the arterial blood?”

An arterial/venous blood gas will need to be drawn and evaluated. Values below reflect normal on an arterial blood gas; Hg = normal, >80 mmHg = hypoxic, >/= 60 = initiate oxygen therapy. (When oxygen concentration is above 21% (room air) the PaO2 values are different.) The expected PaO2 should be 5 times the fraction of inspired oxygen (FiO2). For example if the FiO2 is 40% then a Pa O2 of 200 mm Hg would be considered normal. “What is the respiratory rate and pattern?” Normal- cat 20-30 rpm. In the hospital it can elevate to 40 rpm. Rapid and shallow- also known as choppy or “dys-synchronous” respiratory pattern- pleural space disease.
Postures and patterns that indicate dyspnea in a patient include high pitched stridor on inspiration. This may indicate an upper airway obstruction, i.e. laryngeal paralysis/edema, foreign body aspiration. Head Extension an indicate trying to elongate the airway to maximize each breath. Abducted elbows can indicate the patient is trying to allow more movement from the chest cavity to maximize each breath. Abducted elbows are suggestive of pneumonia, pulmonary edema, pulmonary contusions or fluid overload. Muffled cardiac sounds are suggestive of pleural effusion, pneumothorax or hemothorax. Wheezes are suggestive of bronchitis, obstruction, lower airway disease or feline asthma. When assessing circulation, it is important to note the mucous membrane color, heart rate, pulse quality and dehydration status. Pulses should be synchronous with the heart rate. If the pulses are not synchronous it is suggestive of an arrhythmia or obstruction in circulation.

Lastly to assess circulation status it is important to determine if the patient presenting with a form of shock? Hypovolemic Shock is the most common form of shock and is due to fluid loss of any type (hemorrhage, volume loss or third spacing of fluids) Clinical signs of feline shock- Clinical signs of the 1st stage not generally seen. 2nd stage (Early Decompensatory Stage)-bradycardia, hypothermia and hypotension, weak peripheral pulses, pale mucous membranes, weakness and general collapse. The 3rd stage (Late Decompensatory Shock)-pale to cyanotic mucous membranes, bradycardia, severe hypotension, weak pulses, stuporous mentation, organ failure or cardiac arrest. Clinical signs of canine shock include; 1st stage (Compensatory Shock) - tachycardia, hyperthermia, hypertension, injected mucous membranes, rapid capillary refill time and normal pulse quality. Second stage (Early Decompensatory Shock)-pale mucous membranes, tachycardia, prolonged capillary refill time, hypotension, hypothermia and dull mentation. Third stage (Late Decompensatory Shock)-pale to cyanotic mucous membranes, bradycardia, severe hypotension, pulses weak or absent, hypothermia, stuporous mentation, organ failure and cardiac arrest.

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Immediately placing a large bore intravenous catheter to administer fluids and necessary medications will be indicated in these patients. Patients with heart murmurs should be assessed carefully and fluids are administered at a lower rate to not further their condition. Under the guidance of the veterinarian starting crystalloid fluid therapy is first line treatment for hypovolemic shock. The canine shock dose of crystalloid fluids is 90 ml/kg/hr. The feline shock dose of crystalloid fluids is 45 ml/kg/hr. Administration of shock fluids will include starting with ¼ shock dose over 15 minutes, at the end of the first 15 minutes reassess the patient’s heart rate, respiratory rate, mucous membranes, capillary refill time and non-invasive blood pressure. If patient is still dehydrated, start the second, quarter dose over 15 minutes and reassess. Repeat until patient is rehydrated or until “shock dose” is complete

CPR
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Monitoring the patient is critical following CPR. Using an EKG to monitor electrical activity of the heart, SPO2 monitor the oxygen status of the patient and supplying oxygen if necessary. Monitor either invasive or non-invasive blood pressures, and regular physical exams including pupillary light responses, motor function and breathing patterns are done frequently to monitor the patient’s cerebral function. Almost always these patients will need oxygen supplementation via an oxygen cage, flow by, or nasal insufflations. The heart will almost always need support in the first 4 hours following successful CPR.

**Burnout**

This is something to no take lightly. It can sneak up on you and before you know it you are ready to look for a new career. All of us have had a hard week or a rough spell and this isn’t quit the same thing. Burnout is by definition long term exhaustion and reduced interest in work. It was thought originally that the stress from work only caused burnout but it has been proven that burnout can be caused by many stressors including your personal and work life. It is important to recognize the difference between stress and burnout. They are not the same. Stress is characterized by over engagement; doing too many things in your life at once (aka, too many irons in the fire.) Burnout is characterized by disengagement; not caring, depression or no longer being motivation (aka, my give a damn is busted, seriously!)

There have been several studies done on burnout, first being studied in the 1970’s. Since then several studies have been done and a “standard” has been reached in the psychology world to determine if someone is exhibiting signs of burnout. This is called the Maslach Burnout Inventory. It has been shown that most people exhibiting signs of burnout also meet the criteria for clinical depression. Although a topic like burnout is highly controversial, the Maslach Burnout Inventory is one proven approach to burnout. It is a nice thorough guideline that can be used to help assess burnout. In the past burnout has been solely regulated by the amount of exhaustion one is feeling. This theory is based on not only exhaustion but cynicism and inefficacy as well.

Signs of burnout include exhaustion, getting 8 hours of sleep in important to keep yourself rested and relaxed. If you work an off shift, such as nights or weekends, it is important to still get appropriate amounts of sleep. Black out curtains, sleeping masks or other sleep aids will help you feel rested and ready for your day at work. Relaxation is important in preventing burn out. Taking time off periodically to rest and restore will prevent burn out. Lack of motivation, if you are dragging yourself into work and thinking you hate your job the entire way there, which is a sign of burn out. Complications at home or work, relationships with the people around you, either at home or work can cause stress in your life. Find someone to talk to, friend, family member, supervisor, that can help you with interpersonal relationships. Not taking care of yourself, each day it is important to eat properly, exercise, rest and take time for yourself. Health problems, health problems can contribute to burn out if you do not feel you are getting enough rest or the job you are performing causes anxiety or pain in your ever day routine. Don’t be afraid to ask for help. Take time for doctor’s appointments so you can be healthy and enjoy your life.

Tips to help with burn out include starting the day with a relaxing ritual, do something you love every day, adopt healthy eating, exercising, and sleeping habits, set boundaries, take a daily break from technology, nourish your creative side and learn how to manage stress. Everyone’s stress level is different, you have to learn how to manage yours and figure out what is best for you.
Common calculations commonly used by the ICU technician include the following:

- **Drug calculations:**
  - Units needed = weight (kg) x dose
  - Amount needed = dose/concentration of drug
- **whole blood transfusion mL needed**
  \[ \text{CAT} = \text{patient weight (kg) x 70 x (desired PCV - current PCV)} \]
  \[ \text{PCV of donor blood} \]
- **RER (Resting Energy Requirement) = 70 x weight (kg) to the 0.75 power**
- **MER (Maintenance Energy Requirement) = activity or illness factor x RER**
- **Food dosage = kcal required/caloric density of food**
- **Fluid deficit (L) = % dehydration (decimal) x weight (kg) x 1,000 mL**
- **drip rate = \frac{\text{volume of solution mL x drops/mL}}{\text{volume in drops/minute (or ggt/min)}} = \text{volume in drops/minute (or ggt/min)} \times \text{Time (in minutes)}**
- **mL/hr = \frac{\text{volume of solution mL}}{\text{length of time of infusion in hours}} = \text{volume to give per hour}**
- **CRI Calculations - drug mL/hr x amount of fluid (ml) = amount to add to fluids**
  - Need to know the dose rate of the drug
  - Need to know the patient's body weight
  - Need to know the fluid administration rate
  - Need to know the drug concentration

References available upon request.
Administration of blood products can be beneficial to critical patients. The blood products should come from a trustworthy program, either commercial or private. The benefits of the transfusion should outweigh the risk for the recipient. Potential risks to the recipients would include transmission of infectious diseases from the donor if not properly screened or a transfusion reaction. Even though you may in the trenches there are a few key tools to know about transfusion medicine, all of those will be discussed here.

Component therapy has become important in veterinary medicine and is used today instead of transfusing whole blood to every patient in need. Fresh Whole Blood (FWB) is a unit of blood that has been obtained less than 8 hours prior to administration. It contains all the cellular and plasma components of the blood. It is to be administered to patients who are in need of red blood cells, plasma and platelets. Stored whole blood still contains all the cellular and plasma components of the blood except platelets. It is to be stored at 4 °C and has an expiration date of 28 days. It is used in patients that are anemic and hypoproteinemic.

Packed Red Blood Cells (pRBC) is a unit of blood that has had the red blood cells separated from the plasma content within 8 hours of collection. This blood component should be stored at 4° C and has an expiration date of 42 days. The most common indication for a pRBC transfusion is anemia.

Fresh Frozen Plasma (FFP) is a unit of blood that has been separated from red blood cells and the plasma components are remaining. FFP is viable for up to 1 year when it is stored in temperatures of -20 to -40 °C. All coagulation factors, albumin and protein are present in this component. A common indication for use is primary or secondary coagulopathies. FFP transfusions have also been proven to benefit patients with acute pancreatitis, disseminated intravascular coagulation (DIC), liver failure, rodenticide toxicity and parvo virus. Frozen or Stored Plasma (SP) is frozen plasma that has been stored at temperatures of -20 to -40 °C for greater than 1 year. It is viable for up to 2 years. Stored plasma no longer contains clotting factors. Indications for this component include hypoproteinemia and hypoalbuminemia.

Other blood products such as cryoprecipitate, cryoprecipitate-poor plasma and platelet rich plasma are also available as component therapy. Commonly those types of components are obtained from commercial blood banks due to the infrequency of use and cost associated with preparation of the product. Cryoprecipitate contains high levels of fibrinogen, fibronectin, factor VIII and von Willibran’s factor. It is indicated in patients with coagulopathies due to any of the above plasma protein deficiencies. Cryoprecipitate-poor plasma is indicated in patients that are hypoproteinemic but the risk of synthetic plasma expanders outweighs the benefit. Platelet rich plasma is only viable for 5 days at a constant agitation. Most commercial blood banks make platelet rich plasma available.

Blood typing can be an important step in the transfusion process. A canine blood donor that has never received a blood transfusion is considered to be a universal donor if they are DEA 1 negative. It is thought that the most important canine blood type is DEA 1 because it has a strong alloantibody response after sensitization. Other canine blood types include DEA 1.1, 1.2, 1.3, 3, 4 and 7.

Feline blood types include A, B and AB. Feline blood type A is the most common and feline blood type AB is the rarest. Feline blood types A and B have naturally occurring alloantibodies that can cause severe, life threatening transfusion reactions. The blood type AB does not have naturally occurring alloantibodies but should receive type A blood if they need a transfusion. Simple blood typing cards can be purchased to be used in the clinic to determine the blood type of the recipient. Even though a blood type has been performed on the recipient and donor, it should never take the place of performing a crossmatch before the transfusion to ensure the two are compatible. Bedside agglutination cards are available from DMS laboratories, The Rapid Vet Company ©, Rapid Vet-H Canine and Feline. This is a rapid cross matching system that can be done reliably when performed properly.

Cross matching can be a fast and useful tool to help determine if the patient will have a transfusion reaction. A crossmatch will look for the presence of alloantibodies of the recipient’s blood or plasma against the donor’s blood or plasma. A major crossmatch will look for alloantibodies in the recipient’s plasma against the donor’s red blood cells. A minor crossmatch will look for alloantibodies in the donor’s plasma against the recipient’s red blood cells. The presence of agglutination will determine an incompatible crossmatch. If the patient is already exhibiting auto agglutination or hemoglobinemia, some cross matching methods may be undiagnostic.

Administration of blood products should be through a commercially made filtered administration set. The rate should start out at approximately 25% of the calculated dose for the first 30 minutes to one hour of the transfusion. The patient should have a temperature, pulse and respiratory rate (TPR), blood pressure, mucous membrane color and capillary refill time (CRT) performed before and then every 10 minutes for the first hour. At the end of the introductory period the rate can be increased to the calculated rate and vitals should be performed every 30 minutes to 1 hour for the entirety of the transfusion. To reduce the risk of bacterial contamination of the transfusion, it should be administered over a four hour period.
Transfusion reactions can be divided into immunologic and non-immunologic reactions. The febrile nonhemolytic transfusion reaction (FNHTR) is a common immunologic reaction noted. Non-immunologic reactions include; transmission of infectious diseases from the donor to the recipient and sepsis induced bacterial contamination from the unit or volume overload.

If the reaction is mild the treatment therapy can consist of stopping the transfusion and monitoring the patient’s vitals. Restarting the transfusion in approximately thirty minutes at a reduced rate can usually be handled by the patient. Other clinical signs seen in a mild transfusion reaction include; fever, urticarial and facial edema.

Moderate transfusion reactions can include clinical signs of fever, tachycardia, tachypnea or vomiting. The transfusion should be stopped and glucocorticoids can be administered. Supportive care such as fluid therapy should be assessed individually in each patient. The patient’s vitals should be monitored closely and the transfusion can be restarted if necessary. Severe transfusion reactions can be life threatening but are rare. Clinical signs will include tachypnea, hypotension, collapse, fever, bradycardia or even sudden death. The transfusion should be stopped immediately and administration of epinephrine intravenously. Supportive care for the patient can include intravenous fluids, oxygen therapy or CPR. If bacterial infection or sepsis is suspected in the patient, blood cultures of the patient and the product should be performed.

Transfusion medicine is an important part of critical care medicine. Even though risks are present with administration of blood components, lives can be saved.

References available upon request.
So how does the patient get from the uncomplicated diabetic patient to the complicated diabetic? There are many different reasons why a patient could suddenly have a complication of diabetes. The common complications are diabetic ketoacidosis (DKA), insulin resistance, hyperglycemic hyperosmolar syndrome and hypoglycemia.

Getting to the bottom of it will take good history taking skills and a little detective work. Some things to consider are insulin ineffectiveness due to the following:

- Inactive insulin: Be sure to ask the owners how the insulin was stored. There are some general guidelines for insulin storage and handling. Insulin should never be frozen, used beyond the expiration date or exposed to direct heat or light. Each insulin formulation has specific guidelines and should be included on the product insert.
- Diluted insulin: Insulin dilution is a popular practice with the very small patients because their dose is tiny and hard to accurately pull up in a syringe do to the volume of the dose. This should not be done unless absolutely necessary and dilution should only be done by a licensed pharmacist.
- Improper administration technique: ask the owner to show you where on the pet they are administering the insulin dose.
- Improper dose: ask the owner to show you on the appropriate syringe how much insulin they are pulling up.
- Incorrect frequency of dose: always ask the owner what time(s) the insulin is administered, not just how many times daily. There can be a large variance between “twice a day” and 6am and 6pm.
- Impaired insulin absorption: dehydrated patients do not have adequate tissue uptake of drugs injected by the subcutaneous route.

Once insulin ineffectiveness is ruled out, possible insulin resistance should be considered in the patient.

Insulin resistance is a condition when a normal dose of insulin produces a less than ideal clinical response. Many diseases can cause insulin resistance, some common causes in dogs may include:

- Hyperadrenocorticism – Cushing’s syndrome is a result of too much circulating cortisol. The effects of cortisol on the metabolism of carbohydrates will decrease the cellular utilization of glucose and increases glucose output from the liver.
- Exogenous steroids – administration of corticosteroids for the treatment of another disease can result in the same physiological response as a patient with Cushing’s syndrome.
- Concurrent systemic infections – Diabetics may have underlying renal compromise due to the increase in protein in the urine brought about by elevated blood glucose which can cause urinary tract infections.
- Hyperthyroidism - The thyroid gland affects the metabolic rate as well as the rate of energy use, and the absorption of nutrients. Hyperthyroidism causing insulin resistance is actually rare in the feline patient. (1)
- Acromegaly-There has been documentation of elevated growth hormone secretion as well causing insulin resistance in the feline patient.
- Concurrent systemic illness- It has been proven that pancreatitis, renal disease, liver disease or cardiac disease will cause insulin resistance in the feline patient.

Common diseases that cause insulin resistance in cats include:

- Acromegaly
- Exogenous steroids
- Concurrent infections
- Hyperthyroidism
- Concurrent renal, liver or cardiac disease

**Diabetic ketoacidosis**

DKA is a result of an improper balance of concentrations of all the hormones insulin, catecholamines, glucagon, cortisol and growth hormone. An insulin deficiency in the body is counter regulated by an excess of the catabolic hormones, especially glucagon. Now there is hyperglycemia present in the body, when the concentration of glucose exceeds 260-310 mg/dl in cats it exceeds the renal threshold, spilling into the urine. Osmotic diuresis is present with significant calorie loss, polyuria and polydipsia. Lipase is activated by the improper insulin: glucose ratio in the body so it then mobilizes adipose. Adipose is stimulated for the primary energy source because of the loss of calories and unavailability of glucose and insulin to the body.

Long chain free fatty acids then transport the fat to the liver. Liver ketone formation is preferred over transformation into triglycerides due to the increase of glucagon. Ketone bodies produced by oxidation of free fatty acids change into acetone and acetoacetate becoming an acid. In a normal body, ketone are then metabolized by tissue to form carbon dioxide and water then used...
to form bicarbonate. The bicarbonate is then used to help buffer another ketone in the extracellular fluid. In a diabetic body the ketone formation in the liver will exceed the muscle’s ability to metabolize the ketone which will cause accumulation in the blood. So then the excessive production of ketone combined with the reduced production of bicarbonate will result in ketonuria and eventually metabolic.

During osmotic diuresis the body will lose not only glucose but sodium, potassium and water in the urine. The body will compensate for all the negatively charged ketone loss in the urine by excreting additional positive charged electrolytes, those include sodium and potassium. More sodium will be lost through the kidney due to lack of insulin in the body. Sodium is the primary extracellular electrolyte that holds water within that space. The regulation of sodium balance in the kidneys and the maintenance of effective circulating volume are closely related. The changes in effective circulating volume are triggered by specific volume receptors in the cardiopulmonary circulation, the carotid sinuses, aortic arch and the kidneys. This activates a series of effectors throughout the body to correct the volume depletion. Most of the receptors will then sense a change in pressure and dilate or constrict to compensate for the change in circulating volume. The receptors that are located in the renal afferent arterioles then activate the renin-angiotensin-aldosterone system (RAAS). The non-renal receptors will help govern the activity of the sympathetic nervous system.

Now total body water is significantly decreased and the patient is hypovolemic and if left long enough untreated in a state of hypovolemic shock. This will lead to prerenal azotemia and a decreased glomerular filtration rate increasing the amount of ketones and glucose in the blood even more and finally resulting in metabolic acidosis. With circulating cortisol and epinephrine in the blood because the body is in a “stressed” state, this will increase the level of glucose in the blood even more, exacerbating the patient’s condition. Metabolic acidosis is the result of the exchange of a hydrogen ion for intracellular potassium. Insulin is required to drive potassium back into the cell so with the decreased amount of insulin, potassium will then become extracellular. Most serum chemistry profiles only measure extracellular levels and the total body concentration of potassium is not considered to be decreased.

The most common acid/base abnormality in DKA is metabolic acidosis. It develops because of several different reasons but almost always causes an elevated anion gap. Anion gap is the mathematical difference in measured cations and anions and represents the unmeasured anions. The anion gap is increased in DKA because the concentration of unmeasured anion in the blood is increased due to the production ketoacids and the decrease of bicarbonate concentration. The most important cause for metabolic acidosis in DKA is the production of acidic ketones. Fatty acids that are released can be used for energy in most tissues including the liver but without insulin free fatty acid conversion to triglycerides is impaired. When this process is impaired triglycerides are converted to ketones instead of being oxidized to carbon dioxide. So the liver is then reset to metabolize free fatty acids due to the lack of insulin and increased glucagon to favor ketone production instead of oxidation of fatty acids to carbon dioxide. The other reason for acidosis is the overproduction of lactic acid due to the impaired tissue perfusion from dehydration, shock and reduced renal excretion of hydrogen ions. If the disease has progressed far enough, mixed acid/base disturbances will be seen in the patient. Neurological compromise will lead to depressed respiration (respiratory acidosis) or metabolic alkalosis can be seen with vomiting and diarrhea.

Some clinical signs that the owner may report are, polyuria, polydipsia, lethargy, weakness, hyperventilation, anorexia, vomiting, diarrhea, weight loss, depressed, or coma. Many of these patients have some type of underlying or secondary disease. Other clinical signs include, abdominal pain, neurological abnormalities ranging from depressed mentation to abnormal gait to a coma. Weight loss, muscle wasting, and cataracts can be seen. Some people report a “fruity” odor in the patient’s breath due to the overwhelming amount of ketones in the patient. This is not a reliable clinical sign to use for diagnosis.

Initial database for an emergency patient should include blood glucose, PCV/TS, urinalysis, venous or arterial blood gas and a biochemistry panel. Quick analyzers can be purchased to run some of these tests while waiting on full panels. A glucometer will have results in a matter of seconds if your clinic does not own bed side analyzers. Urine glucose and ketone reagent strips are available for fast results while waiting on full urinalysis. A PCV/TS will give information on your patient’s dehydration status and can be read in just a few minutes. Some bed side analyzers now have the capabilities to run venous or arterial blood gases for your convenience. The diagnosis of DKA is confirmed by the presence of hyperglycemia, glucosuria, ketonuria, and metabolic acidosis. Other abnormalities can include hyponatremia, hypochloremia, hypokalemia, increased anion gap, and azotemia. Treatment of DKA patient can be tricky and time consuming. Correcting dehydration and electrolyte imbalances should be done first. A large bore peripheral intravenous catheter should be placed immediately. When the patient is stable a long indwelling jugular catheter, which fluids can be administered and blood samples can be drawn from should be considered. Hypoperfusion and dehydration should be replaced immediately with crystalloid fluid boluses and colloid fluids if needed. The typical shock dose of crystalloids is 60 ml/kg/hr in the feline patient. Remember that if your patient has concurrent heart disease, the rate of fluids may need to be tailored to fit that patient. Once hypovolemia is corrected, the fluid rate will need to be adjusted to correct the total fluid deficit.

Monitoring any patient that is receiving intravenous fluids is important. Any acute changes in body weight can be a sign of improper changes in water. Any patient that is losing weight while on fluid therapy is not receiving adequate amounts of fluid. Monitoring blood pressure, heart rate, respiratory rate is essential as well. Central venous pressure can be measured and used as a guide for fluid therapy replacement. Readings under 5 cmH2O are indicators of inadequate fluid replacement. Patients that still have
proper renal function, a dehydrated animal will have a urine specific gravity of >1.025. On the other hand fluid overload should be monitored as well. In patients that are experiencing fluid overload or over hydration you will see an increase of nasal discharge, chemosis, increased respiratory rate, pulmonary congestion, crackles, and eventually pulmonary edema will develop.

Knowing which type of fluid to pick off the shelf and why is important. Typically, 0.9% Sodium Chloride is the fluid of choice in the emergency phase of DKA. It is an isotonic fluid and has the highest concentration of sodium compared to other fluid types, which is important to correcting the sodium deficit. Lactated Ringer’s Solution should be avoided at this time due to the presence of lactate in the solution. The hepatic metabolic process to make bicarbonate from the lactate is the same process used to metabolize ketones, reducing the liver’s ability to correctly metabolize lactate. Poor perfusion will also aide in the retention of lactate because it is negatively charged and in the effort of the body trying to maintain electrical neutrality will dump even more sodium and potassium into the urine to be excreted.

Rehydration alone will improve hyperglycemia, acid/base status and electrolyte imbalances. Supplementation of electrolytes may need to be provided additionally due to the dilution effect of fluid administration. Tissue perfusion will be restored and proper urine production will be restored improving metabolic acidosis. Proper tissue perfusion will also help reduce the amount of lactate in the body helping to reduce the amount of sodium and potassium the body puts in the urine. All of this will help the body to restore normal amounts of electrolytes. Rehydration will also help reduce the concentration of ketones and glucose in the body because of the dilution effect. So as you can see the dilution effect of fluid therapy is important to remember in patients it helps reduce the high concentrations but can reduce them too much. Frequent chemistry panels should be ran on these patients, in the beginning it may be necessary to run chemistry panels every 4 to 6 hours and then as your patient becomes more stable, decreasing the frequency to every 12 hours and eventually to every 24 hours. In the author’s experience, a daily chemistry panel is performed until the electrolytes stay within normal ranges; the patient is considered euvolemic and eating on their own.

Regular insulin is suggested in the initial treatment of DKA and is continued until the patient is stable and ketosis has resolved. Therapy is adjusted to reach blood glucose of 250 – 300 mg/dl in approximately 24 hours. Insulin therapy should begin approximately 2 – 4 hours after fluid therapy. Fluid therapy alone will help decrease the concentration of glucose from dilution effect and urine production in the body. If the glucose is dropped too quickly it can result in cerebral edema and a coma. The maximum drop in blood glucose should not exceed 75 – 100 mg/dl/hr. There are several different recommendations to administration and dosage of regular insulin in the initial treatment of a DKA patient. The advantages of regular insulin are, it can be administered intravenously (IV), intramuscularly (IM), and subcutaneously (SQ), it has a rapid onset of action and a short duration of action.

Intramuscular and especially subcutaneous injection may not be absorbed properly if the patient is hypovolemic. Hourly IM injections of regular insulin can be done successfully if needed. The initial dose would be 0.2 – 0.25 U/kg with follow up doses of 0.1 – 0.2 U/kg hourly. The regular insulin is continued until the patient’s ketosis is resolved. When blood glucose drops <250 – 300 mg/dl the hourly dose is decreased by as much as 50%. At that point a 2.5 – 5% dextrose containing solution is started and if the blood glucose drops <100 mg/dl, insulin is temporarily discontinued until it rises above 150 - 200 mg/dl. If the blood glucose drops below 60 mg/dl a 1-2 ml/kg bolus of 25% dextrose should be administered and glucose measurement taken every 30 minutes to 1 hour until rises above 100 mg/dl. Blood glucose measurements are performed every 1 -2 hours until it is continuously in the 250 – 300 mg/dl range.

Regular insulin can be successfully administered IV as well. A popular treatment method is to add the dose of insulin into a 250 ml bag of 0.9 % NaCl to administer it to your patient. The dose of insulin to be added to the 250 ml bag of saline is 1.1 U/kg for the feline patient. This concentration will be started at a rate of 10 ml/hr and infused only with an infusion pump. 50 mls of the solution should be ran through the line and discarded to allow insulin to properly bind to the plastic in the tubing. This will allow for immediate, proper dosing of insulin to the patient. Monitoring the patient is the same as with IM injections of regular insulin that was described above. Once the patient’s blood glucose is stable and they are eating, the insulin can be switched to intermediate acting insulin.

**Hyperglycemic hyperosmolar syndrome (HHS)**

This is an uncommon complication of diabetes in the cat. HHS is diagnosed when the feline patient has hyperglycemia, above 600 mg/dl, hyperosmolality, above 350 mOsm/kg, and dehydration without to ketosis. (5, 8) In HHS it is thought that hepatic glucagon resistance and small amounts of insulin prevents ketosis. It is not known specifically why some feline patients develop HHS instead of DKA as a complication of diabetes mellitus but most patients with HHA have a concurrent illness. Patients can show neurologic clinical signs with this syndrome. Some patients are non-responsive to anticonvulsants and only respond to insulin therapy and rehydration in these situations. Neurological clinical signs are assumed to occur due to cerebral dehydration secondary to the hyperosmolality. HHS will occur more commonly, with concurrent disease such as, cardiac or renal failure, pancreatitis, sepsis, and/or steroid therapy.

Treatment of HHS and DKA are similar with the goals to correct dehydration restore electrolyte losses and provide adequate insulin to correct any metabolic defects. Correcting dehydration and hyperosmolality with 0.9% NaCl is necessary before starting...
insulin therapy. If the blood glucose is decreased to rapidly this will cause a decrease in extracellular fluid osmolality, which will cause cerebral edema. The prognosis of HHS is poor due to the high incidence of serious concurrent disease.

**Hypoglycemia**

Hypoglycemia can occur with an insulin overdose. This can be avoided by client education and making sure the client understands how to properly pull up and administrate the correct insulin dose. Clinical signs usually include ataxia, weakness, behavior abnormalities, depression, shaking, seizures, coma, or death. When the clinical signs of hypoglycemia are first recognized, owners can offer food or apply Karo® syrup to the mucous membranes of the patient until veterinary treatment can be performed. One the patient has arrived at the hospital, 50% dextrose can be administered per the request of your veterinarian. When an IV catheter is placed a dilution of 1:4 of 50% dextrose can be administered. This bolus can be repeated as necessary. A CRI of 2.5% to 5% dextrose should be started to prevent recurrence and continued until the patient can eat.

References available upon request.
Feline Hyperthyroidism is a common disease seen in feline patients. Every technician should understand pathophysiology of the thyroid gland including how the gland affects the body in a normal and abnormal state. As well as diagnostic and treatment options which will help the technician become a better patient advocate and help educate clients on those options.

**Physiology of the thyroid gland**
The thyroid gland helps regulate many different parts of the body. It is one of many glands in the body that makes up the endocrine system. The thyroid gland is located below the larynx on each side of the trachea and is one of the largest endocrine glands in the body. Secretion of the hormones thyroxine (T4) and triiodothyronine (T3) is the primary function of the thyroid gland. These hormones control the rate of metabolism within the body. When the body secretes too much of the thyroid hormones it is termed “hyperthyroidism” and when the body does not secrete enough of the thyroid hormones it is termed “hypothyroidism”. When the thyroid gland needs to secrete more of the thyroid hormones, the anterior pituitary gland will release thyroid-releasing hormone (TSH). TSH will be secreted to the thyroid gland and in return the thyroid gland releases the hormones. Both T4 and T3 are as equally as important within the body even though T4 is secreted at a much higher rate than T3. T3 is four times more potent and but lasts a shorter amount of time than T4.

Iodine is needed to complete the formation of T4. Only a small amount is needed in the weekly diet. In humans, this was the reason why iodine was added to table salt. When iodides are ingested, they are secreted from the gastrointestinal tract into the blood and then thyroid gland will then transform it into an oxidized state and use them to complete the formation of T4. Once the hormone is released it binds with plasma proteins that are synthesized by the liver. The hormones are then introduced to the tissues of the body slowly. T4 is introduced every 6 days and T3 every day. Once they are introduced to tissue, they will bind again with intracellular proteins.

Calcitonin is the third hormone that is secreted from the thyroid gland. Calcitonin, Vitamin D and the parathyroid hormone (PTH) are all closely intertwined to help control the formation and regulation of calcium and phosphate metabolism as well as bone and teeth formation. Calcium specifically plays a role in this activity by decreasing plasma calcium concentrations and has opposing effects of PTH. (For the purposes of this lecture, specific effects of the PTH will not be discussed.) Increased calcium in the extracellular fluid is the primary stimulus for secretion of calcitonin. It only takes a 10% increase of calcium to cause secretion of calcitonin. The immediate effect of calcitonin is to change the amount of absorbed and deposited calcium, especially in the young animal. The long term effect of calcitonin is to decrease the amount of new osteoclasts being formed.

Functions of the thyroid gland include;
- Increasing metabolic rate in almost every tissue of the body
- Increases the amount and activity of the mitochondria that will cause an increase the rate of formation of adenosine triphosphate (ATP). So in return the body uses more energy
- Affects the Na-K-ATPase which will increase transportation of sodium and potassium ions through cell membranes of tissue in the body. This causes more energy to be used and will increase the core body temperature.
- Growth- promotes growth and development of the brain during fetal life and for the first few years after birth. Growth and maturation can be decreased in the event of not enough of the hormones and vice versa if there is too much of the hormones present.
- Carbohydrate metabolism- stimulation of most aspects of carbohydrate metabolism is effected by thyroid hormone secretion. Rapid glucose uptake of the cells, glycolysis, gluconeogenesis, rate of absorption of the gastrointestinal tract and insulin secretion are all affected by the rate of carbohydrate metabolism in which the thyroid hormones play a role in.
- Fat metabolism- they thyroid gland can alter almost every step of fat metabolism. The lipids will be mobilized rapidly from the fat tissue which will decrease the amount of fat stores in the body and this will affect the free fatty acid concentration in the plasma and cause oxidation of free fatty acids to increase with an increase in thyroid hormone secretion.
- Concentrations of cholesterol, phospholipids and triglycerides will be affected with increased amounts of thyroid hormones. And they will be increased with lesser amounts of thyroid hormones in the body.
- Increased blood flow and cardiac output- because the metabolic rate is increased in the body this will cause the oxygen consumption to increase as well. This will cause vasodilation causing an increase in blood flow peripherally.
Vasodilation will occur in the skin to aid in normalization of the increased body temperature. To compensate for the increased blood flow, the body will increase the cardiac output.

- Increased heart rate- The increased heart rate is not only due to the body trying to meet the needs of increased oxygen consumption and cooling the body. The rate at which the heart is beating is increased more than to be expected. It is believed that the increased secretion of thyroid hormone has a direct effect on the excitability of the heart.
- Increased heart strength- Enzymatic activity of the increased flow of thyroid hormone will increase the strength of the heart even if the hormone secretion is only slightly increased. With excessive amounts of hormone in the body the heart will become weak due to long term increased production of protein catabolism.
- Respiratory system- The respiratory system is affected due to the increase rate of oxygen consumption and formation of carbon dioxide. The rate and depth of respiration will be increased with hyperthyroidism.
- Gastrointestinal system- GI motility and rate of secretion of digestive enzymes will be increased to help aid the body in the increased metabolism.
- Central Nervous System- altered amounts of thyroid hormone will affect the patient’s ability to think. Hyperthyroidism will cause the patient to be nervous, fidgety or find it hard to sit still. Hypothyroidism will cause the patient to become dull or even lethargic.
- Muscles- a slight increase in hormone secretion the muscles of the body with react with increased reaction time. When the hormone secretion is excessive they will react slowly because the body is in a continuous state of protein catabolism. If decreased, the body will be sluggish to react.

**Feline hyperthyroidism**

Feline Hyperthyroidism is the most common endocrinopathy in feline patients over the age of 8 years old. It is a multi-systemic disease resulting in increased production and secretion of the thyroid hormone, T4 and T3 within the body. Typically lateral or bilateral small thyroid masses are palpable on physical examination. The mass causing the disease typically contains an adenoma or adenomatous hyperplasia cells. It is less common for the enlarged lobe to be caused by thyroid carcinoma. There is not a sex related predisposition to the disease. It has been reported that Siamese and Himalayans are at a decreased risk for development of Hyperthyroidism. And domestic long and short hair breed are most commonly affected.

**Clinical Signs include the following:**

- Weight loss
- Polyphagia
- Hyperactivity
- Increased vocalization
- Hair coat changes
- Polyuria
- Polydipsia
- Vomiting
- Diarrhea
- Behavior changes
- Tachycardia

Clinical signs can be variable and consist of the non-traditional findings listed above if the disease has progressed. The clinical signs of a progressed state could include anorexia, emaciation and severe dehydration.

**Diagnosis**

Diagnosis of hyperthyroidism can be made on positive palpation of an enlarged node, matching history, clinical signs and documentation of an elevated total T4 on blood work. A total T4 should be run on serum and can be sent to ay commercial laboratory for evaluation. In cases that the Total T4 levels are not conclusive other testing should be pursued to determine a definitive diagnosis.
A T3 Suppression test can be performed if the serum total T4 is indecisive. This test evaluates the responsiveness of TSH that is secreted by the pituitary gland and if the synthetic T3 that was given suppresses its secretion. When the synthetic T3 is administered it should suppress pituitary TSH secretion. This would then cause a decrease in the serum T4 concentration in a normal cat. But if the patient has hyperthyroidism it will still have secretion of the thyroid hormone that has is not related to the pituitary gland. So the administration of synthetic T3 will have no effect on the hyperthyroid patient. To perform the test, collect a baseline serum total T4 and T3, the owner will administer 25 mg of sodium liothyronine three times a day for 2 days starting the next morning. The morning of day 3 the last dose of sodium liothyronine will be administered and a final serum T4 and T3 will be collected 2-4 hours after administration of the last dose.

Lastly a radioactive thyroid scan can be done to diagnose an enlarged thyroid lobe and the presence or absence of metastatic cancer. At the author’s facility, the scan is performed by injecting 2 millicuries (mCi) of technetium intravenously. After waiting 20 minutes for the technetium to take effect, ventral, left and right lateral images of the thyroid and thoracic regions are acquired. A radiologist will read the scans and determine if I131 is an appropriate treatment for the patient.

Treatment

Treatment options for feline hyperthyroidism include; drug therapy, thyroidectomy and radioactive iodine therapy. The mode of treatment will ultimately be determined by several different factors including; the age and health status of the patient, owner wishes, renal function, cardiac function, the presence or lack of hyperplasia, adenoma or carcinoma, the allowance of the patient to receive oral medications, the availability of I131 treatment and the availability of a surgeon to perform a thyroidectomy.

Initially the patient should be treated with antithyroid drugs to help control the side effects of excessive amounts of the hormone in the body. If surgery was chosen it will help reverse the effects on the body and make that patient a better anesthetic candidate. Oral therapy will also help reverse any cardiac or renal hyperthyroid induced derangements. Renal function abnormalities can be masked in the face of hyperthyroidism so when treated with antithyroid drugs any renal abnormalities will be uncovered and will help aid in final treatment options for the patient.

Antithyroid oral drugs include methimazole, propylthiouracil and carbimazole. Methimazole is the drug of choice for daily oral hyperthyroidism treatment in the feline patient. It can be given orally or placed topically on the pinna of the ear. A typical starting dose of methimazole is 1.25 to 2.5 mg/cat every 12 hours. Methimazole does not block the release of thyroid hormone it blocks the oxidation of iodine once the hormone is released. It typically takes 2 to 4 weeks before T4 concentrations normalize after beginning treatment. Side effects of methimazole include; neutropenia, thrombocytopenia scabbing lesions on the pinna of the ear, hepatotoxicity, anorexia, vomiting, lethargy, renal decompensation and rarely Myasthenia Gravis. Monitoring the CBC, biochemistry panel and serum T4 levels should be done at weeks 2, 4 and 6 initially. If owners choose to give the transdermal methimazole, it is important to educate them on proper administration and the importance of wearing gloves to not allow the medication to absorb into their skin and alter their thyroid levels.

Advantages of I-131 for the treatment of feline hyperthyroidism include the following: eliminates the difficulty of administering twice a day medication, eliminates the possibility of reactions to anti-thyroid drugs and eliminates the risk of anesthesia during the thyroidectomy. Disadvantages of I-131 treatment includes; the availability of I-131 is limited, it requires knowledge and safety precautions of the radiation therapy, the patient must be hospitalized for a specific period of time to allow the I-131 to be eliminated from the body (the typical hospitalization time is 7 to 10 days), the patient has to be isolated for that period of time without owner visitations, cost, and the patient may not respond properly to a single treatment.

Patient selection for I-131 treatment is very important; the patient must be able to be isolated and unmedicated during the entire duration of hospitalization. If the patient has concurrent medical diseases such as cardiovascular, renal, gastrointestinal, other endocrine or neurological diseases they may be excluded from this particular treatment plan. Pre-radioactive iodine treatment work up should include the following; CBC, biochemistry panel, urinalysis, serum T4, thoracic radiographs, echocardiogram and have been off of methimazole for 7 days. If all requirements are met at that time the patient can have I-131 treatment.

Safety precautions should be followed during hospitalization. They would include the patient being confined to an isolated area of the hospital particularly a nuclear medicine isolation ward, trained personnel should only touch the patient, this team of people should be properly trained on radiation safety and know the proper PPE. Long laboratory coats, disposable plastic gloves and dosimeter monitors are the proper PPE for radiation patients. Every day the radiation level should be monitored and recorded in the patient’s chart to ensure the level of radiation is decreasing. In the author’s facility, daily readings are performed by trained personnel until a measurement of 2.5 millirem per hour (mr/h) is obtained. Upon discharge owners should keep the cat strictly indoors, limit the amount of contact time with the cat and dispose of the cat waste properly. Children and pregnant women should not come into contact with the patient for two weeks after discharge. Typically I-131 will restore euthyroid in a single dose. The hormone concentrations are normal within two weeks of therapy and typically the patient starts to feel better within days after treatment. However, there are approximately 5% of cats who do not respond appropriately to a single dose and must have a second dose of I-131 to become euthyroid.
Patients that are good surgical candidates are considered a low anesthetic risk, the availability of I-131 is low and the availability of funding is low. Advantages of a thyroidectomy are it is 90% efficacious and/or curative. The disadvantages of a thyroidectomy include; high initial expense, the risk of hypoparathyroidism, it is nonreversible and the anesthetic risk of the patient. Post operatively patients should be monitored for 7 days for clinical signs of hypocalcemia. Other post-operative complications include; Horner’s syndrome, laryngeal paralysis, damage to the laryngeal nerve and permanent hypothyroidism.

Iodine restricted diets are available for hyperthyroid patients. If the patient is put on this diet, it must be fed this diet exclusively, physical exams and rechecking blood work must be done every 6 months for the rest of the patient’s life and they must be taken off antithyroid drugs over a course of 2 weeks while the patient is introduced to the iodine-restricted food. Only cats that are diagnosed with hyperthyroidism can eat the iodine restricted diet.

**Euthyroid sick syndrome**

Euthyroid Sick Syndrome is diagnosed in a patient with a nonthyroidal systemic illness with concurrent decreased serum thyroid level. Severe nonthyroidal illness will decrease serum thyroid levels to the low or undetectable range even in patients without concurrent hyperthyroidism. With concurrent systemic illness, patients with serum thyroid levels in the normal to high range should be suspected to have hyperthyroidism. A second serum thyroid level should be checked approximately 1-2 weeks later. If total T4 levels are still suspicious but inconclusive other diagnostic methods for diagnosis of Hyperthyroidism should be pursued.

References are available upon request.
Stabilization and Monitoring of the Critical Patient
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Following triage of the critical emergency patient, the first few steps we take as technicians and veterinarians can be vital in providing life-saving stabilization as well as obtaining diagnostic information. With the guiding tenets of working efficiently and stressing the patient as little as possible, we will discuss tools such as the minimum database, electrocardiogram, pulse oximetry and blood pressure monitoring. Techniques behind these tools, troubleshooting and application will all be discussed, with relevant case examples provided.

Initial stabilization
For most emergent patients, initial stabilization will include obtaining intravenous access, supplementation of oxygen, fluid therapy if necessary, and administration of medications if indicated. General sites for IV access include the jugular, cephalic and saphenous veins; intraosseous (IO) access should also be considered and may allow more rapid access in patients with cardiovascular collapse. Oxygen therapy should be supplied via flow-by mask initially, and is able to achieve an FiO2 between 30-40%. As these stabilization measures are taking place, the quick, easy diagnostics below should also be considered to guide further treatment.

Minimum database
The minimum database (MDB) generally consists of a packed cell volume (PCV), total solids (TS) and blood glucose (BG). These diagnostics can all be performed in the emergency room with a very small amount of blood, meaning that they can be completed rapidly and in patients of various sizes.

PCV and TS should always be interpreted together, and can allow for assessment of volume status as well as differentiation of causes of anemia if present. For example, there are three general categories of causes of anemia: loss (hemorrhage), which can be internal or external; destruction, such as with hemolysis; or lack of production, as with chronic disease or a bone marrow issue. By evaluating the PCV/TS together, one can narrow down the causes of a patient's anemia. In cases of hemorrhage, both the PCV and TS should be low, since both red cells and proteins are being lost. In cases of destruction or lack of production, the PCV should be low and the TS should be normal, since protein values will generally not be affected. (*Pearl: In cases of acute hemorrhage, especially in dogs, it is common to see a low TS in combination with a normal or even slightly increased PCV. This is due to acute splenic contraction and release of red cells into the circulation when hemorrhage occurs). Evaluation of capillary tubes post-centrifugation can also be helpful in looking for evidence of hemolysis, icterus or lipemia.

In most emergency rooms, glucometers are used to determine blood glucose levels. These small handheld tools are convenient, inexpensive, and can be used with serum, plasma or whole blood. Recent research has shown that measurement of whole blood glucose using a glucometer generally results in values that are roughly 30 mg/dl lower than serum glucose values in both dogs and cats.1 In critically ill patients, hyperglycemia (>180 mg/gl in dogs, > 220 mg/dl in cats) can occur secondary to stress or trauma, or can be directly related to the patient’s problem, such as with diabetes or diabetic ketoacidosis. In general, patients with hyperglycemia should be stabilized with fluids and other supportive as indicated, and the blood glucose rechecked before considering direct treatment of the hyperglycemia with insulin therapy. Hypoglycemia (< 60 mg/dl in dogs or cats) can occur with sepsis, endogenous or exogenous insulin release as with insulinomas, accidental insulin overdose in diabetic patients, secondary to xylitol toxicity, hypoadrenocorticism, and decreased production in neonatal patients. (*Pearl: In general, hypoglycemia does not occur in adult dogs or cats secondary to anorexia, and should instead be an indication to look for other more serious causes.) Hypoglycemia can be life-threatening and should be treated immediately upon recognition with intravenous dextrose (0.25-0.5 g/kg of 50% dextrose, diluted to 1:2 to 1:4 and given IV over 5 minutes).

Electrocardiogram
Electrocardiogram (ECG) allows for assessment of the electrical rhythm generated by the heart and sensed at the body surface. ECG monitoring can be helpful not only for patients presenting with cardiac arrhythmias, but also for any patient that presents with a history of trauma, weakness, collapse, or requires monitoring during resuscitation and beyond.

The majority of ECGs used in emergency room settings have three bipolar limb leads: I, II and III. Newer devices also offer wireless and telemetric options. While ECGs should ideally performed with patients in right lateral recumbency, this may not be possible in patients with dyspnea or other critical illness. The leads should be attached to the distal or proximal caudal elbow and over the stifle, and wetted with 70% isopropyl alcohol to ensure electrical contact. Keep in mind that activity of the patient and electrically operated equipment such as clippers can cause interference, so they should try to be minimized while a reading is being obtained. For patients that require longer monitoring, adhesive electrodes may be used to reduce patient discomfort.
ECG readings can be used to evaluate patients for bradyarrhythmias or tachyarrhythmias that may be noted upon triage; irregular rhythms can also be evaluated. ECG is also useful in CPR situations to guide resuscitation techniques. For critically ill patients who are hospitalized, ECG can be incredibly useful in a busy setting to monitor the patient while other things are happening. For example, a patient who comes in with pericardial effusion and has a pericardiocentesis for stabilization should have an ECG placed during hospitalization as the redevelopment of tachycardia may be one of the first indications of re-effusion.

**Pulse oximetry**
Pulse oximetry devices allow for assessment of oxygenation via measurement of the percent of hemoglobin that is saturated with oxygen (SpO2 or SaO2). The pulse oximeter probe is attached to an area of non-pigmented skin or mucous membrane, and sends two wavelengths of light into the blood circulating through the capillaries. These wavelengths reflect the amount of oxygenated hemoglobin in the blood, expressed as a percentage (an SpO2 of 95-100% is considered normal). The device should also report a pulse rate, which should match that of the patient (confirmed via palpation or your ECG) to ensure that the measurement is accurate. (*Pearl: If you are getting a pulse ox reading but no pulse reading, or an incorrect pulse reading, the pulse ox value is likely inaccurate!*) SaO2 is directionally (but not linearly!) related to PaO2, which is the partial pressure of oxygen dissolved in the arterial blood (normally around 100 mmHg). It is important to remember that because of this non-linear, sigmoid characteristic of the oxygen-hemoglobin dissociation curve, small drops in SpO2 can equate to major changes in PaO2. For example, an SpO2 of 94% is equal to a PaO2 of roughly 80 mmHg, and an SpO2 of 90% is equal to a PaO2 of roughly 60 mmHg, which indicates severe hypoxemia.

Pulse oximetry readings can be very helpful in assessing critically ill patients during triage, and monitoring them over time for response to therapy. However, the devices can be finicky, and many of the problems seen in patients presenting emergently, including hypothermia, hypotension and vasoconstriction, can make it difficult to obtain a reading. (*Pearl: Don’t depend too heavily on your pulse ox if you can’t get an accurate reading! If your patients appear to need supplemental oxygen, just treat them!*) It is also important to remember that pulse oximetry does not tell us about the ventilation side of respiration; measurement of end-tidal, arterial or venous CO2 is required.

**Non-invasive blood pressure monitoring**
While direct arterial blood pressure monitoring is the gold standard, non-invasive methods are commonly used in veterinary medicine and are a rapid, relatively easy to perform way to assess blood pressure. Normal systolic blood pressures for dogs and cats are 150 ± 20 mmHg and 125 ± 10 mmHg, respectively, with average mean pressures of 105 ± 10 mmHg for both species. Hypotension is defined as a systolic blood pressure less than 90 mmHg, or a mean blood pressure less than 60 mmHg. Causes of hypotension in veterinary patients include shock, heart failure or severe arrhythmias, and peripheral vasodilation secondary to SIRS or sepsis. Hypertension, generally defined as a systolic blood pressure greater than 160 mmHg in dogs or cats, is usually secondary to stress, pain, or an underlying disease process rather than a primary problem.

The two most common non-invasive methods of measuring blood pressure are via Doppler or oscillometrics. Both techniques rely on inflation of a cuff to occlude arterial blood flow, with the blood pressure measured when flow returns. Cuff size is important in both methods, and is a common source of error: a too small cuff will result in a falsely high blood pressure, and a too large cuff will result in a falsely low blood pressure. Recommended cuff sizes are approximately 40% of the limb circumference for dogs, and 30% for cats.

The Doppler method of measuring blood pressure relies on a 10-MHz ultrasound probe to detect blood flow in an artery, and is usually used over the dorsal metatarsal artery in the hind leg or over the palmar aspect of the metacarpals in the front limb; the ventral base of the tail can also be used. With the cuff attached and inflated proximal to (above) the probe, Doppler sounds become audible when the pressure in the cuff is less than the pressure in the artery, and a reading can be obtained using a sphygmomanometer. Doppler blood pressure readings are commonly obtained in small patients, especially cats and small dogs. It is also useful in patients with arrhythmias, since oscillometric readings will be inaccurate in these patients.

The oscillometric method involves an automated system in which a cuff is applied to the patient’s limb and blood pressure readings are obtained by the machine. The machine alternates between inflating and deflating the cuff, and during deflation, pulse pressure changes are sensed by the transducer. The machine reads the mean arterial blood pressure, and systolic and diastolic pressures are calculated. Similar to the pulse oximetry device, oscillometric monitors read and report the heart rate, which should match that of the patient to suggest an accurate reading.

**References**
Bullying has become more prevalent in today’s society, not only among school children, but within the workplace as well. Younger generations have been moving away from face-to-face communication with the overuse of social media and texting, so their ability to have direct communication tends to be less constructive. When faced with these situations, it may be harder to know how to communicate that this is unacceptable and stand up for themselves.

The repercussions can range from a lowered morale to intense emotional damage to the victim. Victims of bullying often experience feelings of depression and anxiety, and feel isolated. Sleep and eating patterns can be disrupted, and psychosomatic symptoms such as headaches, abdominal pain, and chest pain can arise. These individuals begin to dread coming into work, which results in increased absenteeism and decreased productivity. The employee is made to feel that nothing they bring to the table will be appreciated or recognized, so they stop trying. Highly talented, hardworking employees can appear to become complacent in the face of bullying behavior.

In more and more states, it is also becoming illegal to behave this way in the workplace. Currently, in 30 states, the Healthy Workplace Bill has been introduced. This bill defines what is considered an abusive work environment, and gives employers a more direct reason to terminate offenders. It also allows employees a path for legal compensation for health harming harshness at work. This bill holds the employer accountable for setting up internal correction and prevention procedures, and seeks to recover lost wages and benefits for the employee. Beyond protecting your employees because it’s the right thing to do, with this bill, it’s important to protect your practice by ensuring proper preventative procedures are put into place. This starts with an anti-bullying policy, which communicates to all employees that bullying behavior will not be tolerated. It is clearly defined and examples are provided. There is a focus on the effects felt by the disrespected individual, not on the intent of the offender. Regardless of intentions, perceived incivility will not be tolerated and the offender will undergo a corrective process.

In the workplace, individuals should be assessing their mental health and wellbeing on a regular basis, and be able to label bullying behavior when it’s occurring. When faced with bully-like behavior, individuals are often constantly criticized. It doesn’t matter what the employee does to try to improve or fix their work, instead of coaching or positive reinforcement into better performance, bullies will hold the individual to a higher, unfair standard and continue to criticize. While it sounds completely unprofessional to even fathom, another tell-tale sign of workplace bullying is using raised voices or even outright yelling to express concerns. Often times this is done while insulting or humiliating the individual in front of their coworkers.

Combating bully-like behavior starts with identifying it and eliminating any self-blame. Utilize mental health professionals for additional healing support if needed. Finding emotional stability is very important prior to making a decision as to how you will combat the problem at work. While in most circumstances speaking directly to the individual is recommended, with bullies this tends to be less effective. Research your company’s employee handbook for any internal policies on harassment, respect or specific bullying behavior. Speak to your manager and/or the owner of the practice regarding the issue, backing up your case with specific examples, and include reference to any relevant company policies. Quality employers will not stand for this behavior and will squash the problem quickly. However, if you find that your employer does not take action and/or the retaliation from the bully is ignored, it may be time to plan an escape route into new employment.

It’s important to keep an eye on your own mental wellbeing in any job, especially if you feel you are the target of bullying behavior. The stress can have negative effects not only on your mental health, but physical as well. Encourage your employer to create an anti-bullying policy before it personally affects you. Having new hires review and understand that this behavior is unacceptable will help build positive morale and eliminate bullying behavior before it starts. Not only will the employees be happier and more productive, the employer will not waste excessive time and financial assets in dealing with high turnover and corrective processes.
Employees under high stress equal lower productivity and increased turnover. Our field naturally produces high levels of stress at work, between sick patients, client demands, and coping with euthanasia. The expectation of our team members and doctors is to be able to go into a room to discuss end of life decisions, then be able to hop into a new puppy room with a smiling face an hour later. It can be emotionally draining and it wears on everyone. It’s important to be proactive as an employer and ensure team members are taking care of themselves. When a supportive culture is created, you will keep valued employees for much longer, and deal with much less absenteeism. You may also find that employees become devoted ambassadors of your company and brand in the community.

Prioritize health and wellbeing of the employees by implementing regular programs that promote a healthy lifestyle. Offer twice monthly activities for the employees to join in on, such as yoga or kickboxing. Not only will it enrich their health lives, it will also serve as a team building experience. Other concepts include wellness challenges such as trying to drink a certain amount of water each day, or consuming a certain serving amount of veggies and fruits. Wellness challenges are also often centered around performing a certain amount of exercise on a regular basis. The employer can establish a point system for increments of healthy choices, with a small prize at the end. Other programs include offering full health assessments, along with coaching and support to create individualized plans for your employees. Nutrition and exercise wellness lectures can be offered as part of your team meetings, or on a semi-annual basis.

Managers also should take some responsibility for their employees’ wellbeing and stress levels. Regularly check in with staff one on one to see how their job is going, and where there could be improvement not only in performance, but their level of contentment as well. There may be times that certain assigned tasks do not lend themselves to an individual’s work style or strengths in the workplace, so reassignment to an alternative task may make them feel more fulfilled and less overwhelmed. When employees see that their fulfillment is a priority of the organization, they are more likely to produce their highest quality work. While not always possible to immediately fulfill, the opportunity for growth should be available to employees so that they can envision a plan for their future and feel more invested in their position.

Fulfillment in an employee’s position at work is also correlated to the extent of staff development offered by the organization. Offer regular training and educational opportunities, whether it be clinical CE, or leadership CE for those interested in pursuing management opportunities one day (even if it is unlikely there will be an opening with your company specifically- if you invest in them, they will be more invested in you in the present). Outside of company created CE, it’s advisable to allow for a CE budget for all staff- assistants, client service representatives, and technicians. Not only does this help them grow and better themselves in their positions, it empowers them and makes them feel valued by their employer.

Ensure that the new employees you are trying to win over and engage are not left in the dark. For new hires, be sure to include phase training programs, and regular training check-ins that include seeking their feedback on how to improve the process. Offering cross training opportunities will not only help employees better understand all sides of the company’s operations, but will also help match up their personal strengths and goals with their job duties.

Those in leadership roles should set a positive example for the staff. When their supervisors value a positive work/life balance, and don’t stay late every night, and choose not to order fast food for lunch and skip out on exercising, the staff is more likely to prioritize their health as well. Creating a culture that checks in on each other and genuinely cares, on a personal level, how their coworkers are functioning will promote regular self-care in the workplace.
Most staff members are terrified of the concept of direct communication. There are so many “what if”s that take over an individual’s psyche. What if the person on the receiving end gets angry? What if they retaliate against you? Or even what if it ends up being a wasted discussion? While these are all possibilities, and potential challenges, the benefits far outweigh the pitfalls.

Team members who are willing to tackle direct conversations are more likely to see desired outcomes come to fruition. It is much easier to communicate a concern, and back it up with examples, when it’s coming directly from the person who was effected by the behavior. While a discussion led by a manager on a team member’s behalf may stall with excuses and retorts, this is less likely to occur when the team member approaches their coworker on their own. An employee will not push back and argue whether or not something actually occurred with the individual who was also present during the incident.

Moreover, even if the information received is hard to hear, employees feel respected when their coworkers come to them directly to solve problems versus going above their head to management. The team member feels that their coworkers are giving them a chance to fix the problem on their own before “getting in trouble” with the higher-ups. The individual leading the conversation also gains respect within their workplace as someone who is clear about where they stand in situations.

On the opposite end, the repercussions of triangulated conversations are dangerous to the success of a business. Often times, the message is distorted or misinterpreted by the third party relaying the information.

Implementation of a direct communicative culture starts with management and owners. New hires should be encouraged to speak directly to their coworkers (and management as well) when they have ideas or concerns. Managers must achieve a balance of ensuring the staff knows when they are stuck in a communication barrier with an employee, they can come to you for assistance, but the first step is never to immediately go above their coworker’s head.

When team members need help further resolving the problems they have between each other, management should help facilitate direct face-to-face communication with a supervisory employee as the moderator. Ensure both team members are equally heard and no sides are taken by managerial staff.

A culture of direct communication can also be achieved in part by conducting regular surveys on various issues that arise within the workplace. Whether it be opinions on protocols, training methods, or assessing morale, employees should feel comfortable voicing their opinion, and have a platform to do it. Equally important, the data obtained from employee surveys should be transparently utilized by the organization and not just collected, then ignored.

Management should also promote an open door policy with team members so that they are encouraged to directly communicate, even when they have a concern with management. There should never be fear of retribution, or losing their job, if a team member brings a concern, or even complaint, to management. Some methods to avoid team members shying away from these conversations include offering regular 360 reviews that allow staff to evaluate and comment on management’s performance in an anonymous manner. Having more than one “boss”, but rather a few individuals on the management team also allows employees to feel that there isn’t just one person in control of all elevated decisions. Therefore, if an employee has a concern with one of the supervisors, they understand it’s less likely if they bring up these issues that they will be treated differently or even terminated.

Unfortunately, in many veterinary practices, since the teams tend to be small, gossip and pent up hostility tend to take the place of honest conversations. When team members observe management or owners exhibiting this behavior, it makes it all the more difficult to turn a new page and switch to direct communication. Often in these environments, the “problem employee” is ganged up on, gossiped about, and alienated until they decide to move on. Not only does this approach create toxicity and lower productivity in the workplace, but it also does not even give the employee a chance to improve. We must remember that we go through a time-consuming, expensive process to select, hire and train new staff, so we should protect that investment. Not only is it the right thing to do by the employee, but also the smarter business move. If we can have a few more conversations and a little more coaching to get the employee back on track, it will increase morale for staff to see the investing nature of their employer, as well as save on rehiring processes.
With jungle gym careers, increased competition for jobs, more complicated customer interactions (social media, yelp, and google reviews, anyone?), veterinarians have to establish critical relationships and communicate important messages to their clients and colleagues. In a business world that largely relies upon extroverted strengths, finding space to be heard can be a challenge for the introverted veterinarian.

Fortunately, extrovert-centric self-promotion is so last decade. Today - influencers will stand out if they can build other people up and commit to listening over talking.

Before we can talk about the strengths of introversion, it’s important to understand what introversion is. An introvert is someone who seeks solitude to recharge energy. Introverts draw energy from within themselves. Introversion is not shy. Shy is behavior or behaviors caused by anxiety in social settings. Characteristics include needing and desiring time alone, tendency to think before speaking, prefer to dig deep vs. small talk, may be less likely to express emotion and can be difficult to read, enjoy writing over talking, and can be private, quiet, and reserved.

In the American workplace, there can be barriers that prevent introverts from becoming influential leaders. These can include an emphasis on team approaches that can be draining and stifling to the creativity of an introvert, a tendency to shy away from self-promotion, pressures within the American business culture to behave like an extrovert, feeling talked over by extroverts, pressures to make decisions quickly, and the stress that goes with these barriers.

It is important for introverts to know that they are not alone in feeling frustrated by these perceived barriers, and that being an introvert is not a weakness. In order for introverts to establish professional success, we must first stop trying to behave like extroverts, and instead, focus on the strengths that come with an introverted nature.

Introverts must schedule quiet time to recharge, prepare, find creativity and solutions, and not burn out. Preparation and ability to focus is a strength of introverts, but they must have time alone to exploit this strength. Quiet time allows preparation by visualization, and increases the likelihood of success of professional encounters with clients and staff. Even a few minutes of solo concentration can help an introvert increase focus and influence.

How do you find your quiet time? How can you prioritize this sacred time and use it to your best advantage?
Where can you go without distraction?
What activity (or activities) provide you with recharging quiet time?

Think about a challenge that you are currently facing. How can taking some quiet time help you with influencing change?

A second strength of introverts is preparation: Introverts are game-changing strategists. We hate to wing it. We like a game plan, and rehearsal, and all details ironed out well before its game time. This allows an introvert to present himself or herself as the expert on the topic at hand, and increases confidence of both the veterinarian and the client.

Another area of strength includes intentional and attentive listening to clients, an ability to read body language, and tuned-in empathy, which encourages clients to share feelings and questions more readily. It also gives an ability to help clients make hard decisions. Introverts tend to display tremendous listening skills, which is critical to patient management and successful practice. Introverts can use this ability to gain credibility and achieve better compliance, especially through the use of open-ended questions and focused conversation to really understand the problem before provided customized treatment and diagnostic plans.

Introverts also display a penchant for writing, and writing for influence, whether, through one-on-one interactions with clients, via veterinary or pet publications, or through thoughtful use of social media is yet another way introverts can influence and lead our profession.