CLINICAL BrIeFS

Quick considerations for treatment success.

2006: Advances in Radiosurgery

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On a daily basis, the general dentist is faced with the need to provide a wide range of procedures. These procedures can range from routine restorations to advanced forms of periodontal or oral surgery. The general dentist must constantly update his or her base of knowledge for the rapid, ever-changing procedures and materials becoming available.

Radiosurgery is the term used to describe the most advanced form of electrosurgery. It is the removal of soft tissue with the aid of radio frequency (RF) energy. This electromagnetic energy operates between the frequencies of 3.0 megahertz (MHz) to 4.0 MHz, with 4.0 MHz being the optimal frequency. The older electrosurgical instruments, when performing similar procedures, operated at lower frequencies of 1.0 MHz to 2.9 MHz. Research by Maness and his group has shown that these lower frequencies produce more lateral heat to the surrounding tissues and should be avoided when in close proximity to bone.[1] Use of the older electrosurgery equipment should be considered contraindicated for contemporary periodontal, implant, and any other delicate surgery, and the clinician should consider updating to the newer radiosurgery instruments for reliable, more precise, and less traumatic tissue removal.

The waveforms used in radiosurgery include "fully filtered" for incising tissue and "fully rectified" for incising tissue with concurrent coagulation being performed. A "partially rectified" waveform is used only for hemostasis of the soft tissue.

The field of radiosurgery continues to make advancements. Monopolar radiosurgery is used for cutting tissue with the use of a fine wire electrode to make an incision. Bipolar electrosurgery is used for excision as well to establish coagulation in a field of blood. Bipolar radiosurgery is the latest advancement in the field. This form of surgery can now be accomplished with the use of a high-frequency RF unit.

Bipolar surgery is used for excision as well as hemostasis of soft tissue. The bipolar electrode consists of two parallel wires, one to make the incision and the other to act as the antenna to receive the RF energy. This modality is believed to minimize transmission of the RF to the surrounding tissue and thereby minimizing any lateral heat. This modality has been recommended when exposing an implant as well as coagulating in the presence of an implant because the signal is absorbed by the adjacent electrode tip. This absorption minimizes any heat transfer to the implant should the electrode inadvertently touch the implant.[2]

The older bipolar electrosurgery techniques were initially used in medicine because coagulation could be accomplished in a field of blood. The signal traversing the two electrode tips located so closely together made pinpoint coagulation an easy task. The development of different shaped electrode tips paved the way for controlled incisions to be accomplished.

The latest development is to couple the bipolar electrodes with the more desirable radiosurgical wave. This waveform operates at a higher radio frequency of 4.0 MHz than the bipolar electrosurgical signal of 2.0 MHz. Research has shown that high-frequency radiosurgery produces less tissue alteration and lateral heat to the surrounding tissue than the low-frequency electrosurgical signal.[3] Bipolar radiosurgery is a major advancement over the earlier bipolar electrosurgery.

Ellman International (Oceanside, NY) has taken bipolar surgery one step further by developing an instrument that is both monopolar and bipolar. The clinician who is familiar and comfortable with monopolar radiosurgery can continue to use this modality for all general dental procedures. When treatment is in close proximity to implants or large metal restorations, the bipolar modality can be readily used. The instrument, known as the Radiolase II™, comes equipped with different handpiece styles and connections to prevent accidental use of the wrong modality, and it complies with all international safety standards. It has an adjustable audible tone when the instrument is activated to minimize any accidental incising of the tissue. Disposable single-use electrodes are included with the instrument; however, the autoclavable electrodes of earlier models and the new silver alloy electrodes can be used as well.

Using a scalpel blade, the point of application is the precise point at which the incision is made. Similarly, with the high-energy RF energy from the electrode tip, the incision is controlled and easily visible at the point of application, with the lateral energy reducing rapidly from the high intensity at the applied tip as the energy is dispersed into the tissues. This means that the effect of the application can be accurately observed with the ability to fine-tune the instrument for optimum performance and with respect for tissue safety.

The single-use, disposable electrode tip, originally developed for application in the medical field, is one of the latest advances in radiosurgery, and many regard it as the safest cutting tip available. It is based on the same principle as that of disposable scalpel blades. Single-use in design, the tips will not tolerate heat sterilization and should not be cold-sterilized because their sterility cannot be assured. One advantage of a single-use, disposable electrode tip is that there is always a clean, unbent electrode with which to work. Gone are the days of broken loop electrodes and bent straight-wire tips. Disposable tips also eliminate the chance of a needlestick, which is a potential risk when cleaning straight-wire electrode tips for reuse.[4]

A new silver alloy electrode has recently been developed to specifically reduce tissue damage and heat generated to the surgical site. The silver alloy electrode has been shown to produce thermal damage no greater than 10 µm in depth, compared to the older tungsten electrodes that produced thermal damage as high as 30 µm in depth. Another important advantage of the silver alloy electrode is its ability to minimize tissue sticking to the electrode tip. This ensures a clean cutting tip, providing a more precise, microfine incision.

CASE PRESENTATION

A 46-year-old man presented with the complaint that he was unable to fully extend his tongue. On clinical evaluation he was diagnosed with ankyloglossia (limited movement of the tongue), which is caused by a broad lingual frenum attachment on the base of the tongue. This enlarged frenum creates speech and eating problems and can easily be addressed by a general dentist

Figure 1 A preoperative photograph showing an extensive lingual frenum at the base of the tongue. This frenum limited the tongue's movement and inhibited speech.

Figure 2 The Ellman Radiolase II, a 4.0 MHz radiosurgical instrument offering both monopolar and bipolar radiosurgery capabilities.

Figure 3 A silver alloy #118 Vari-tip straight-wire electrode was used to incise the frenum.

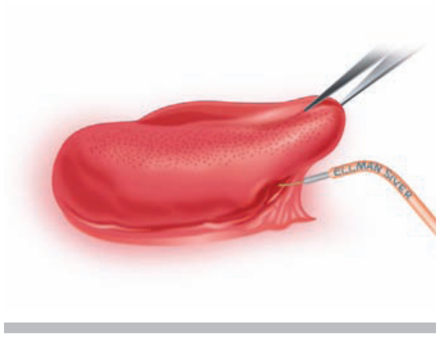

Figure 4 Illustration showing tongue reflection using a tissue forceps or a 2 x 2 piece of gauze.

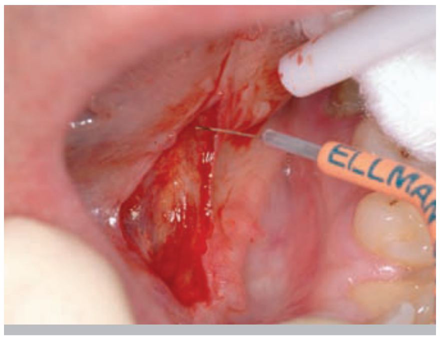

Figure 5 A silver alloy #118 Vari-tip electrode was used with a fully filtered waveform to incise and remove the frenum. The fully filtered waveform was selected because it produces the least lateral heat to the surrounding tissue. A surgical suction tip is in close proximity to the surgical site to eliminate odor and remove blood.

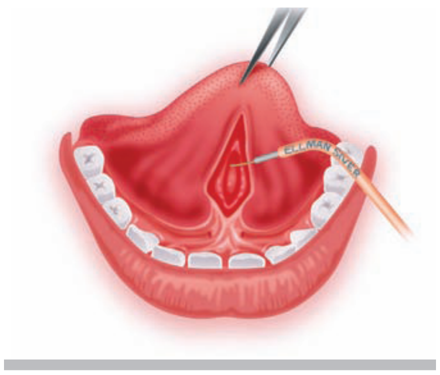

Figure 6 Drawing depicting the frenum being totally removed with the #118 electrode.

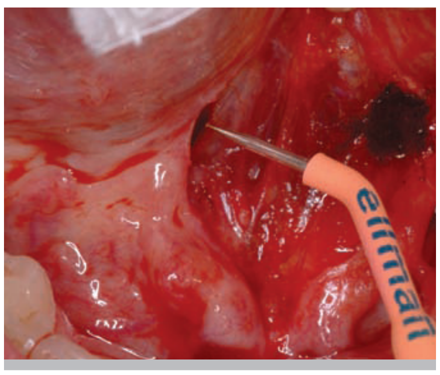

Figure 7 A #113F pencil-shaped silver alloy electrode was used with the partially rectified waveform to establish pinpoint coagulation.

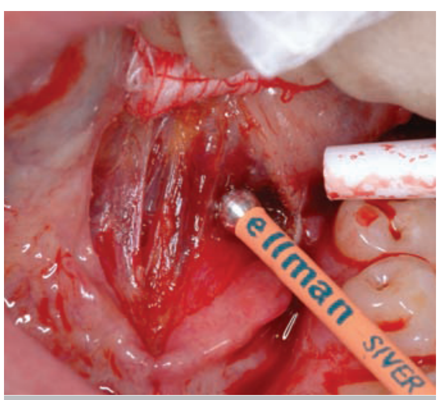

Figure 8 A #135 ball-shaped silver alloy electrode was used with the partially rectified waveform to establish broad areas of coagulation.

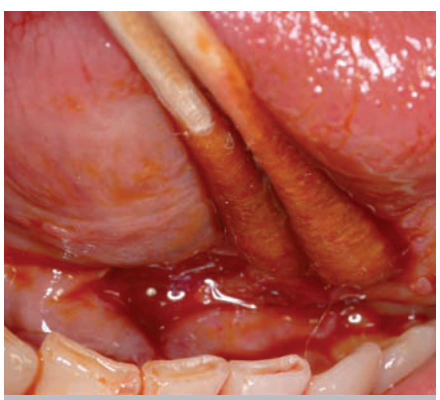

Figure 9 To act as a postoperative dressing to the surgical site, several layers of a tincture of myrrh and benzoin were liberally applied to the surgical site, air-drying between layers.

skilled in the use of radiosurgery. The lingual frenum was excised with the use of silver alloy electrodes and the Radiolase II (Figure 1 through Figure 5). A fully rectified filtered waveform was used to make the incisions and incise the frenum. The partially rectified waveform was used to establish coagulation (Figure 6 and Figure 7). A postoperative dressing was placed on the surgical site and home care instructions were given to the patient (Figure 8).

CONCLUSION

Radiosurgery continues to make advancements that allow it to be the modality of choice in the dental office. This modality offers cutting, coagulation, and cutting with hemostasis without the high cost of a laser.

DISCLOSURE

The author's textbook Oral Radiosurgery and "Video Atlas of Oral Radiosurgery" are sold by Ellman International.

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