**DENTAL EQUIPMENT AND INSTRUMENTS**

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**Introduction**

Providing optimal dental care for your patients can be very challenging if you don’t have the right tools to provide the best level of care. From simple hand instruments to advanced imaging, you can start or enhance your dental practice more effectively by obtaining, and maintaining, quality instruments, equipment and products. There is such a wide variety of choices out there, you will often have to make decisions on the level of equipment you want, compared to the budget you might have.

**Operator Support**

Another area often overlooked is the equipment that should be available to provide the operator with the best working environment. Specific dental tables may have sinks to allow water flow away from the patient, preferably with space underneath to provide a seating space for the operator. Too many times dentistry is provided from a standing position, and for many procedures, this may not be ergonomically favorable for the operator. Tables with adjustable heights, and special chairs to encourage better posture can help decrease operator fatigue.

Good access, lighting, and being able to see the operating field clearly is also important. Surgical lighting overhead or a head lamp can provide direct lighting in the area, and some high-speed hand-pieces have fiber optic lighting as well. Magnification can make a big difference in the ability to discern small lesions and handle delicate tissues. Using loupes also encourages the operator to perform in a more upright position, with better posture, when the loupes are adjusted for the proper working distance between the loupes and the operator’s hands. The availability to suction excess fluids can also help keep the operating field clearer. Another frequently forgotten technique to aid in visualization during extractions occurs when removing overlying bone to expose tooth roots. In addition to the combination of blotting or suctioning the area, just watching where bleeding arises helps differentiate between tissues. If buccal bone remains overlying the tooth surface, the whole boney surface will bleed. Since cementum and dentin do not bleed, taking breaks to inspect the surgery will reveal those surfaces as not oozing which is helpful to guide the operator to know where to continue to remove bone and outline the tooth root.

**Power Equipment**

Using power equipment can greatly speed up scaling of teeth, and most clinics have some type of ultrasonic scalers. The ultrasonic movement of the working tip generates significant heat, so water irrigation is important to not only manage friction generated heat, but also to help trap bacteria and debris from becoming aerosolized. Personal protective equipment including eye protection and a surgical mask should be worn when hand or mechanical scaling to prevent the operator from being exposed.

Understanding the path of movement for your ultrasonic scaler is important for using the equipment properly. Piezoelectric scalers work by through electricity pulsing through a crystal in the hand piece. The crystal expands and contracts which is transferred to the working tip and results in the tip moving in a linear motion. Recognizing how to properly orient the ultrasonic tip to the tooth is key to ensure that the movement moves calculus away rather than resulting in the tip repeatedly hitting the tooth surface. Two other common forms of ultrasonic scalers include magnetorestrictive scalers found as a ferromagnetic stacks or ferrite rods. Both scalers ultrasonically travel through either a figure-of-eight or circular motion of the scaler tip. The combination of the mechanical contact between the tip removing calculus and the cavitation by the irrigant on surface bacteria contributes to cleaning the tooth. Ultrasonic scaling equipment should be carefully cared for since dropping a piezoelectric hand piece, delamination of the magnetorestrictive stack or fracture of the ferrite rod will all render the hand-piece inefficient or useless. Care and upkeep of ultrasonic scalers should be based on the manufacturer’s instructions. Commonly, manufacturers will include recommendations for frequency adjustments or specific subgingival scaler tips that are less aggressive and can be safely used to debride subgingival calculus, plaque and debris.

Small electrically driven micro-motors with low-speed hand-pieces can be used with burs and polishing cups. However, their use is limited as they operate below 30,000 RPM, have high torque and produce vibration. There is no water for cooling, so if a bur or disc is used to section teeth or bone, a second person must spray water in the area to cool the bur. If used primarily for polishing, the low speed handpiece needs to be limited to around 3000 RPM.

Air-driven units have the advantages of higher speeds, less torque and water delivery. Air is provided either from compressors or nitrogen tanks. Smaller ‘chairside’ compressors may have to run continually, while remote compressors can be larger, power multiple units and produce noise outside the operatory. An oil-cooled compressor will need oil-free filters to prevent contamination but are generally less expensive than air-cooled compressors. Water source for the high-speed units can be provided directly from water lines, with filters that remove impurities, or by using distilled water in an attached water tank.

Air-driven units are equipped with at least one high-speed hand-piece port (often two), one low-speed port, an air/water syringe and sometimes suction. The high-speed handpieces are used with a variety of burs, from cutting and finishing to gingivectomy burs. The low-speed handpiece is often used with polishing angles and cups, but can be used for other low-speed functions such as contra-angles, reduction angles and even HP straight burs. The air/water syringe is extremely helpful for irrigation and drying surfaces during restorations. Optional suction pieces are used to remove excess fluids from the operating field when needed. Some high-speed hand-pieces come with fiber-optic lighting, for optimal visualization in the direct field of work.

**Complete Dental Assessment**

Complete dental records, including history, findings during the examination and treatment should be kept in a precise manner. Visual assessment can cover the extent of plaque and calculus, the level and region of inflammation, broken or discolored teeth and other abnormalities. A full-page dental chart sometimes double sided for examination notation on one side, and treatment on the other, should have sufficient space to record all indices and pathological findings. Four-handed charting (one measures, the other writes) is an efficient way to record the findings.

Assessment with a periodontal probe is necessary in determining the depth of a sulcus or pockets, or the level of root exposure or presence of furcation exposure. There are many types of probe, so be aware of what your instrument’s measurement marks are. When measuring around teeth, also remember that the full extent of attachment loss includes both the root exposure and pocket depth. On the other end of most probes, the periodontal explorer with its sharp tip (Shepherd’s hook) can be used to feel for open canals or tooth resorption.

Dental radiography is an essential part of practice, not a luxury. You must be able to correlate the extent and type of bone loss associated with periodontal disease, the presence of apical bone loss in endodontic disease, tooth resorption, and changes associated with oral tumors. A major equipment decision is made in the selection of the x-ray generator. While fairly standard in output, options for wall-mounted, stand-mounted or handheld can provide flexibility for your practice needs.

Standard dental films can still be used, with developing solutions in a chairside developer or an automatic processor, but digital dental radiography is generally preferred. Direct digital radiography uses a sensor attached directly to a computer, and when exposed, will produce an immediate image on the computer screen. Advantages are the rapid image evaluation that assists with the initial learning curve of taking the radiographs, as well as the ability to immediately adjust the positioning if needed. The disadvantages lie in the bulk and single size (#2) of the sensor, and its expense to replace if broken. Indirect digital radiography uses phosphor plates, available in a number of sizes, that are placed in sleeves and then exposed. The plates (thin, flexible) are less expensive than a sensor, but need to be replaced if scratches mar the surface. Scanning the plates only takes 10-20 seconds but will slow down the process if adjustments need to be made for an additional image. Advanced imaging techniques such as MRI, CT and Cone Beam CT can offer superior evaluation of tissues and can provide detail for oral tumors and fractures that radiography may not. Expense is the primary hurdle for such options.

**Peri-operative Tools**

While details of anesthetic units and monitoring equipment are beyond the scope of this lecture, they are integral items to provide optimal dental care and should be available for daily use in the dental operatory. Maintaining body temperature can be a big challenge in dentistry, with a large population of older, smaller patients that get wet during the procedure.

Providing appropriate pain management, both systemically and locally/regionally is also very important in dental procedures. Local analgesia benefits the patient by the ability to reduce the amount of general anesthesia and to provide a smoother recovery time. It is important to get good technique training, and to keep below the maximum dose rates. Bupivacaine (2mg/kg for dogs, 1-2 mg/kg for cats) provides longer duration that lidocaine, and the addition of buprenorphine can be considered.

**Complete Dental Cleaning**

Whatever you want to call it – COHAT (complete oral health assessment and treatment), Oral ATP (assessment, treatment, prevention), SRP (scaling, root planing, polishing) – a complete dental procedure is more than just scaling teeth. Mechanical scalers have already been discussed and are used frequently in most practices. Polishing cups on prophy angles can be used on a micro-motor unit, or on a low-speed handpiece on an air-driven unit.

Where many clinics can improve is in their collection and care of hand instruments. Supragingival scaling can also be accomplished by hand scalers and curettes, angulating the working head 90 degree to the tooth surface to dislodge calculus in a pull stroke. A hand scaler has a sharp tip and often has a sharp back with a triangular shape in cross-section. This should only be used on the crown but can be very helpful in getting calculus out of grooves in teeth. A hand curette, in contrast, has a rounded toe and rounded back – half-moon shape in cross section. The opposite ends of the instrument are mirror images of each other, angled in opposite directions. The edge that contacts the tooth surface (with the face ‘closed’) is advance into the sulcus/pocket and then re-oriented to engage the tooth surface. Overlapping, short strokes are used to crosshatch or plane the root surface to remove calculus and debris. Holding the curettes in a modified pen grasp can help decrease operator fatigue. It is extremely important to keep the working edge of the instrument sharp.

Periodontal kits can be put together and organized in a perio tray or sterilization bag, to have one ready for each patient anticipated on a daily basis. At minimum, these kits should have a probe/explorer, a hand scaler, at least one curette and a dental mirror. A W-3 beaver tail can be added for placement of perioceutic gels, and some clinics like having calculus forceps handy to use carefully. Care of the kits includes cleaning and sterilization and keeping the working ends of the instruments sharp. An Arkansas stone for sharpening is usually sufficient for most instruments, but training is critical.

Periodontal Treatment

Treating periodontal disease does not stop at supragingival cleaning and polishing. One of the most important aspects of periodontal treatment is thoroughly cleaning below the gum line, whether it is with hand curettes or special ultrasonic scalers. For soft tissue (above the alveolar bone) periodontal pockets up to 5 mm, closed root planing can be an effective way to thoroughly clean the root surface and even gently debride the inner lining of the soft tissue pocket. Polishing with a splayed prophy cup and irrigating the pocket is very important. For additional therapy, placement of a perioceutic gel allows you to deliver the antibiotic directly to the site, and the anti-collagenase properties of doxycycline makes it ideal for the treatment. Placement of the gel can be a little tricky, but don’t over-fill the pocket, gently scrape the cannula tip on the tooth surface to dislodge the gel, and apply a few drops of water before packing the material under the gum line (with the W-3 beaver tail mentioned previously). Other products, including the use of doxycycline from a capsule don’t provide the same benefits of the solidified gel that will gradually be absorbed by the body. Local antibiotic use can also help decrease the need for systemic antibiotics in some patients.

When the periodontal pocket is caused by the overgrowth or enlargement of the gingival margin, instead of a true pocket, then trimming the excess gingiva can help return the ‘pseudopocket’ to a normal depth. As long as sufficient attached gingiva (2 mm) remains, excision of the tissue can resolve everything from minor pockets to severe generalized gingival hyperplasia (enlargement) in a Boxer. Minor, local areas can be easily trimmed with a 12-fluted finishing bur or diamond bur. Care should be taken to not damage the tooth when trimming excess gingiva. Cold steel – a scalpel blade, gingivectomy knives, or crown-and-collar scissors can grossly de-bulk larger areas of hyperplasia, with the use of the burs to recontour the edges (gingivoplasty). Electrocautery can be used cautiously (partially to fully rectified), but the underlying tooth must not be damaged, which can be an issue with laser resection.

When a periodontal pocket is deeper than 5 mm, or the pocket has formed in between the tooth and surrounding bone, then a surgical approach must be done. A gingival flap can be elevated to expose a soft tissue pocket greater than 5 mm to allow access for complete root planing, but this would typically be on a very strategic tooth that needs to be saved (canine tooth). At times, the gingival flap can be re-sutured further down on the tooth, positioned over the lower alveolar bone, to help decrease pocket depth. While treatment of infrabony (intrabony) pockets can be considered advanced periodontal surgery and at times should be referred, there are conditions for which primary practice clinics can provide care. A common site of infrabony pocket formation is at the distal aspect of the mandibular first molar (or between the mandibular third incisor and canine). By extracting the second molar (or third incisor) and elevating the gingiva at the site, all debris and granulation must be curetted from the second molar alveolus and in the infrabony pocket around the distal root of the first molar or canine (sometimes with extension onto the lingual surface). Once the area is completely cleaned, a bone graft material may be placed, and in some cases, a membrane can be placed. These materials discourage soft tissue (epithelium, connective tissue) from growing rapidly into the defect, instead allowing bone and periodontal ligament cells to repopulate the area.

**Extraction Instruments**

Extractions in dogs and cats can either be frustrating, if you don’t have the right tools and experience, or reasonably challenging. Not all will be easy with the right equipment but having the right stuff can make a big difference, and by taking the right steps. You can organize extraction kits with some basic instruments, making a few variations to have kits selected for different sized patients. Operator preference plays an important part in organizing these kits, with a few general suggestions. Smaller scalpel blades, such as the 15 or 15C allow for more precise incisions for flaps and sulcular release. Periosteal elevators are absolutely essential in elevating flaps, which are absolutely essential in all but the simplest of extractions. Molt #9 or Freer elevators have a broader working end than the more delicate Molt #4 and Molt #2, but all are similar in their thin blades that are used to separate periosteum from bone. Any periosteal elevator that appears to have identical working ends should be closely inspected. Many periosteal elevators will have one end honed sharper than the other designed for sharply starting periosteal elevation or sharp dissection versus the blunt end which is better at elevating periosteum from bone.

Dental elevators come in many varieties, but the important point is that the working edge must be thin enough – and sharpened – to be able to fit into the narrow periodontal ligament space (PDL) between tooth and bone. True luxators are with sharp edges designed to be used in a circular cutting motion to start the separation between tooth and bone. They should not be used with force to pry to torque the tooth. Elevators are typically thicker to be able to apply more force or torque, and can either be flat or winged, cupped to fit the curve of the root. Different sizes should be available to adjust to the tooth size, and all should be kept sharp! Dental extraction forceps are used just to remove the tooth segment from the alveolus without undue force, so the small breed forceps are best. They can also gently be used during elevation to provide a gentle twisting motion, both to continue to fatigue the PDL and to see where further elevation or bone removal is needed.

For surgical extractions, burs are used to either section multi-rooted teeth or remove alveolar bone to provide better access and leverage for elevation. Common sectioning burs are cross-cut fissure burs, with sizes 699 (small for cats) to 700, 700L, 701 and 701L. the “L” designates a longer cutting head that is useful for sectioning larger teeth, and longer surgical lengths shafts are also available, but should be used with discrimination because they are more likely to break and irrigant is not aimed at the bur’s cutting surface. Burs for alveoloplasty (reshaping the alveolar bone to remove any rough areas or diseased bone) can include pear shaped burs (329-332), round burs (1,2,4) and diamond burs.

In addition to scalpel blades, other basic surgical instruments are used for dental surgery. Good scissors are important for flap release and trimming and should have small, sharp blades. Iris scissors can be used to help release periosteal fibers. Tissue handling forceps should be atraumatic when possible, smaller rat tooth for less crushing of delicate mucosal tissues. Needle holders can be standard or Castroviejo but are usually smaller as well. Absorbable, monofilament suture materials work best in the oral cavity with limited drag, greater handling characteristics and stable knots. Smaller sizes such as 4-0 for dogs (small reverse cutting needle) and 5-0 for cats (cutting taper needle) often work best.

Complications can always occur with extractions, so being prepared with the right instruments can help work your way out of those. Additional bone removal for broken roots provides better access, then the use of small, fine elevators or root tip picks. Special root tip extraction forceps with small tips can be advanced into the alveolar to retrieve the loosened root tips. Irrigation in the air-water syringe can help flush out roots that have been pushed into the mandibular canal or nasal cavity, once the ‘entrance hole’ has been widened.

Sharpening of elevators and luxators is a necessity, not a luxury. A basic Arkansas stone and sharpening oil can be used to smooth out rough edges, burs and divots in the instrument. It is key to have the working edge of the instrument sharp and thin enough to be able to fit into the PDL shape, wedged in between the tooth and alveolus. Broader (thicker metal) instruments cannot be forced into this space, and even good elevators will eventually be sharpened down to a level where the metal is too thick to be useful. The outer edge of the elevator can be sharpened on the flat part of the stone, or the inner edge can be sharpened on a rounded edge of the stone, just as long as one knife edge is provided.

**Summary**

Dentistry can be rewarding, even fun, if you have the right tools and the right training. Making an investment in good equipment can be rewarding for your practice as well.