Dr. Mathis's version of the 5 Minute Veterinary Dentistry Extraction Consult.

No pet should have a known painful condition unaddressed or overlooked just because they are hiding the symptoms. It is better to be without a tooth than have a painful tooth.

Though cats usually have 30 teeth and dogs usually have 42, only the canines (4) and carnassials (4) are important to save for oral structure and function. One could make an argument for keeping the upper third incisors and upper first molars in dogs as well.

Some think cats just want to lose teeth…. and it's hard to argue that point. – but let's perform extractions correctly so we don't leave behind sources of pain and infection. A recent study of dogs and cats reported retained tooth roots were present 90% of the time when intraoral radiographs are not taken even though the operator stated the entire tooth was removed in the medical record. This may be part of the reason 55% of the cause of inflammatory rhinitis is due to dental problems.

A tooth with pulp exposure or discoloration needs root canal therapy or extraction. A tooth with a 'chip' fracture (no pulp exposed nor root/gum involvement) often needs a restoration. Yet be aware, 25% of upper 4th premolars with uncomplicated crown fractures are non-vital (endodontically compromised) requiring root canal therapy or extraction.

Every tooth should have one of the following types of flaps performed to extract it unless the tooth fell out during cleaning (FODC):

1) Envelope
2) Triangle
3) Square
4) Split

Some teeth use a square plus a triangle flap (lower canine). Many other flap types exist, but these four work for 99% of extraction needs.

Every extraction site should be cleaned of granulation tissue and closed in an appropriate fashion even if it just fell out during cleaning. If it just fell out during cleaning, debride the diseased tissue to reveal healthy tissue or healthy bone. The resulting clot can be stabilized with a cruciate stitch across the alveolus/defect.

All flaps must be closed without tension in apposition (except for the upper first molars: the ONLY exception to this rule). The upper first molars can be closed like the FODC teeth stabilizing the clot in the alveolus.

To have tension free flaps, we must fenestrate the periosteum underlying the *mucosal* part of the tissue. The parts of the 'gums' are

1) gingiva
2) mucosa

The gingival collar is the firm, fibrous part of the gums that surrounds the tooth. Having a snug gingival collar is important to future tooth health of adjacent teeth after oral surgical procedures. The mucosa is further from the tooth past the 'line' (mucogingival junction aka MGJ). Appropriately fenestrated periosteum under oral flaps can stretch mucosa up to 10 times its original size.

When suturing the mouth, use needle holders without scissors and faster absorbing, non braided suture. Poliglecaprone 25 (Monocryl) and Chromic Gut are appropriate choices. Chromic gut expands a little allowing for help in holding knots, absorbs fast, and is soft on the tissues and tongue during the healing phase. For large flaps or areas requiring more holding power, Poliglecaprone 25 is a preferred choice. Reverse cutting needles are traditionally used especially when involving the more fibrous gingiva of the dog. In the author's experience, cobra black coated taper needles for cats are preferred, as a taper needle is less likely to tear thin tissues and the taper needle stays sharp longer with the cobra black coating. Although there are many suture types preferred for the varied types of advanced oral surgical procedure, the suture selection 95% of the time is one of the following: 4-0 or 5-0 Chromic Gut with a cutting needle or poliglecaprone 25 when needed for areas that have more flap handling.

The standard closure pattern is simple interrupted. Many alternative closures have been successful depending on site preparation, tissue health, suture selected, and knot quality. A recent study of small extraction sites with tension free closure showed that simple interrupted, a short continuous run, and cruciate patterns all may be appropriate for closure. (Pegg 2021)

A suggested order for extractions is:

1) Place regional nerve blocks prior to tissue incisions (https://bit.ly/blockvideo)
2) Flap margin incision(s) resecting diseased tissue at the same time
3) Elevate the flap with the periosteal elevator
4) Retract the flap with the zombie on bone (4 handed dentistry can be helpful)
5) Remove as much buccal bone as is necessary to see the furcation or widest part of the tooth with an appropriate sized <u>round</u> bur (generally ½ or 2) Goal is to 'paint' away the marginal buccal bone until you can visualize PDL spaces while leaving the tooth root fully intact without bur marks
6) Create grooves on the sides of each root as if you are taking away the periodontal ligament (PDL) that looks like a grey line with an appropriate sized <u>round</u> bur (generally ¼ or ½) (Round burs are usually placed perpendicular to the bone)
    - The above two steps can be thought of as sanding away three 'PDL' sides of a square peg. Each tooth root is a round peg, but it's easier to visualize with the square peg thought. This means that the fourth side of the peg needs to have the PDL stretched the most.
7) Extend these PDL grooves towards the crown of the tooth and its natural tapers. This resects a diamond shaped part of the upper PM4. Thin the cusps for 'straight access' to the periodontal ligament space with a cross cut <u>taper</u> bur (699 cats or 701 surgical length dogs) (Side of taper bur, *not* the tip, against bone)
8) Use an appropriately sized luxator to *cut* the periodontal ligament in a vertical fashion holding your finger near the tip to provide a stop in case of 'slippage' (Clear view models and intraoral radiographs can help ensure your luxator direction is *parallel to the long axis of the tooth* root). Do not twist luxators, as the thin metal will fail damaging the instrument.
9) Sing 10 second elevator music to yourself for each of the 4 root 'sides' as you hold even pressure with a finger stop. Some think of this as isotonic exercise. We are not moving much but are working to fatigue the PDL fibers. Do not expect to advance the luxator at this point of the extraction.

10) Use an appropriately sized elevator to stretch and advance vertically while singing 20 second elevator music all the while holding pressure with a finger 'stop' in place. (Controlled even pressure to fatigue the PDL, not forcing through)
    - One advantage of a live patient when using elevators and luxators is that as the ligament stretches, blood fills the space helping to facilitate the extraction. Lab specimens do not do this, thus are harder. If you can take it out in a lab, you can take it out often easier on a live patient.
    - Though blood is helpful, it also can obscure your ability to see the PDL for initial elevator/luxator placement. Suction is helpful to resolve this.
11) Scoop (NOT twist) with elevators (no scooping nor twisting with luxators) to reposition to the other sides of the root. Scooping is going around the tooth root. Twisting forces the side of the elevator into the tooth root. This is where elevator shape and size matters.
12) Use of rongeur style extraction forceps to grasp the root in the same plane as the root with *gentle* twisting can help fatigue the PDL fibers. It can also help determine which side of the root need more attention with elevators/luxators. If the twist is in the wrong plane, or if this is done too soon, or with too much force, this action will only serve to break roots and make extractions more difficult. If you haven't taken out at least 10 teeth in your career, this is not something you should be learning yet.
13) Practice can remove each tooth root in 2 minutes (Do not rush, as this will only create problems adding evn more time) (30 seconds x 4 'sides' is 2 minutes!)
    Though this is attainable, you are welcome to laugh, as not every situation is ideal.
14) Curette the alveolus scraping against healthy bone as mentioned above.
15) Smooth the rough edge of the remaining jaw bone with a medium to coarse grit (blue or black stripe) diamond of your choice of shape (ball, football commonly). This called alveoloplasty.
16) Release the flap (cutting periosteal fibers) to ensure tension free closure if it was not released during flap creation. **It is not appropriate to close an extraction site unless you can lay the flap against the opposing side and release all forceps and the tissue still says in apposition. If the tissue retracts as you let go, it is NOT released enough.
17) Be sure to release the tissue off of the palatal and/or lingual side as well. Not having 1-2 mm of free tissue here is a common cause of inadequate suture throws and your suture pulling through as you tie it. This release also allows for improved alveoloplasty of the palatal/lingual side.
18) Bone augmentation/large defects after extractions:
    - Pressure and time allowing a clot to fill the defect provides all of the properties to allow bone regeneration
    - Any hint of granulation tissue/disease left behind will result in failure and possible worsening of a glass scaffold (consil), thus I do not recommend its use.
    - If bone augmentation is truly needed, a freeze-dried demineralized bone allograft WITH a barrier membrane is needed from Veterinary Transplant Services. A bone graft without a membrane is less successful than a natural blood clot alone.

Complications

- Sharp instruments are less likely to slip. (This in planned to be offered in a separate lab: instrument care and sharpening.) Always use a finger stop grip.

- If you cannot find a 'sticky' spot in the PDL, remove more buccal or interdental bone (best to preserve buccal and lingual maxillary/mandibular walls)
- Tooth fracture =retained tooth root (RTR): Remove surrounding bone with a round bur and irrigation (not air to avoid air embolism possibility); once the grey PDL margin is revealed, create a crescent groove site to place your instrument
    - If downward pressure is likely to result in the RTR entering the nose or mandibular canal, select a smaller elevator and/or root tip pick to 'scoop' the sides of the RTR until it is loosened
    - A luxator is best then followed by an elevator if vertical pressure is not a risk
    - Interradicular (between the roots) bone removal can also be done if needed
- Retained tooth root (RTR) enters the mandibular canal: the best opportunity for removal is NOW as later will result in granulation tissue making removal more difficult and sometimes impossible/impractical. Do NOT expect the fragment to resorb even with the most zealous wishful thinking.
    - As the fragment is lying on the pillow that is the neurovascular bundle, the path of least resistance is the hole from which it came…
    - Never take anything larger from a smaller hole unless you have had an epidural and can name it afterwards (Heidi-ism) – thus make the hole larger by removing interradicular bone
    - Water irrigate. (No air) You are looking for the pearl in the red sea. Irrigation often results in it floating right up if you've provided the space to do so while preventing your bur from damaging the neurovascular bundle during interradicular bone removal. (Easier said than done.)
- Retained tooth root (RTR) enters the nose:
    - Take a radiograph
    - Remove with suction out the alveolus should it aligned with an alveolus. (unlikely)
    - Otherwise, pack the pharynx with clean dry gauze to prepare to catch it
    - Irrigate with water stream
    - REPEAT above 3 until you've caught it and confirmed it has moved out of the sinuses (many radiographs needed)
    - Waiting to do this later results in granulation tissue, root retention, and a nidus of infection.
- Tooth resorption (TR):
    - Determine the type with radiographic imaging (Offered in a separate lab): Inflammatory (black spot) or replacement (become part of jaw bone) resorption
    - Expect the tooth to break, though we are sometimes surprised
    - If you can see PDL, get it out.
    - Drilling away the RTR pieces is NOT acceptable as it causes many problems. (This is called root pulverization and it results in SQ emphysema, trauma/pain, or more.)
    - If there is only replacement resorption, you can do a crown amputation to the level of alveolar bone or lower. This modified extraction technique (MET) begins with nerve blocks and flaps just as in any other extraction. It ends with intentional root retention (IRR), alveoloplasty, and gingival closure without tension. We must <u>continue to monitor</u> (CTM): follow up intraoral radiographs at least annually as the success rate is high but not 100%

- For marginal root resorption (RR) NOT affecting the neck/alveolar rim – If no other types of resorption or periodontal disease are present, only CTM; ie leave the tooth intact. (This is typical older and large breed dogs.)

Preventing Complications

- Take pre extraction radiographs (dilacerated roots?) (resorption?) (bone quality?)
- Use sharp instruments as they are less likely to slip
- Use a finger 'stop'
- Use patience
- Sing elevator music (pressure for the full 30 seconds per side to stretch the PDL)
- Do not rush or it will always take longer

Additional resources can be found at: https://tooth.vet/wvc-extlab

Thanks for attending!