

Chapter 8: Equipment

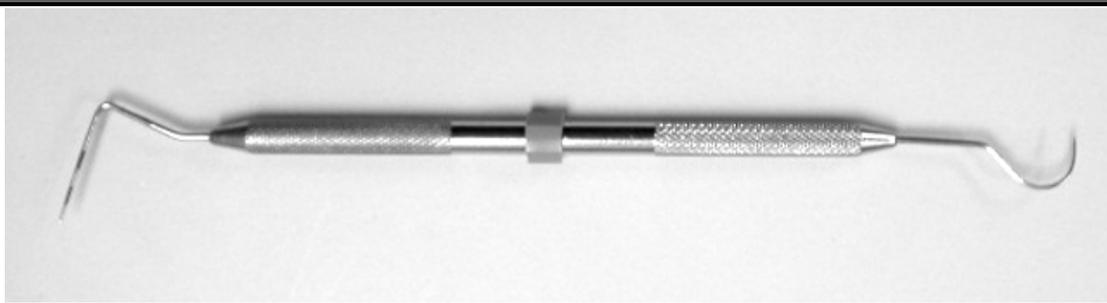


Figure #8.1. A periodontal probe/explorers. The end to the left is the periodontal probe, which has a blunt tip and a graduated end. It is used as an intra-oral ruler to measure the depth of periodontal pockets or anything else. The end to the right is the shepherd's crook dental explorer, used for detecting caries, resorptive lesions, pulp exposures and other dental abnormalities.

Periodontal Probe/Explorer

The periodontal probe/explorer has been described as the most important dental instrument. In fact, it has been suggested that if you do not have one, you should lock away all your dental instruments until you get one.

The reason for this fervor over such a simple implement is that, without one, you cannot accurately assess problems below the gum line, which is where most of the trouble lies. This applies to the pre-treatment assessment as well as to monitoring your progress intra-operatively.

As you can see, one end has a blunt tip on a straight arm. This probe is graduated in some way to act as a ruler.

The probe is *gently* introduced into the gingival sulcus and slowly advanced to the floor to measure the depth of the sulcus. The probe is then retracted a millimeter or so, moved along the tooth a few millimeters and re-advanced. The process is continued until the probe has been walked or hopped all the way around each tooth, taking several measurements on each. In this way, you will discover many deep periodontal pockets that you might otherwise have missed.

Probing can easily damage the junctional epithelial attachment to the tooth and create a defect where none existed before. This not only causes disease but will lead to an over-estimation of the degree of disease present which could lead to inappropriate treatment planning.

When probing, 20 grams of pressure is suggested. This can be practiced by placing the

tip of the probe against your thumbnail and pushing just hard enough to cause blanching. Pushing your probe harder than this will not only give inaccurate results, but will also create damage to the very tissues we are trying to help.

The other end of the instrument has what is known as a Shepherd's Crook. This fine, sharp tipped explorer has several uses. After root planing, the explorer is introduced subgingivally and gently dragged across the surface of the root. Any irregularities such as residual calculus, diseased cementum or pits in the dentin will be detected as the fine tip transmits the vibrations up to the shaft of the instrument and into your hand. The principle is the same as with the phonograph needle, for those old enough to remember what they were. No other instrument in your kit will be as sensitive for this crucial application. You would not send a fracture patient home without first taking a post-operative radiograph, and you should not start polishing the teeth until you have thoroughly explored the sulci to ensure that the roots are smooth and clean.

Some dentists prefer to use the probe end for subgingival exploration, feeling that the sharp explorer is potentially too damaging to the sulcar and junctional epithelium.

The explorer is also useful for detecting small subgingival resorptive lesions ("neck lesions") in cats.

In dogs, caries (cavities) will often start in the occlusal fossae of the first upper molars. Visually, they might appear as brown staining,

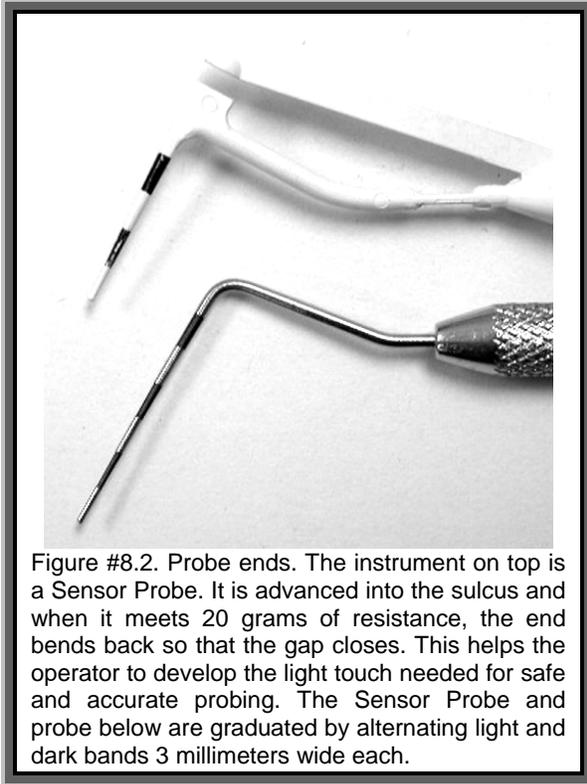


Figure #8.2. Probe ends. The instrument on top is a Sensor Probe. It is advanced into the sulcus and when it meets 20 grams of resistance, the end bends back so that the gap closes. This helps the operator to develop the light touch needed for safe and accurate probing. The Sensor Probe and probe below are graduated by alternating light and dark bands 3 millimeters wide each.

but when explored more closely, you will feel the difference. With staining of enamel, you cannot get the explorer to stick in. If there is a caries lesion, you will be able to force the tip into the softened dentin, and when you withdraw, there will be a tugback.

When you see a cusp that is worn down or broken off, you will be curious to know if the injury extends into the pulp chamber. Here again, this fine tip on the explorer is a big help. Run the



Figure #8.3. A dental explorer being used to confirm pulp exposure on a fractured fourth upper premolar tooth. The hole into the chamber was plugged with calculus, but the explorer easily broke through to fall into the hole.

tip over the suspect area and if you can get it to drop into a hole, you know the pulp is exposed and that the tooth needs endodontic therapy or extraction.

I have often used an explorer in the examination room to demonstrate to skeptical clients that there really is a hole in a tooth. Remember that in most cases, by the time you see the tooth, the coronal pulp is already dead and so the animal will not feel your probing. If red pulp is visible, do not stick the explorer in, as this will cause great pain.

Probes also make good pointers to show clients other problems in the mouth while allowing you to keep your fingers from obscuring the view.

I suggest you order a probe/explorer for each exam room and one for each dental kit. Having previously practiced with only one, I found that it was seldom where I needed it. I cannot guess how much time was wasted and how many miles were traveled trying to find my probe.

Probe/explorers are available from any human dental supply house and a growing number of veterinary catalogues. I would look for one with a fine explorer end as some on the market are too thick to transmit minute vibrations effectively. Prices will range from about \$15.00 to \$25.00.

Scalers and curettes

When it comes to scaling, many of us are very dependent on our mechanical aids. An ultrasonic scaler can be found in almost every practice. Although these machines can speed up the removal of supragingival calculus, the hand instruments must not be over looked.

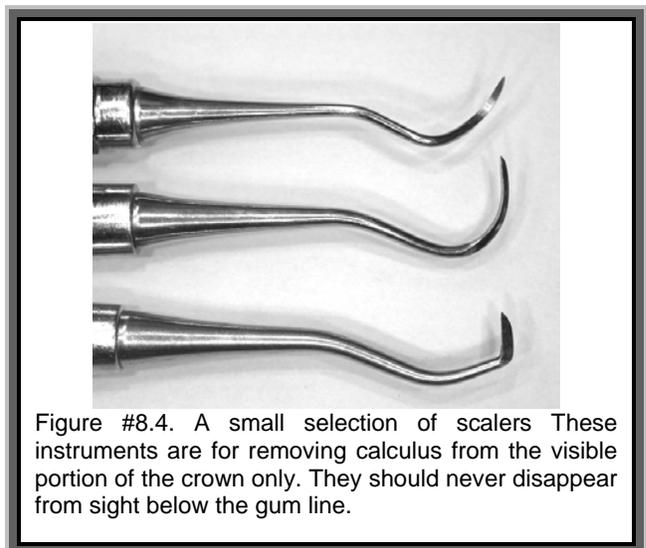
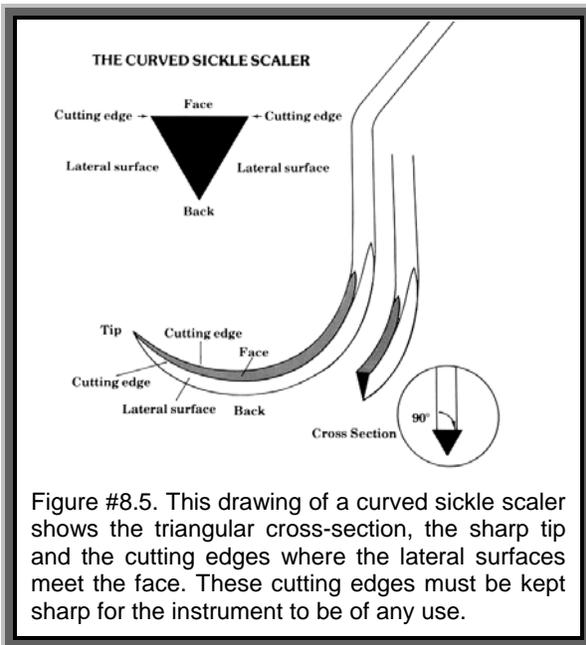


Figure #8.4. A small selection of scalers. These instruments are for removing calculus from the visible portion of the crown only. They should never disappear from sight below the gum line.

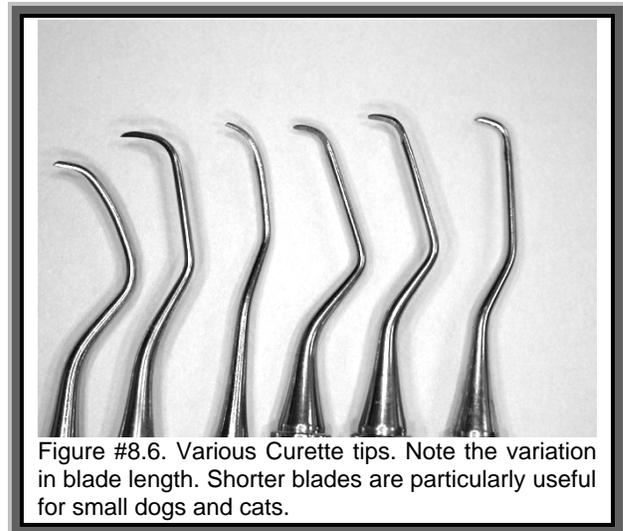
One reason hand scalers and curettes receive so little respect in most clinics is because, until recently, no one was selling proper dental hand instruments to veterinarians. As a result, we were left with the monstrous hoes and hatchets our suppliers offered us or the dull and damaged cast-offs from human dental offices. Fortunately, this situation is being corrected. Several companies now offer proper scalers and curettes to veterinarians. As well, instruction on the care and maintenance of these delicate instruments is now available.



All these instruments have a handle and usually two working ends. Scalers have sharp tips on the working end and are triangular in cross section. There are curved sickle and straight sickle scalers. Scalers are used above the gum-line only, as the sharp tip is very traumatic to the delicate sulcal tissues. By keeping the tip sharp, scalers can be useful for scaling in deep grooves and tight interproximal areas.

Curettes have rounded ends called toes. In cross section, the working portion is semicircular. The rounding of the toe and the back of the blade on the curettes allows them to be placed sub-gingivally for root planing and sub-gingival scaling. They can also be used to remove necrotic debris lining the periodontal pocket in a procedure known as sub-gingival curettage.

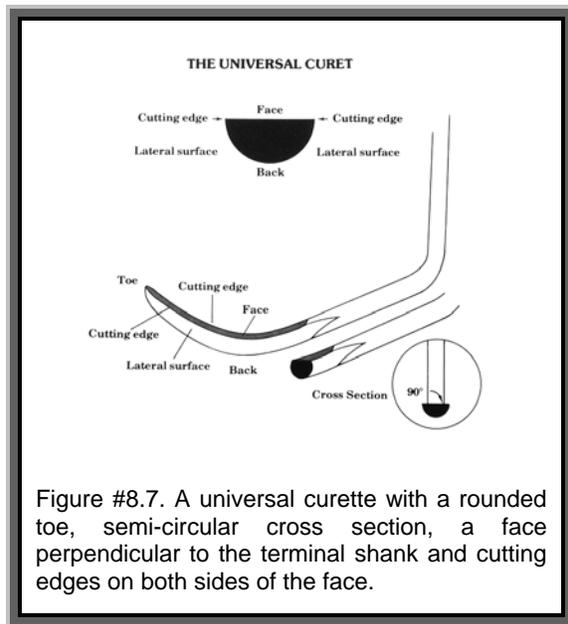
There are two basic types of curettes. Universal curettes have their face perpendicular to the shank while the Gracey curettes have the face

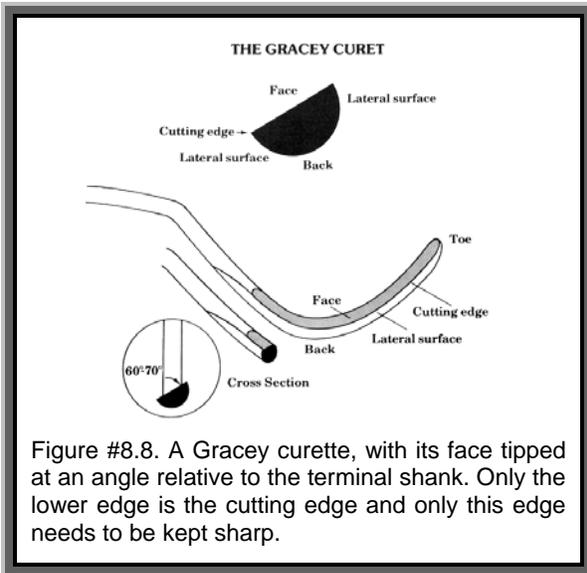


tipped 20 to 30 degrees from the perpendicular. Universal curettes are designed so that one instrument can be used in all areas of the mouth. Gracey curettes are area specific so that there is a different instrument for each region of the mouth.

Hand instruments must be kept sharp to be of any value. A dull instrument will not remove calculus effectively and can actually burnish it onto the tooth surface. Dull instruments will result in operator fatigue, a poor job and a lack of enjoyment of dentistry.

Information on care and sharpening of scalers and curettes can be found in Chapter 9.





Extraction Forceps

As with any job, one of the most important factors in allowing for success is having the right tools. Not only the proper shape and size of instrument for the job, but one that has been maintained to function as originally designed.

There are whole catalogues devoted to extraction equipment for the human dentist. They have a different extraction forceps for every tooth. On the other hand, the veterinary dentist has, traditionally, been offered only a very few choices, and many of them not very good ones.

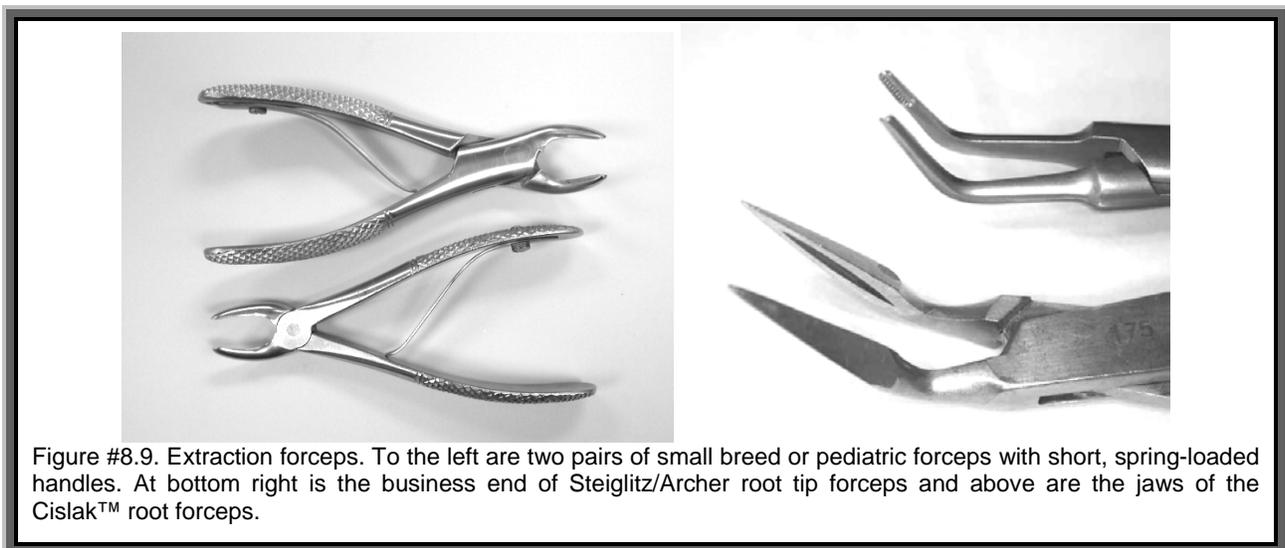
The basic equipment we need to extract teeth are elevators and forceps. I will tell you what I use and why. This does not imply that these are the only good instruments, but it may be helpful to

some of you looking for new toys.

My main forceps is known as a Small Breed Extraction Forceps or a Pediatric Forceps. The distinctive features include spring loaded handles. This means that the jaws open automatically as you relax the grip on the handles. Also, the handles are much shorter than most forceps. This means that it is harder to accidentally squeeze too hard and fracture a tooth. If the tooth is not loose enough to extract with these delicate forceps then you must elevate more.

For feline teeth and fractured root tips, I like the Steiglitz/Archer type of root tip or silver point forceps. In human dentistry, they are often found in the endodontic section of the catalogue because they are often used for handling endodontic silver or gutta percha point. The pair I have has a spring-loaded handle. The working end resembles very fine tipped needle-nosed pliers. They are available with straight tips or with tips offset at 45 and 90-degree angles. I use the 45-degree variety. These delicate forceps will not grab a tooth very firmly, reducing the risk of fracturing teeth. The very fine tips will reach deep into an alveolus to grab a retained root tip once it has been elevated loose. As the tips are very sharp, they are prone to being ruined if handled roughly. One drop on the floor could ruin an expensive instrument, so be careful. To prevent damage to the tips during cleaning and storage, I place a vacutainer tube top (10 ml) over the tips.

I also have some larger forceps for use on very large teeth, but they often do not get used from one week to the next.



Dental Elevators

When the decision to extract has been made, a selection of good dental elevators is needed. Dogs and cats come in a wide range of shapes sizes and so do their teeth. It is not uncommon for me to use as many as six different elevators when extracting a single tooth.

The purpose of the dental elevator is to act as a wedge between the root and the alveolar bone, to force the tooth against the other side of the socket. This stretches the periodontal ligament on one side and compresses it on the other side of the tooth. In order for an elevator to perform properly, it must be sharp enough to fit into the space between root and bone and have the same contour as the part of the root being worked on.

Large canine teeth in dogs have an oval cross section with broad flat areas on the buccal and palatal sides and tight curves mesially and distally. No one elevator works well on both areas.

There are large teeth and small teeth and ones in between and so you need large elevators and small ones and ones in between.

For very tiny teeth and for retrieving retained root tips, a root-tip-pick of some sort is the instrument of choice. There are few differences among root tip picks, so any one should do. Again, keep them sharp. I like the West Apical Root Tip Picks from Cislak™. The set of three has one straight instrument, one with a bend to the left and one bent to the right. This allows easy access to a variety of locations in the mouth.

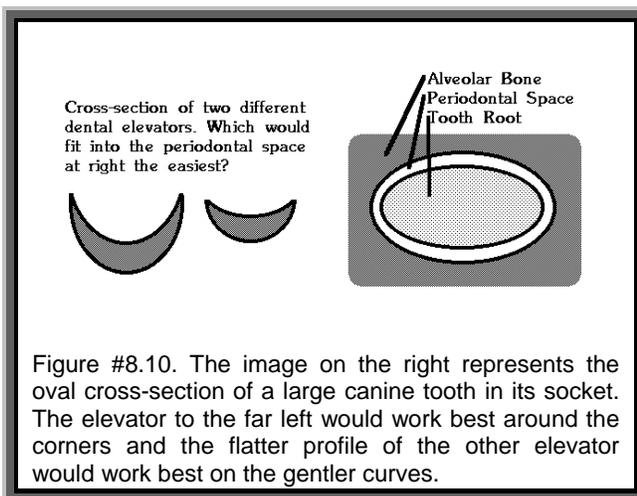


Figure #8.10. The image on the right represents the oval cross-section of a large canine tooth in its socket. The elevator to the far left would work best around the corners and the flatter profile of the other elevator would work best on the gentler curves.



Figure #8.11. A selection of dental elevators from large to small with root tip picks at the bottom.

Another recent entry is the set of winged elevators designed by Bob Wiggs. There are four elevators in the set ranging from 1 to 4 millimeters in width. The tip of each elevator has a blade that is quite thin but forms a semi-circle in cross section. These elevators can be helpful when elevating cylindrical roots. I have found that the more I use these elevators, the more I like them. However, the “wings” are quite thin and, therefore, subject to bending and breaking if these elevators are not used carefully.

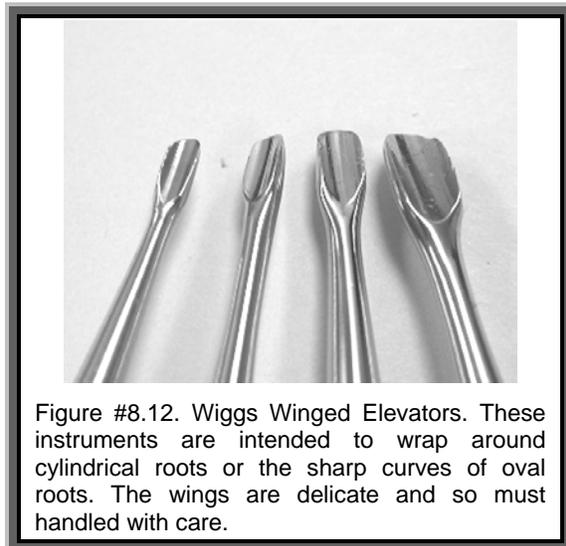


Figure #8.12. Wiggs Winged Elevators. These instruments are intended to wrap around cylindrical roots or the sharp curves of oval roots. The wings are delicate and so must handled with care.

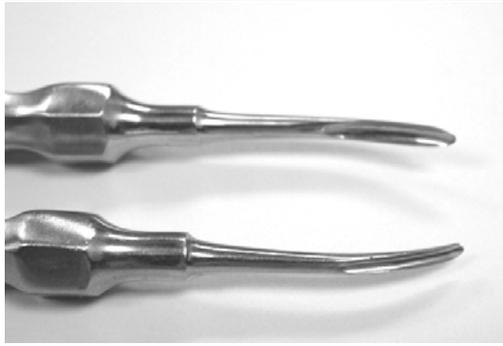


Figure #8.13. The long working ends of these Fahrenkrug elevators are curved outwardly on one end and inwardly on the other. They are specifically designed to follow the curved roots of the canine teeth of dogs. The inwardly curving blade is used on the mesial surface of the tooth and the outwardly curving blade is used on the distal surface.

The sharp edges on my elevators tend to get bent and chipped, so regular sharpening is required to keep them working properly. This is a small price to pay to keep them working well.

Other Hand Instruments

As well as scalers, curettes, elevators and forceps, there are number of other hand instruments that can be very useful in veterinary dentistry.

Periosteal elevators are necessary for elevating and reflecting gingival, mucogingival and palatal flaps. These should be kept sharp so that they cut rather than tearing. Rounded edges are safer than square cornered blades as the former is less likely to inadvertently perforate the flap. I have been using the Cislak™ EX7 (very similar to the Hu-Friedy™ P24G) and find it small enough for



Figure #8.14. The two ends of the Cislak™ EX7 periosteal elevator.



Figure #8.15. From left to right is a Wedelstadt chisel, an Ochsenbein chisel, and two double-ended bone rasps.

use in cats and tiny dogs as well as working in much larger patients. For those that want an even smaller blade, Cislak does have a feline model.

When performing various periodontal procedures and extractions, bone chisels and files offer a means of contouring bone. The Hu-Friedy catalogue has many files and rasps of various sizes to choose from – some tiny and some larger. As with other instrument groups, having a variety of sizes and designs make it easier to deal with a variety of situations. I use my Ochsenbein #1 most often, but also find a Wedelstadt useful.

Spoon curettes and excavators are useful for debriding deep defects. Extraction sites often contain debris and infected soft tissues, which should be removed to speed healing.



Figure #8.16. Top is a spoon curette and bottom is a dental excavator. Both are double ended. The excavator is 1 mm across the width of the blade.

Mechanical scalers

Sonic and ultrasonic scalers provide a means of rapid and easy removal of gross tartar. The vibrating tip against the tartar causes the tartar and underlying tooth to vibrate. When these two substances resonate at different frequencies, they separate and the tartar is fractured away. The stream of water cavitates at the tip to enhance this effect, acts to cool the working tip and the tooth and flushes away debris for better visualization of the work field. There is also evidence that the sonication has a direct antibacterial effect. When used and maintained properly, these instruments cause minimal damage to the teeth or soft tissues.

There are several type of mechanical scalers on the market and the differences between them are important to know.

Magnetostrictive

These units use a series of metal strips stacked on each other and placed in a field of alternating current. The *stack* vibrates at between 18,000 and 30,000 cycles per second depending on the quality of the instrument. This vibration is transmitted to the tip, which is tuned to vibrate most actively at the very end.

The tips vibrate in a jackhammer or elliptical fashion and so must be placed on the tooth at the correct angle or gouging of the enamel and cementum will result. Use the back or sides of the distal 1/16th of an inch of the instrument against the tartar. Use light pressure. Excess pressure will dampen the vibration leading to reduced efficiency and increased heat build up and tooth damage.

The stack wears out in time and becomes less

efficient. How long a stack will last depends on how hard it is used. As they wear out gradually, it is often difficult to tell when one should be replaced. One test is to keep a brand new stack on hand. Once a month, listen to the sound produced by the stack in use and compare it to the sound of the new stack. If there is a noticeable difference in the tone, discard the old stack, use the new one and order a replacement to have on hand for the next test.

Another indication that your stack is wearing out is if the hand piece is heating up during use. This not only tells you that the instrument is working inefficiently, but also warns you that it is generating sufficient heat to cause thermal damage to the teeth.

In some units, the stack and tip are one unit, while in others they are two separate pieces. In either case, they are removable and autoclavable.

For units that have separate stacks and tips, the tips also need to be periodically replaced. In time the tips wear down, becoming shorter, which changes their resonant frequency and so the efficiency with which they work.

Piezoelectric

Piezoelectric scalers operate by converting alternating current into 40,000 cycles per second frequency through a piezoelectric crystal. The tip vibrates in a linear motion. These hand pieces are very durable and have no internal parts to wear out. Also, there is no heat build up in the hand piece. These units are the most efficient and powerful as well as being the least traumatic (when used properly!) by virtue of their cool operation and linear vibration.

Although the hand piece does not wear out, it can be damaged by rough handling (such as dropping) so do be careful. Some brands now feature removable, autoclavable hand pieces. For those that do not have removable hand pieces, the tips can be removed for autoclaving.

Again, the tips will wear out in time and should be replaced periodically. Keeping a brand new tip on hand as a reference as to what your working tip should look like is a good idea.

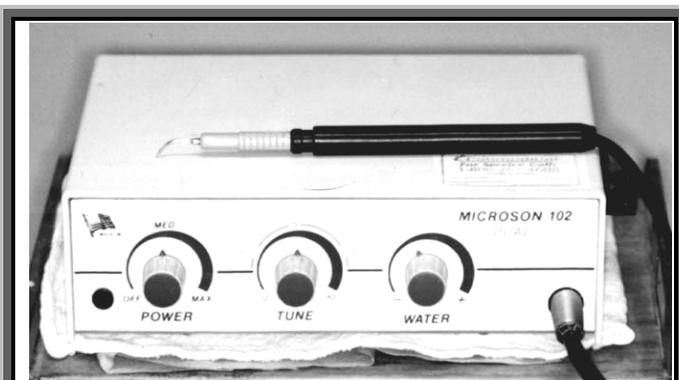


Figure #8.17. A typical, magnetostrictive ultra-sonic scaler. Remember to replace the stack regularly.



Figure #8.18. A Star Titan SW sonic scaler. These attach to the high-speed tubing of an air-driven dental station.

Sonic Scalers

Sonic scalers operate at a frequency of up to 18,000 cycles per second. They are run by compressed air supplied by an air driven dental station. The vibration is produced as air passes through a metal rotor in the hand piece. Again, no heat build up will occur with these. These units vibrate in an elliptical fashion as with the magnetostrictive. Though sonic scalers are considered the least efficient of the bunch, some are much better than others. Three that have had good reviews in the literature are the Densonic from Dentsply, the Micro-Mega 3300 from Medidenta and Star Dental's Titan SW. I used the Titan for several years and was quite happy with it. They are delicate and expensive to repair, so read the manual and follow the instructions carefully.

General Comments

Regardless of which type of scaler you use, some rules apply. The scaler tip will wear away with time. As it becomes shorter, its resonant frequency changes and so efficiency declines. Therefore, the tips should be replaced periodically. Again, keeping a fresh one on hand to compare with the in-use one is a good idea. You can also use a gauge to measure the tip length, which will tell you when to replace it. These gauges are available from Dentsply and work for Dentsply and compatible inserts.

Sonic and ultrasonic scalers are recommended for gross debridement. They are not for use in interproximal areas, where they cannot vibrate freely, or for reaching into narrow grooves. Mechanical scalers should not be used below the gum line because the spray of cooling water will not reach the tip. The risk of damaging the tooth is great. Also, mechanical scalers do not offer much tactile information. If you are working subgingivally, where you cannot see, it is important to use instruments that let you feel what is going on.

When using a mechanical scaler, use a copious flow of water, especially with the magnetostrictive. Use only distilled water or filtered tap water. Using water with a high mineral content will lead to clogging of the tubing, reduced water flow and subsequent repair bills.

If you use a water bottle, rinse it at least weekly with a disinfectant and let it dry out at the end of each day. Failure to do so can have two results. One is that the bottle will become a cesspool and

you will be infusing your patient's mouth with dirty water. The other is that mold may start to accumulate in the bottle and this can clog up the pipes, leading to reduced waterflow...

Putting chlorhexidine in the water bottle will help to keep it clean and will give you a disinfecting solution to work with in the mouth. A concentration of 0.1 to 0.2 % is desired. This can be obtained by diluting 60 ml of the 2.0% Hibitane™ Disinfectant in 1 liter of water for a 0.12% solution. The chlorhexidine will form a weak electrical bond to the teeth and so must be polished off before applying any restoratives or fluoride treatments. One disadvantage of doing this is that the solution will foam, obscuring your field of view.

A study (Verez-Fraguela J, Valles MAV, Ezquerra LJ. Effects of Ultrasonic Scaling on Pulp Vitality in Dogs: An experimental study. J Vet Dent 17(2), 75 – 79, 2000.) found that ultrasonic scaling can cause pulpitis in teeth even without any significant increase in tooth temperature. The conclusion was that the damage to the pulp was due the shock waves transmitted through the enamel and dentin. The recommendation was that the scaler should not be left on any tooth for more than thirty consecutive seconds.

Rotary Scalers

Some lecturers and supply houses are advocating the use of Roto-Pro burs in a high speed dental hand piece as a method of tartar removal. These burs are hexagonal in cross-section and have no cutting edges. As they spin at 300,000 to 400,000 rpm in a high-speed hand piece, the corners of the hexagon bounce on tartar or tooth to set up an ultrasonic vibration. These instruments are very effective in removing tartar. Unfortunately, they are also efficient at removing cementum and dentin, and will even cut enamel. They will also generate damaging heat easily. **These instruments have a very high potential to cause damage and should be avoided.**

Power Equipment

At the centre of the dental operator is the power *workstation*. There is a staggering array of options in power equipment and each operator must decide what they want to be doing in order to ensure appropriate selection of equipment. Simple, relatively inexpensive units may not be powerful or versatile enough for the serious veterinary dentist. The elaborate, more expensive

units might well be unnecessarily advanced for a practice that is only interested in doing basic prophylaxis and extraction work. Therefore, the first step in power equipment selection is to determine what you want to be doing with it today and over the next few years. You might decide to buy more power and versatility than you need today so you can grow into your equipment rather than outgrow it. On the other hand, with the rapid changes in dental technology, a state-of-the-art machine might become obsolete before you get a chance to use all of its features.

Power equipment refers to *dental hand pieces*, of which there are two basic types, *low speed* and *high speed*.

Low-speed Hand Pieces

Low-speed hand pieces can be driven by internal electric *micro-motors*, belts and pulleys or compressed air. The *motor* typically rotates at between 5,000 and 30,000 rpm and a variety of *nose cone* attachments are available that can either reduce or increase the rpm's. The motor and nose cone are usually two separate pieces. By purchasing one motor and a variety of nose cones, the versatility of the hand piece will be increased.

Low-speed hand pieces are best suited for polishing teeth and for finishing and polishing

restoratives. If used carefully, they can be used to cut teeth for cavity preparation, to gain endodontic access and to section teeth for extraction and crown reduction. However, the low speed cutting action has a tendency to cause chipping and a rough preparation. They have also been used to remove and shape alveolar bone (alveoloplasty and osteotomy) although my preference is to use a high speed hand piece for this.

The low speed cutting action is not nearly as smooth or as efficient as with high-speed hand pieces. Also, low-speed hand pieces have relatively high torque, and if used on vital tissue such as bone, can quickly generate enough heat to cause thermal necrosis. Therefore, the surgical site should be copiously lavaged with sterile saline to keep the bur and tissue cool.

High-Speed Hand Pieces

High-speed hand pieces are driven by compressed air from nitrogen tanks, air tanks or from a compressor. They turn at 350,000 to 500,000 rpm when under no load. At these speeds, the cutting blades of the bur cuts much more quickly and smoothly than with low-speed hand pieces. High-speed hand pieces do not generate much torque and will stall if pressed too hard. This can actually be a safety feature by forcing the operator to use a light touch, which is less likely to generate dangerous heat or bend the bur shank. The latter will cause the bur to run eccentrically and damage the *chuck* and *turbine* in the hand piece. A bur that stalls with gentle pressure is likely no longer sharp and needs to be replaced.

High-speed hand pieces are used with a variety of cutting *burs* to remove tooth structure for sectioning, cavity prep and endodontic access. They can be used for osteotomy and alveoloplasty and even gingivoplasty, with special burs. With various *finishing burs*, restorative materials can be shaped and finished to a smooth surface. Since the hand piece has a cooling spray of water or saline directed at the cutting end of the operative bur, there is much less danger of causing thermal damage to vital tissues. When working with moisture sensitive materials, the water spray can be turned off.

Most high-speed hand pieces are fully autoclavable. All, except hand pieces with ceramic bearings, also require lubrication on a regular basis. To lubricate a high-speed hand piece, oil or spray lubricant/cleaner is instilled

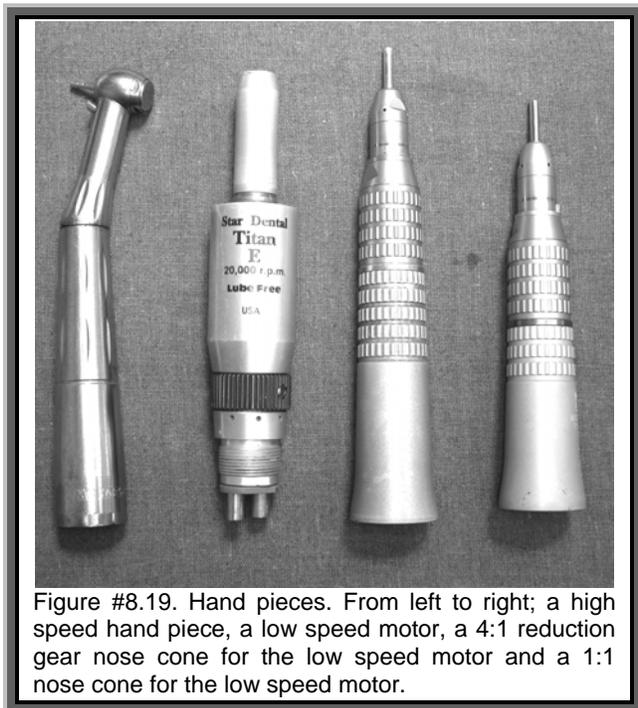


Figure #8.19. Hand pieces. From left to right; a high speed hand piece, a low speed motor, a 4:1 reduction gear nose cone for the low speed motor and a 1:1 nose cone for the low speed motor.

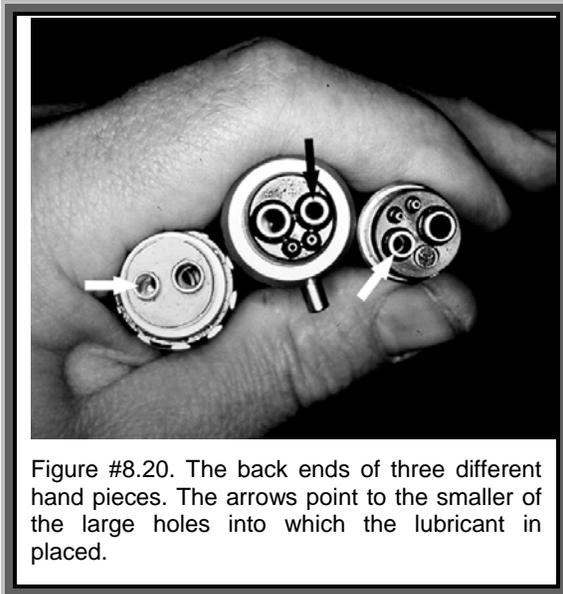


Figure #8.20. The back ends of three different hand pieces. The arrows point to the smaller of the large holes into which the lubricant is placed.

into the smaller of the two large holes at the back of the hand piece, which is then run for a minute or so with the spray water turned off. This ensures that the lubricant spreads throughout the internal workings of the turbine and helps to flush debris from the operative head. This should be done before and after each autoclaving and between patients if the hand piece is only surface disinfected between patients.

The *turbine* (or *cartridge*) of the high-speed hand piece can be removed to allow cleaning of debris from inside the head of the hand piece. The turbine is the most likely component to fail, but they are replaceable by the user. Having a new one on hand for emergency repairs is a worthwhile investment. With hand pieces which require a bur tool to loosen and tighten the *chuck*, over tightening is a very common cause of damage. Tighten the chuck only enough so that you cannot pull the bur out easily and have a spare chuck on hand just in case. High-speed hand pieces are available with spring-loaded *push-button chucks*, which save time and reduce the risk of over tightening.

Fiber-optic illumination systems are widely available for high-speed hand pieces and for an increasing number of low-speed hand pieces. I have used fiber-optic high-speed hand pieces but do not bother with them any longer. I found the fiber-optic bundles did not stand up well to autoclaving so after a few months, they transmitted very little light. I rely, instead, on a halogen head-mounted lamp to illuminate the field.

Electric Drives

Electric dental engines consist of a power box with speed controls, a foot activated switch and a slow-speed hand piece containing a *micro motor*. The motor in the hand piece is capable of producing variable speeds from 0 to 20,000 or 30,000 rpm in either direction. Some units are now available that are capable of speeds up to 100,000 rpm and the slower units can be adapted, with accelerating *contra-angles*, to achieve this speed as well. Electric engines do not come with the availability of fiber optic illumination or water spray, but these can be added to many machines with after-market accessories. However, by the time all of these additions are made, there may be no savings compared to an air-driven station. As well, such a system would be excessively complicated and have higher maintenance and repair costs than an air driven station.

The micro motor portion of the hand piece must be kept dry because moisture in the electric coils will cause the motor to fail. Therefore, this portion of the hand piece is not sterilizable. The nose-cone, which fits on the end of the micro motor and accepts the burs and contra angles is autoclavable and should be removed, lubricated and sterilized between patients. This will often necessitate maintaining more than one nose cone so one can be in use while the other is being sterilized.

The micro motor is a delicate thing. Care should be taken to avoid dropping it. Also, when it is working against a load, pressing too firmly will cause the motor to slow down and over-heat the

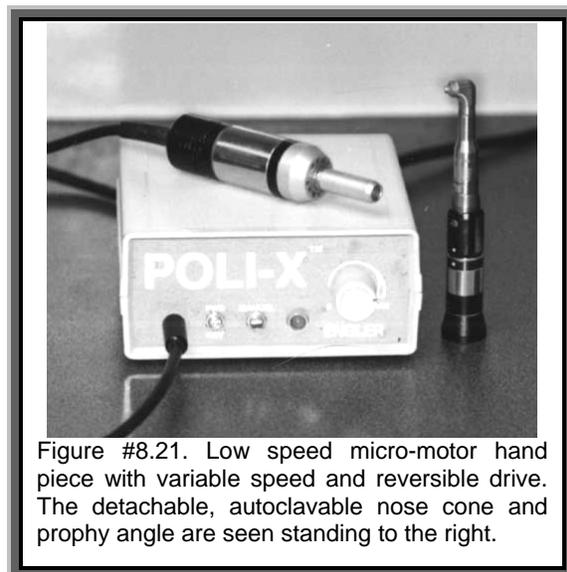


Figure #8.21. Low speed micro-motor hand piece with variable speed and reversible drive. The detachable, autoclavable nose cone and prophyl angle are seen standing to the right.

coils. As with all power tools, do not force them to work harder than they were designed.

Another form of electric low speed engine is the *bench engine* in which a larger motor is mounted on the table and rotary power is transmitted to the hand piece via belts and pulleys along an articulating arm. These units have a top speed of 10,000 to 15,000 rpm. There is concern that hair from the patient or operator might become tangled in the belts and that the rigid sections of the articulating arm make the unit less flexible in its movements compared with the micromotor type of machine. As with most slow-speed units, bench engines are made to be used in dental laboratories in the fabrication of dental appliances and are not really intended to be used in the oral cavity.

Air Driven Dental Stations

The most versatile power equipment is the air-driven dental station. Basic models come with an air driven low-speed hand piece, a high-speed hand piece and a *three-way air/water syringe*. More elaborate units are available which have a built-in *piezo-electric scaler* or an outlet for use

with an *air-driven sonic scaler*, built-in *venturi suction*, fiber-optic illumination system, extra electrical outlets, built-in electro-surgical unit and a variety of other options.

The air/water syringe is a small gun, which can be used for spraying either a stream of irrigant solution (water, saline, chlorhexidine...) or compressed air by pressing one or the other of two buttons. By pressing both buttons simultaneously, a mist of solution and air is produced.

Air pressure can be supplied by a compressor or compressed gas in bulk tanks. The pressure delivered to the hand pieces can be finely controlled by knobs on the workstation.

Compressors are either oil-cooled or oil-free. Oil-cooled compressors tend to be less expensive than oil-free.

The least expensive oil-cooled compressors are quite noisy and are usually installed at some distance from the dental suite (in a utility closet or the basement). The air pressure is then delivered through a pressure hose. This remote installation removes the source of noise from the



Figure #8.22. An air-driven dental workstation. This unit includes, from left to right, an air/water syringe, a low-speed hand piece, an air-driven sonic scaler, a high-speed hand piece, a saliva ejector and a high volume suction unit. This is all powered by a "silent" oil-cooled compressor mounted on the legs. It has a self-contained water source. This unit just plugs into the wall outlet and is ready to use.

treatment area, but also may make it easier to neglect regular maintenance of the compressor. As well, with a long hose, there is a pressure drop between the compressor and the hand piece: the longer the hose, the greater the pressure drop.

Very quiet oil-cooled compressors are available which can be mounted on the base of the workstation. This avoids the pressure drop and keeps the compressor close at hand for routine inspection and maintenance.

With oil-cooled compressors, the oil level should be checked at least weekly and topped-up as needed. The oil should be changed every six months or so, or the motor is likely to fail prematurely. One disadvantage with oil-cooled compressors is that a variable amount of oil may get into the drive air supplied to the hand pieces and air/water syringe. This compressor oil is reputed to cause damage to the internal workings of hand pieces. If the air/water syringe is used to dry a tooth prior to placing a restorative, oil contamination will weaken the bond. To alleviate this, *oil filters* are available which can be placed in-line between compressor and workstation.

Oil-free dental compressors tend to be noisy and more expensive than oil-cooled but there is no concern about oil contamination of restorative work and there is less routine maintenance required. Purchasing a compressor from a hardware distributor as opposed to a dental supplier can save some money, but the purchaser must know how much horse-power will be needed, how many cubic feet of air per minute will be consumed and at what pressure the air should enter the station.

With either type of compressor, there will be some moisture condensing in the system when compressed room air is allowed to expand. There is usually a *moisture trap* in-line that should be drained regularly. Also, the *pressure reservoir tank* should be drained at the end of each day to remove accumulated water that could become a source of bacterial contamination in the drive air.

Another option for air supply is the use of bulk nitrogen tanks. These provide quiet, clean, dry drive gas from a maintenance-free source. Setting up is less expensive than a compressor and the dry, oil-free nitrogen is less harmful to hand pieces. Depending on the volume of dental work done and the amount of air driven equipment used, nitrogen is a worthwhile option. If, however, you have a high volume dental practice running many hand pieces (low-speed,

high-speed, sonic scaler, venturi suction) the cost of consumed nitrogen might be more than the cost of a good compressor. Bulk compressed gas tanks must be stored and handled carefully. If one falls over and has its valve broken off, it becomes a massive, high velocity projectile capable of penetrating concrete walls.

Most dental stations offered to veterinarians are mounted on mobile dental carts so that they can be used in multi-purpose rooms and moved about the hospital. For clinics wishing to dedicate a room to the practice of veterinary dentistry, wall-mounted workstations with under-cabinet or remote compressors offer some advantages. Getting the machine off the floor makes it easier to maneuver about the patient's head, an area already occupied by the anesthetic machine.



Figure #8.23. This dental station has two "silent" compressors housed in an easy-to-clean cabinet with an access door in the rear. The two compressors provide more than enough power to run the high-speed hand piece and surgical suction simultaneously. A magnetostrictive ultrasonic scaler is mounted in the basket hanging from the side and is connected to the water supply of the dental station. The unit has outlets for high, low and sonic hand pieces.

Slow-Speed Attachments

Slow-speed hand piece nose cones accept a variety of attachments for various applications.

Prophy Angles and Cups:

Prophy angles are used for polishing teeth. They attach on the end of a low speed nose cone at one end and have a 90-degree bend at the other. At the working end, a rubber *prophy cup* screws or snaps on or is attached by a *latch-type shank*. Prophy angles generally work in a simple rotary fashion, but this can lead to entanglement of the patient's muzzle hair in the spinning cup. To avoid this, the *Prophy-matic™* angle oscillates 90-degrees either way.

Prophy angles are either autoclavable steel or disposable plastic. The re-useable ones should be broken down and cleaned out regularly as prophy paste will find its way into the gear housing and wear it out prematurely. *Triple-Seal™* prophy angles have a system of rubber seals to exclude foreign material from the inside of the angle, thereby reducing maintenance problems. Disposable angles are to be used for one patient and then discarded.

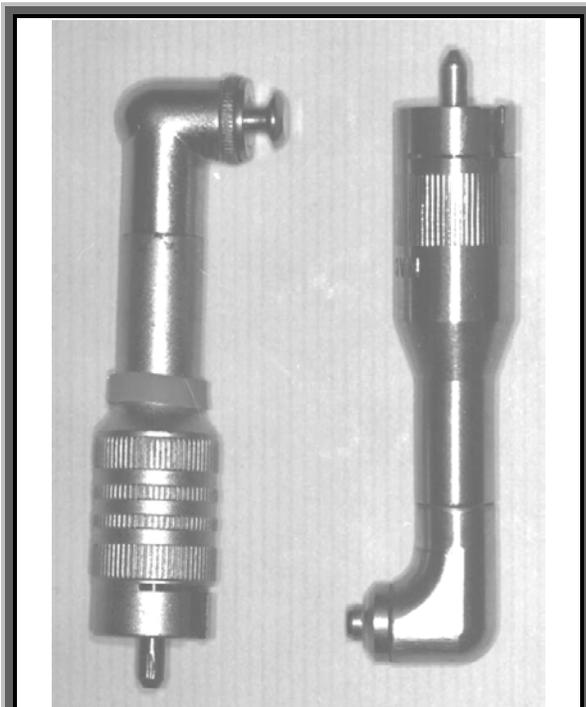


Figure #8.24. Autoclavable prophy angles. To left is a typical angle to accept snap on prophy cups. To the right is a Young Triple-Seal™ angle, which requires specific screw-on cups. Though more expensive, the Triple-Seal™ last much longer if properly maintained

Prophy Cups are available in a variety of colours and styles. Regular, white cups are generally stiffer rubber than gray cups. Therefore, to get the lip of a white cup to flare into the sulcus takes more pressure than with a gray cup. Black cups have finer webbing and a thinner outer edge and so flair into the sulcus very easily. Most cups have straight webbing and/or ribs inside to retain the paste. *Turbo cups™* have spiraled ribs, which are suppose to retain paste better, thereby reducing paste splatter. Pointed cups are available for polishing in tight places such as furcations. All prophy cups are definitely designed to be used once and then disposed of. They are also to be used with a light touch as a heavy hand can cause the paste to etch the enamel and can cause frictional heat damage to the pulp. If you doubt me on this, try to polish your thumbnail with a prophy cup for five seconds.

Contra-Angles and Attachments:

A *contra-angle* is an attachment for a low-speed hand piece, which has a 90-degree bend at the end and a slight bend in the other direction (the contra-angle) close to the end. This makes it easier to reach into tight places in the mouth. Contra angles accept a number of burs and accessories. The latter are retained by either a latch mechanism or by *friction-grip*. Latch type contra-angles accept only burs and mandrels designated as *RA (right angle) or Latch-Type*, which are usually 20 millimeters long. Latch-type burs fit relatively loosely in the contra-angle

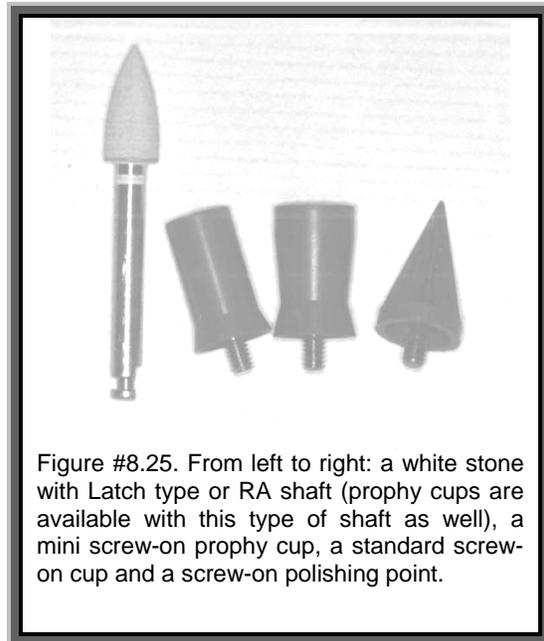


Figure #8.25. From left to right: a white stone with Latch type or RA shaft (prophy cups are available with this type of shaft as well), a mini screw-on prophy cup, a standard screw-on cup and a screw-on polishing point.

and so there may be some lateral wobbling of the bur making it difficult to control. Friction grip contra-angles accept burs designated as *FG* and are held tightly in the chuck with no wobbling.

Among the accessories available for contra angles are *carbide* and *diamond burs* in hundreds of shapes and styles, *mandrels* for holding *abrasive disks* and *wheels* and *abrasive stones*, *points* and *cups*.

Miscellaneous Low-Speed Accessories:

Low-speed hand pieces can be used without a contra or prophy angle. Long (40 millimeters or more), large diameter (3/32" shank) burs are available which fit in the end of the nose cone. These burs are designated as having *HP (hand-piece)* shanks. Since the bur projects straight out the end of the hand piece, their use in the mouth can be cumbersome. Certain burs are, however,



Figure #8.26. Two latch-type contra-angles for use on low-speed hand pieces. To the left is a standard 1:1 contra-angle. To the right is a 10:1 reduction gear contra-angle.

useful in the dental laboratory for trimming and shaping dental models and acrylic appliances.

When using a contra-angle in a low-speed hand piece, there are a number of composite finishing disk systems available. A mandrel is placed in the contra-angle and successively finer grits of abrasive disks are used to shape and then polish composite restorations.

Diamond coated discs mounted on a HP mandrel are often sold to veterinarians as instruments for cutting teeth in crown reduction and sectioning prior to extraction. They were designed for use in dental laboratories and *were never intended to be used in the oral cavity*. These discs can be dangerous in a number of ways. They are used in a high torque, low-speed hand piece and so are prone to "walking off" the tooth if they meet resistance. Their large diameter (about 20 millimeters) makes it difficult to cut a tooth without causing damage to adjacent soft tissues and opposing teeth. If the disc is flexed while cutting, it may fragment and send pieces of shrapnel flying about the mouth. Since diamond discs are dangerous and safer alternatives exist, ***their use in the oral cavity cannot be justified.***

Burs

The greatest amount of variety in shapes and styles of burs is found in the *FG* type. *FG* burs have shank lengths ranging from 7 to 10 millimeters and overall lengths of about 18 to 24 millimeters. Many burs are also available as *RA* and some as *HP* type.

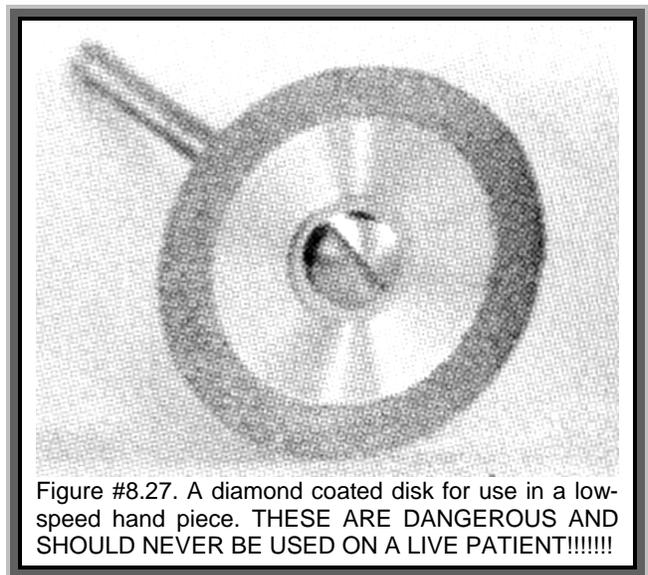


Figure #8.27. A diamond coated disk for use in a low-speed hand piece. **THESE ARE DANGEROUS AND SHOULD NEVER BE USED ON A LIVE PATIENT!!!!!!**

Cutting burs are made of either tungsten carbide or diamond grit bonded to metal blanks. The shape and size of the cutting head is given a standardized number regardless of manufacturer. A suffix of *SS* denotes short shank burs, the suffix *L* denotes a longer than usual cutting head and *surgical* burs have longer than usual shafts and so are useful for reaching into deep surgical sites.

Round burs are sized from 1/4 for the smallest, to 8 for the largest. These burs are useful for removing enamel, dentin and non-metal restorations for endodontic access and cavity preparation.

Inverted cone burs are numbered from 33½ to 39. Inverted cones are useful for creating undercuts in dentin and for slot preparations for retrograde endodontic fillings.

Pear shaped burs, (329 to 332) are useful in cavity preparations and for creating round edged under cuts.

Taper fissure cross cut burs (699 to 703) and



Figure #8.28. From left to right, a #1/2 round bur, a #1 round bur, a #2 round bur, a #4 round bur, a #701 taper fissure bur, a #699L taper fissure bur, a #701L taper fissure bur and a #701L surgical length taper fissure bur. All of these burs are Friction Grip (FG).

straight fissure cross cut burs (556 to 559) are useful for sectioning teeth and crown reduction.

Composite trimming and finishing burs are available in a wide array of shapes and sizes. Those designed for gross reduction of composite have 12 *cutting flutes* and leave a rough finish. For finer finishing, burs with up to 36 flutes are available.

Diamond burs are available in the same shapes and sizes as carbide burs and a number of others as well. Coarse grit burs are for rapid gross reduction of tooth or restoration and there are a number of grits down to ultra-fine which are for final finishing of composites. The grit will become clogged with debris and so the burs must be cleaned by running them through a special *diamond cleaning stone* or a regular pencil eraser prior to sterilization. Diamond burs stay sharp much longer than carbide burs and so last longer, but they break just as easily and are lost just as easily if dropped. Most diamond burs cost many times more than carbide though single-use diamonds are about the same price as carbide.

Goldie burs are HP burs for laboratory use in trimming dental stone models and acrylic appliances. They can also be used in a low-speed hand piece to trim direct-placed acrylic appliances.

Summary

This has been a brief overview of power equipment. I hope it will be helpful as your dental practice evolves. One absolutely essential point to keep in mind is that no amount of technology or equipment can act as a substitute for skill and knowledge. Without a thorough understanding of the proper maintenance, use and limitations of power equipment you can cause a lot of damage in a very short time.



Figure #8.29. A selection of diamond burs used for a variety of purposes in operative dentistry.

Let There Be Light

On more than one occasion, I have done work on an animal that had had a prophylaxis only weeks previously. Often, I find significant accretions of mature calculus that was obviously missed by the previous operator. I am convinced that a major reason for this incomplete cleaning is a lack of sufficient light in the oral cavity.

The mouth is a dark place to work, and without a good source of illumination, a lot of oral pathology will be overlooked. I have never seen a floor-standing or ceiling-mounted light that could properly illuminate the back of the mouth or the lingual aspect of the mandibular teeth. The solution, that I have been very happy with, is a headlight. That is, a light that I wear on my head.

Before I got my headlight, I did not really appreciate how much I needed one. I was put off by the cost and the concern that most must be plugged into a wall outlet. Now that I have been using a light for many years, I cannot imagine working without one.

I currently use a rechargeable light with a halogen bulb, which gives a nice bright field. The light can be aimed to fall where I am looking so no matter how I move about, the light

is always where I want it. The unit provides continuous light for about two hours and recharges in a few hours. The battery pack is separate and so can easily be replaced when it wears out. There is also a wall adapter so I can plug in if the battery runs out in the middle of a procedure. Actually, I have two battery packs so one is charging while the other is in use.

Another light that I have heard good things about is from Light-Tech Inc. It also has a halogen bulb and can be used as a cordless rechargeable or a plug-in unit. It gives about one hour of operation per charge, but its main advantage is a weight of only four ounces and it is reported to be very comfortable. Cost for this unit was about \$360.00 CDN in 2001 compared to the \$750 I paid.

There are many styles of lights available with a variety of power sources and bulb types. Each has its advantages and disadvantages. Prices can range from \$20.00 to \$1200.00. So, have a look around, try some on, decide what you can afford and then get one. I guarantee that once you have used a head-mounted source of illumination for dental procedures, you will wonder how you managed without.

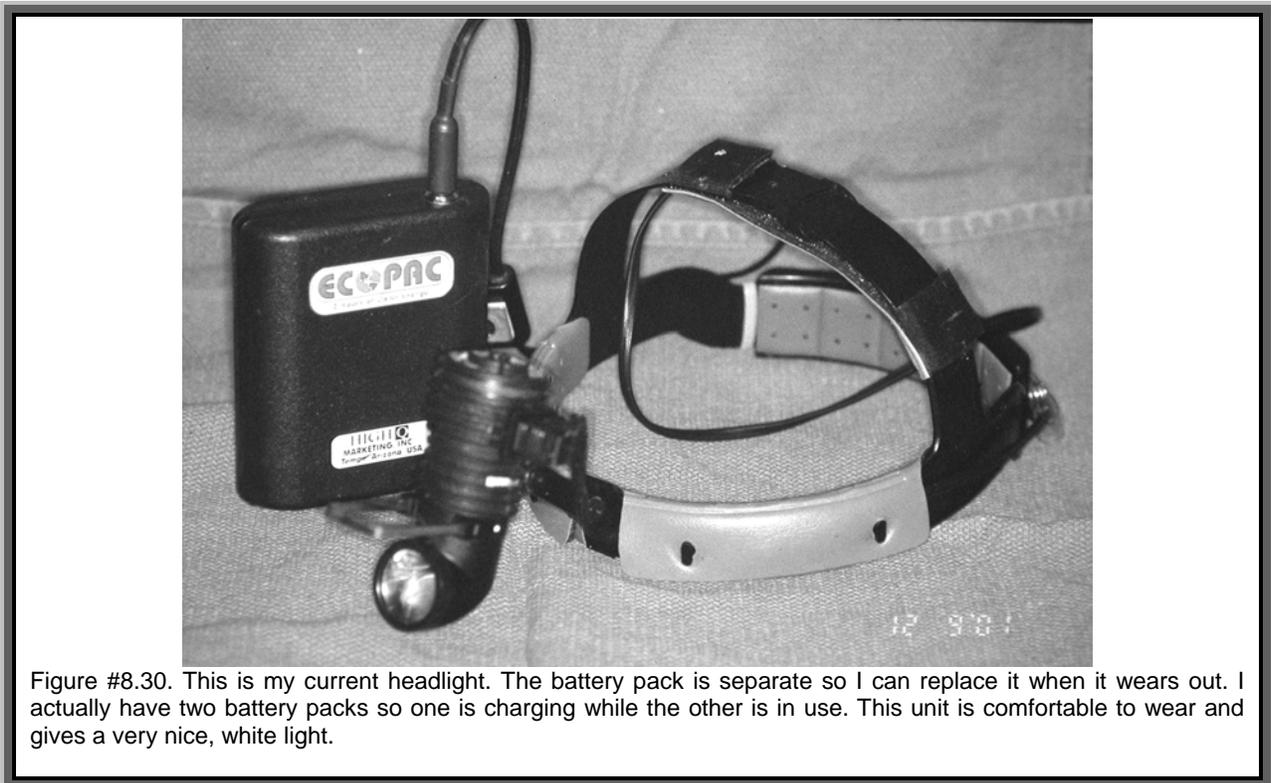


Figure #8.30. This is my current headlight. The battery pack is separate so I can replace it when it wears out. I actually have two battery packs so one is charging while the other is in use. This unit is comfortable to wear and gives a very nice, white light.

Magnification

As well as needing light to see well, a source of magnification can be of great value. Many dental lesions are very small and difficult to see with the naked eye. A surprising new world will open up before your eyes if you get some “cheaters”.

Again, as with headlights, there is a wide range of options. Binocular loupes, which clip onto the frame of regular eyeglasses, are the least expensive at around \$30.00. They are available from dental suppliers but might also be found at hobby stores and hardware stores (such as Lee Valley Tools). The local trout fishing store has head loupes for fly tying, so look around.

At the top end of the range are customized surgical telescopes designed specifically for the cranial and ocular anatomy of the wearer. In between are a number of adjustable units that could be shared among veterinarians and technicians within the practice.

Whatever you choose, I highly recommend some form of magnification for all persons involved in dental care.



Figure #8.31. Magnification. These are my surgical telescopes by Designs For Vision™. The carrier lenses have my reading prescription and the position of the magnifying lenses is set to match the anatomy of my head.