Radiosurgery for Gingival Melanin Depigmentation

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Radiosurgery is one of the most important and versatile instruments in dentistry today. Its numerous uses range from performing surgical incisions and excisions to establishing hemostasis. It offers the advantages of safe, fast, and efficient incisions/excisions with an excellent field of visibility. The patient receives a pressureless cut with a minimal amount of bleeding that often requires no suturing. Studies by Hultcrantz and Ericsson and Miller report less thermal damage and faster healing with the 4 MHz Radiowave technology over the scalpel or lasers.

RADIOSURGERY INDICATIONS/ CONTRAINDICATIONS

In the general dental practice, radiosurgery can be used throughout the day for a number of very common procedures: exposing subgingival decay, gingivectomies, gingivoplasties, and frenectomies. Radiosurgery can also be used for cosmetic periodontal surgery involving the removal of gingival pigmentation due to excessive amounts of melanin.

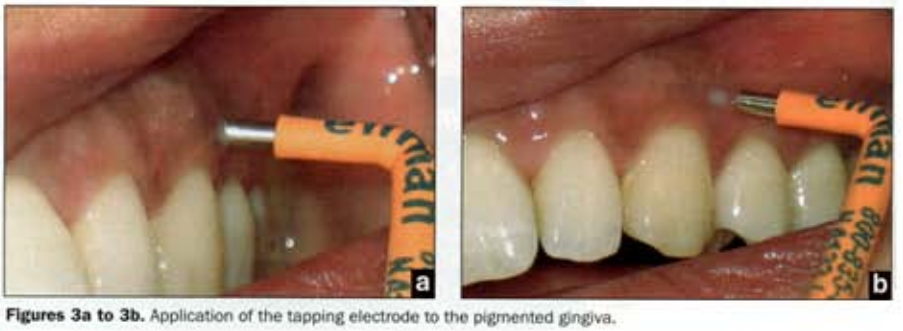
Radiosurgery uses a 4 MHz radio signal to produce a fine microsmooth incision with no overt lateral heat being sent to the surrounding tissues. This is extremely important for extensive areas of oral surgery, where proximity to the underlying soft and hard tissue requires a delicate incision. Traditional electrosurgical machines with lower frequencies and lasers produce higher temperatures in tissue and are not recommended for this and other oral procedures.

The main advantage to radiosurgery can be found in its ability to produce coagulation in an operative area which would often have extensive bleeding. This enhances the surgeon's vision and the ability to perform a more accurate incision. The absence (or minimal amount of bleeding) during surgery allows the procedure to be performed more rapidly and with more confidence. Patients are less apprehensive due to the lack of bleeding, and this even decreases their awareness that surgery is being performed.

Contraindications of radiosurgery and bipolar surgery include cardiac pacemakers, cardiac defibrillator implants, and cochlear implants.

Figures 1a and 1b. Aesthetic results achieved following crown lengthening (gingivectomy) and depigmentation with RF surgery.

Figures 2a and 2b. Clinical views of a case before and 6 months after the depigmentation.



Figures 3a to 3b. Application of the tapping electrode to the pigmented gingiva.

RADIOSURGICAL WAVEFORMS AND INSTRUMENTATION

Radiosurgery offers a variety of waveforms for making incisions. *The Fully rectified filtered waveform* is the waveform of choice for performing deep precise surgical incisions. This waveform mimics the cut of a scalpel blade, however it is pressureless and therefore it cuts with only minimal coagulation. The *filtered waveform*, when used with a Vari-Tip (Ellman International) straight wire electrode, produces the most delicate of incisions and offers the least amount of tissue alteration histologically. The *fully rectified waveform* produces an incision with concurrent coagulation. The advantage of using this waveform in comparison to the

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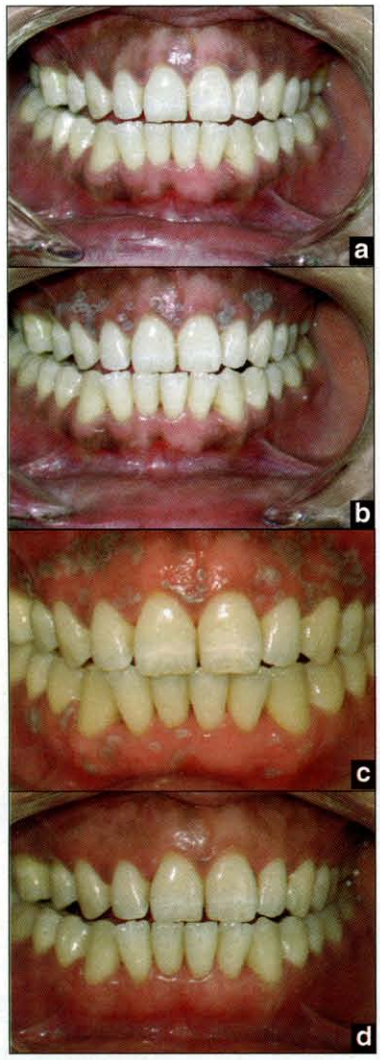
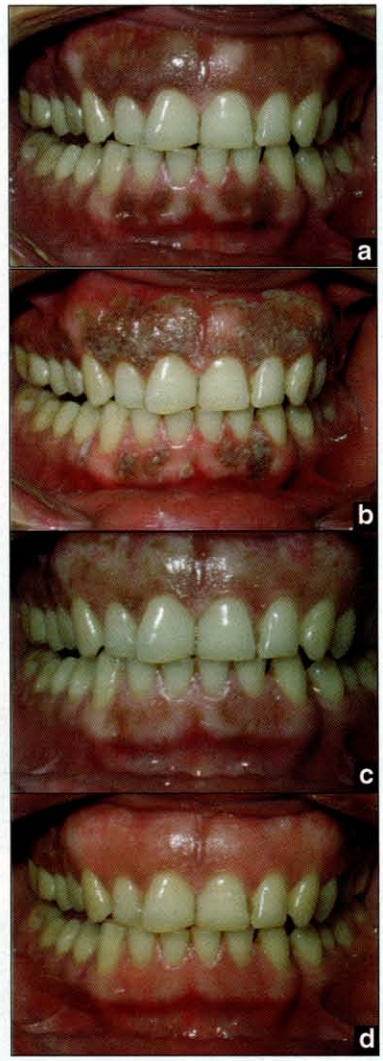
filtered waveform is that increased visibility is established due to the enhanced coagulation. The *partially rectified* waveform is strictly a coagulating waveform and can be used to establish coagulation in areas of bleeding or oozing. Areas of extensive bleeding can be controlled with the aid of the bipolar coagulating electrode or the *fulguration waveform* on those instruments that do not offer bipolar capabilities.

Bipolar surgery is used for excision as well as hemostasis of soft tissue. The bipolar electrode consists of 2 parallel wires, one to make the incision and the other to act as the antenna to receive the radio signal. This modality is believed to minimize transmission of the radio signal to the surrounding tissue and thereby eliminating any lateral heat. Another excellent use for *bipolar* is pulpotomies.

A new proprietary Advanced Composition (Alloy) Electrode (known as the ACE Electrode [Ellman International]) has just been developed to reduce tissue damage and heat generated to the surgical site. The ACE Electrode has been shown to produce thermal damage in micrometers no greater than 10 µm in comparison to tungsten electrodes that have produced thermal damage as high as 30 µm. Another important advantage of the ACE electrodes is their ability to minimize tissue sticking to the electrode tip. This insures a clean-cutting tip providing a more precise microfine incision. These electrodes are easily identified by the orange coloring of the protective sleeve. The physics behind the reduced thermal damage is matching the alloy to the frequency, waveform, and wattage to produce a harmonic signal around the RF electrode.



Figures 4a to 4d. Clinical views of a case before and after the procedure.



Figures 5a to 5d. Total removal of heavily pigmented lesions done in 2 RF sessions within a 4-week period of time.

GINGIVAL MELANIN PIGMENTATION

Melanin pigmentation of the gingiva is of endogenous origin caused by excessive deposition of melanin. It is more frequently observed in some races such as Asian, African, and Mediterranean populations and called racial or physiological pigmentation. However, pigmentation may vary not only among the subjects of the same race, but within different regions of the mouth. This kind of pigmentation presents as a well-demarcated, bilateral, dark-brown, asymptomatic lesions in the keratinized gingiva mostly in the anterior region. This phenomenon is due to more melanocyte activity as both dark- and light-skinned subjects have similar amounts of melanocytes in the gingiva.

As toxic agents in tobacco smoke can induce melanocytes to produce melanin, smoking is also a cause of pigmentation in subjects with light skin and may aggravate pigmentation in dark-skinned subjects (smoker's melanosis). The severity and extent of melanosis is usually correlated with the duration and quantity of smoking and it decreases following the cessation of smoking.

Gingival melanin pigmentation is an aesthetic problem, not a medical problem. The color and display rate of the gingiva when smiling is an essential part of overall aesthetics for today's high cosmetic expectations. Since brown-black melanosis lesions mostly involve anterior vestibular gingiva, heavily pigmented gingiva can cause an unaesthetic smile. Therefore, depigmentation procedures have attracted much interest, and numerous procedures have been introduced with similar results up to date (Figure 1). However, a novel gingival melanin pigmentation removal method performed with RF surgery offers advantages over other depigmentation methods such as speed, reliability, lack of postoperative pain, bleeding, and the discomfort of a local anesthesia injection (Figure 2) (Table 1).

RADIOSURGERY TREATMENT FOR MELANIN PIGMENTATION

Drs. Arikan and Gurkan have reported on numerous cases of depigmentation using radiosurgery cited in article by Hultcrantz E and Ericsson E. They state that melanocytes are primarily located in the basal and suprabasal cell layers of the epithelium. Therefore, a superficial effect is sufficient to remove pigmentations. Touching the pigmented areas lightly with the No. 135 ball shaped electrode or tapping the area with the No. 134 L-shaped electrode when the Ellman Surgitron or Radiolase II is operating (Figure 3) will successfully treat the case.

Operating settings for this procedure is power setting of 11 in the *fully rectified cut mode* for thick, hard gingiva and a power setting of 7 in *partially rectified coag mode* for gingiva exhibiting softer consistence and areas near alveolar mucosa. Ball tip and tapping electrodes provide controlled penetration into the gingival tissue and therefore complete scaling of the pigmented areas is not needed. Tiny electrodes (preferably a 2 mm ACE electrode) provides access to narrow areas like the interdental

Table 1. Comparison of Gingival Depigmentation Methods.

	Bleeding	Needle anesthesia	Postoperative pain	Periodontal dressing	Ease of access to interdental papilla region	Major disadvantage of other methods
Scalpel surgery	+	+	+	+	-	Bleeding
Particle abrasive methods	+	+	+	+	-	Bleeding
Laser	-	+	-	-	+	Expense
Gas cryosurgery	-	-	-	-	-	Safety
TFE cryosurgery	-	-	-	-	-	Lack of access to interdental papillary region
Radiofrequency surgery	-	-	-	-	+	

Table 2. Patient Evaluation.

Smoking habit (duration and number per day)
Duration of pigmentation
Skin pigmentation
Perioral pigmented lesions (lips, face)
Systemic diseases (Addison's disease)
Systemic symptoms of malignancy (fatigue, malaise, weight loss)
Medications
Lymph nodes
Characteristic of the pigmented lesions (size, number, distribution, shape, color, surface, and borders)

papillary region allowing a more delicate procedure to be performed.

The pigmentated area is anesthetized using a topical 10% lidocaine spray. Patients report little or no discomfort during the depigmentation procedure. Minimal discomfort is reported, if an increased time of tissue contact is attempted with the active electrode without the use of additional anesthetic spray. In areas of extensive pigmentation the area can be infiltrated with a local anesthetic solution.

TECHNIQUE FOR MELANIN DEPIGMENTATION

First and foremost, patients presenting with pigmented lesions should be thoroughly evaluated by taking dental and medical histories, performing extra/intraoral examinations and laboratory tests. Biopsy should be performed if a lesion cannot be explained by other factors (Table 2).

Place the lip retractor and apply the anesthetic spray to the region of interest. Adjust the Radiolase II or Surgitron to the *Filter Cut mode* with a power setting of 10 to 11. On smaller areas of pigmentation use the *Partially Rectified Coag mode* at a power setting of 7.

Since melanocytes are primarily located in the basal and suprabasal cell layers of the epithelium, touch the pigmented areas lightly with the electrode tip. Remove the electrode as soon as the tissue around the electrode becomes whitish. Repeat the procedure for all pigmented areas.

After the first week, slight redness is observed around the margins of the surgical site. Epithelization is completed in 10 days and at 2 weeks post-op a second procedure can be performed in cases with heavy pigmentation (Figures 4 and 5). Postoperatively, the patient is given chlorhexidene rinses and a prescription for an analgesic medication. The patient is instructed to perform only gentle tooth brushing in the area(s) of the surgery.

CONCLUSION

Not only is gingival melanin depigmentation a reliable procedure, it has an extremely short learning curve and can be easily and quickly performed by the general dentist, oral surgeon, or periodontist. The cosmetic result is rewarding to these patients who are often self-conscious about their condition.✦

Suggested Readings

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Dr. Sherman is a leading authority in the field of radiosurgery. He has published 3 textbooks on the subject, has 2 technique videos, and has published numerous articles in international and national dental journals. He is a Diplomate of the American Board of Oral Electrosurgery, and a Fellow of both the American and the International College of Dentists. He is the executive director of the World Academy of Radiosurgery, and has lectured at numerous dental schools and meetings throughout the world, including Yale University, New York University, Tufts University, Louisiana State University, Cairo University, and Seoul Dental Institute. He maintains a private general dental practice in Oakdale, NY. He can be reached at (631) 567-2100 or esurg@aol.com.

Disclosure: Dr. Sherman's textbook and video on radiosurgery are sold by Ellman.

Dr. Gürkan graduated from Ege University School of Dentistry, Izmir, Turkey, with the highest honors, where he received his PhD degree and currently serves as a research assistant in periodontology. He is particularly interested in host-modulatory therapies in periodontal disease, plastic periodontal surgery, and aesthetic periodontal interventions. He is an active member of European Federation of Periodontology and published more than 20 articles in national and well-respected international journals. He can be reached at ali.gurkan@ege.edu.tr.

Disclosure: Dr. Gürkan declares that he has no financial involvement or affiliations with any companies or products mentioned in this article.

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