

# roots

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# Apical microsurgery—

## Part I: Patient preparation

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**\_Surgery can never replace** solid endodontic principles and should always be a last resort. Apical microsurgery consists of nine basic steps that must be completely performed in their proper order, so the desired result can be achieved:

1. Instruments, supplies and equipment (including the operating microscope) ready;
2. Patient, doctor and assistants positioned ergonomically;
3. Anaesthetic and haemostasis staging completed;
4. Incision and atraumatic flap elevation;
5. Atraumatic tissue retraction;
6. Access, root-end bevel (RER and REB) and crypt management;
7. Root-end procedures: root-end preparation (REP);
8. Root-end fill (REF) techniques and materials; and
9. Sutures, healing and post-operative care.

Predictable microsurgery requires the use of an operating microscope (OM) and a team committed

to operating at the highest level. The six-handed team approach optimises the instruments, equipment, techniques and materials that today's level of technology presents for the benefit of all, especially the patient (Fig. 1).

Dr Berman, an old retired general surgeon, one of my senior-year dental school instructors, would begin each general surgery lecture by tapping the lectern with his pencil, and when he got our attention, he would say: "Treat the tissues with tender loving kindness and they will respond in a like manner." I have heard those very words many times while performing apical microsurgery; it is truly a gentle technique when the steps are followed in the proper order.

A thorough past medical history and dental examination, using as many diagnostic aids as possible, is a requirement for a predictable microsurgical event. Thoroughness can help one avoid unfavourable experiences. For example, if the patient, or their physician, states they are sensitive or allergic to epinephrine to any degree apical

**Fig. 1** The six-handed team utilises all that current technology can offer, to achieve results that are precise and highly predictable.

**Fig. 2** All equipment, instruments, monitors etc. are readily accessible when required during the entire surgical procedure.



microsurgery should not be performed. One of my golden rules of thumb is: *No Epi, No Surgery ... Period!* Should the doctor choose to proceed with the microsurgical procedure, it will be exceptionally more difficult for both the doctor, and the patient.

Today's technology presents us with much more pre-surgical information than was available even a few years ago; thus, recent advances should be included in the diagnostic process whenever possible. A good example of current technology is cone-beam computed tomography (CBCT). The radiological images we used for many years were the best we had but were very limited. Now CBCT enables the microsurgeon a view of all angles of areas of concern in the maxillofacial region and supplies much of what was missing in the field of dentistry.<sup>1</sup>

The preparation of the patient takes not only the patient into consideration, but also the entire surgical team. The microsurgical protocol we teach involves four people: the doctor (pilot), the 'scope' assistant with the co-observer oculars (co-pilot), the surgical assistant using the monitor as a visual reference (flight director) and the patient (first-class passenger; Fig. 2).

The medical history and all necessary pre-medications are reviewed with the patient to ensure they are taken at the appropriate times before the surgery appointment. The patient is also instructed to rinse with Peridex and take an anti-inflammatory (preferably 600 mg of Motrin if no allergies are present) the night before and on the morning of the surgery. At the time of the appointment and before the patient is seated, they are again asked to rinse with Peridex.

The dental chair should allow the patient to recline comfortably and even allow the patient to turn to one side or another. Small Tempur pillows placed beneath the patient's neck, small of the back or knees make a big difference when used (Fig. 3). After the patient is completely comfortable in the chair, they are coached on making slow and small movements of their head, if necessary during surgery. The patient is appropriately draped for the surgery. It is especially important to wrap a sterile surgical towel around the head and over the patient's eyes for protection from the bright light of the microscope and any debris from the surgical procedure (Fig. 4).

An important psychological point is not to tell the patient that they may not move. To an already tense patient, telling them they may not move would probably cause unnecessary apprehension, stress or



panic. In over 500 surgeries, I've only had one patient who didn't hold still during the procedure once they were relaxed and had profound anaesthesia.

**Fig. 3** These small but effective Tempur pillows should be available for the comfort of the patient wherever needed.

The surgical team must now become comfortable with the position of the patient, the microscope, endoscope and associated equipment. The modern OM has many features to enhance comfort and proficiency during its use. Accessories like beam splitters, inclinable optics, extenders, power focus and zoom, variable lighting and focal length all contribute to ease of use, ergonomics and proficiency for the entire surgical team. The mutual comfort of the patient, the surgical assistants and the doctor is of the utmost importance. The microsurgical procedure may take an hour or more, so unnecessary movements or adjustments for comfort's sake during the operation may cause considerable inconvenience.

The doctor's surgical stool must have adjustable arms to allow the elbows to support the back and serve as a reference point, or fulcrum, if the doctor has to reach for an instrument during the procedure. Ideally, neither the doctor nor the 'scope' assistant are to remove their eyes from the oculars of the OM during the entire operation. The task of directing the whole operation belongs to the surgical assistant. The surgical assistant is the choreographer for the procedures viewed through the OM. He or she is in a position to observe, coach and/or pass instruments to either the doctor or the 'scope' assistant. The surgical assistant can see the entire surgical environment and is the only one on the team that has an overview, to keep track of everyone's needs. It



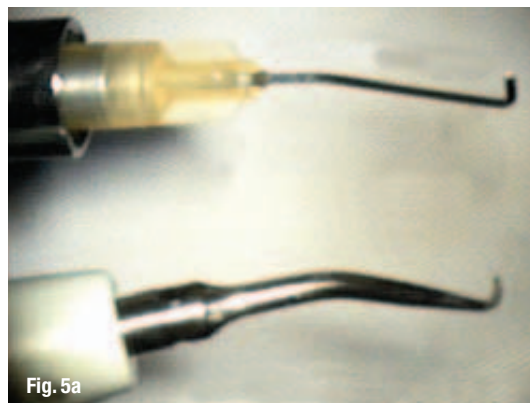


Fig. 5a



Fig. 5b

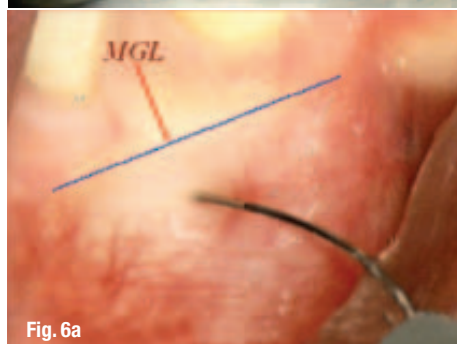


Fig. 6a

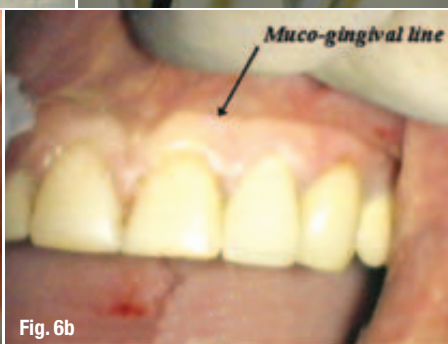


Fig. 6b



Fig. 7

**Fig. 5a** The modified needles to be used in the Stropko Irrigator are bent to the same general shape as the tip to be used on the ultrasonic during the root-end procedures.

**Fig. 5b** Set of three Stropko Irrigators with a variety of tips in place ready for use during the surgical procedure.

**Fig. 6a** Owing to the ballooning and blanching effect, the muco-gingival line becomes more pronounced during the haemostasis staging injections.

**Fig. 6b** When the buccal portion of the haemostasis staging is complete, the doctor can easily plan the incision.

**Fig. 7** Before the incision is made, the area is rinsed again with Peridex.

is important that all possible surgical instruments be organised for ease of access during the operation.

While the anaesthesia is becoming profound, the needles that will be placed into the tips of the Stropko Irrigators for use during the surgery can be modified. The notched ends of 25-gauge Monoject Endodontic irrigating needles (Ultradent/Vista) are removed by bending with Howe Pliers and placed into the end of the Stropko Irrigators. One tip is used with an air/water syringe, and the other tip is used with the dedicated air-only syringe (DCI). The endodontic irrigating needles are then bent in the same configuration as the ultrasonic tip that is used for the root-end preparation (Fig. 5a). After the needle has been bent, the ergonomics of the bend can be verified quickly and easily because the patient is in the proper position and so is the doctor.

Optimally, three Stropko Irrigators should be available for any surgical procedure: one three-way syringe fitted with a larger tip (Ultradent/Vista), for more general flushing of the surgical area (we call it the Big John); another three-way syringe fitted with a modified 25-gauge needle, for more precise cleaning and drying (Little John); and one with an air-only syringe also fitted with a modified 25-gauge needle, for precise and dependable drying of the area without worry of moisture contamination (Fig. 5b; Note, air pressure to the syringe must be regulated.)

Also, as the lumens of the high-speed evacuator tips (Young's Surgical) are so small, extra tips must be

available if one should become clogged. A beaker of water should be available, so that the 'scope' assistant can occasionally clear the evacuator system of blood and tissue debris from the evacuator tip.

After topical anaesthetic has been placed, local anaesthesia is begun using less than one carpule of warmed 2% lidocaine containing 1:50,000 epinephrine. This small amount is used to anaesthetise the injection sites that will be used next for the blocks and infiltrations. The 1:50,000 lidocaine is used prior to the 0.5% bupivacaine (Marcaine) because the Marcaine tends to cause a burning sensation upon injection, whereas the lidocaine is much more comfortable to the patient. This is then followed with one or two 1.8cc carpules of warmed Marcaine for nerve blocks and/or infiltrations. All anaesthetic is warmed and injected very slowly to avoid any unnecessary trauma to the tissue and to create much less discomfort for the patient.

After administering the local anaesthetics, haemostasis staging is performed using 2% lidocaine containing 1:50,000 epinephrine. It has been shown that 2% lidocaine containing 1:50,000 epinephrine produces more than a 50% improvement in haemostasis compared with 2% lidocaine containing 1:100,000 epinephrine.<sup>2</sup> While keeping the bevel of the needle towards the bone and directed apically towards the root ends, small amounts of 2% lidocaine 1:50,000 are slowly injected into the free gingival tissue in two or three sites to the buccal of each tooth (MB, B, DB), approximately 3mm apical to

the muco-gingival line. Slow injection of just a few drops of the anaesthetic causes a slight ballooning and blanching of the tissue in the immediate area. This is an important step as it causes the muco-gingival line to become more pronounced, allowing the doctor to have better vision, which results in more accuracy with the following haemostasis injections (Fig. 6a).

As the anatomy of the tissue unfolds during the injections, the doctor should continue visualising and planning the incision (Fig. 6b). The amount and nature of the attached gingiva is an important consideration whether a full sulcular or a muco-gingival (Leubke-Oschenbein) flap is used. In general, a full thickness sulcular flap is routinely used unless aesthetics is a concern and there is an adequate zone of attached gingiva present.

In order to ensure haemostasis, the lingual tissues should also be infiltrated to reduce blood flow during the surgical procedure more completely. When performing surgery on the posterior quadrant of the mandible, special attention should be given to the apical region of the mandibular second molar. On occasion, a small foramen, called the *foramen coli*, may be present. The *f. coli* contains an ascending branch of the mylohyoid nerve. Lingual haemostasis staging can contribute to more profound anaesthesia, will enhance crypt management and will contribute to a more predictable event with less stress for the entire team as a result.

If the surgery is to be performed on the maxillary, the patient is instructed to close on approximately

eight layers of sterile gauze, (four 2 x 2s folded over once) for stability of the jaws and keeping any debris from inadvertently entering the oral cavity. A single piece of a sterile 2 x 2 is also gently placed distal of the tooth/teeth to be operated on. If the surgical procedure is to be performed on the mandible, especially if a full sulcular flap is to be used, the doctor may want to make the incision with the mouth slightly open before placing the gauze.

In either case, with the aid of the OM and using a pre-filled 3 ml syringe fitted with a 20-gauge needle the entire surgical site is rinsed with Peridex, to ensure the area is free of debris and plaque before the incision is made (Fig. 7). The surgical site is now ready for the next important step in the procedure: Flap design, the incision and atraumatic flap elevation.

Stropko Irrigators are available from Sybron Endo or Obtura Spartan in the United States, from Clinicians Choice in Canada, or directly from [www.stropko.com](http://www.stropko.com).

*Editorial note: Please read Part II: Incision and atraumatic flap elevation in roots Vol. 5, Issue 3/2009.*

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**Dr John J. Stropko** received his DDS from Indiana University in 1964 and for 24 years practised restorative dentistry. In 1989, he received a certificate for endodontics from Boston University. He recently retired from the private practice of endodontics in Scottsdale in Arizona, USA. Dr Stropko is an internationally recognised authority on micro-endodontics. He has been a visiting clinical instructor at the Pacific Endodontic Research Foundation (PERF), an Adjunct Assistant Professor at Boston University and an Assistant Professor of graduate Clinical Endodontics at Loma Linda University. His research on in vivo root canal morphology has been published in the *Journal of Endodontics*. He is the inventor of the Stropko Irrigator, has published in several journals and textbooks, and is an internationally known speaker. Dr Stropko has performed

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