Use of an 810-nm Diode Laser in the Treatment of Multiple Hemangiomata of the Lip

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J Laser Dent 2008;16(1):45-49

SYNOPSIS

The use of a diode laser for dealing with multiple hemorrhagic lesions is described.

PRETREATMENT

A. Outline of Case

1. Full Clinical Description

A 68-year-old female patient attended for treatment including the provision of dentin-bonded crowns at several tooth sites. At examination, it was noted that there were several discrete pigmented lesions of the right lower lip, which appeared to be blood-filled. Otherwise, the appearance and function of the lip was normal.

MEDICAL HISTORY

The patient was in general good health. She had been receiving hormone replacement therapy for many years and had recently been prescribed statins for hypercholesterolemia, which was maintained within normal limits.

DENTAL HISTORY

The patient had been a regular and well-motivated attendee of the practice during many years. Teeth #1, 12, 16, 17, 19, 28, 29, and 30 had been lost, with the latter three being replaced by a fixed bridge (Figure 1). Her general oral health was good, with no caries, and the periodontal condition was satisfactory. The lesions on the right lower lip had appeared during a period of several months. Although considered unsightly, they did not arouse any concern for the patient.

2. Occlusion

The patient had an increased overbite at 5 mm and slightly retroclined upper incisors, although these had been cosmetically enhanced by crowning. Her molar relationship, together with the incisal appearance, was consistent with a Class II division 2 occlusion.

3. TMJ

Examination of both temporomandibular joints, through palpation, revealed normal structure and movements. Opening / closing and excursive movements of the mandible revealed no abnormality.

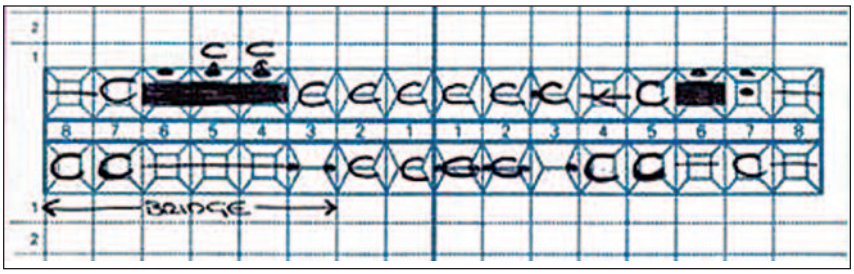

Figure 1: Patient chart

Figure 2: Preoperative appearance of lip lesions

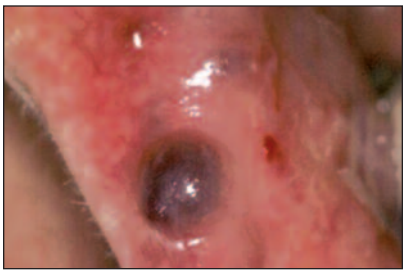

Figure 3: Close-up view of lesions

4. Radiographic Examination

The presentation and scope for treatment of the lip lesions did not warrant any radiographic investigation.

5. Soft Tissue Examination

General oral soft tissue: Examination of all oral soft tissue structures revealed no abnormality. All tissues appeared normal in appearance, and dorsal and ventral tongue surfaces, together with tongue movements, were within normal expectations. Regional lymph node palpation was normal.

Specific: The appearance of the pigmented lesions on the lip was consistent with some traumatic etiology. There was no associated pulse on palpation, nor was there

any emptying of each lesion on pressure, such findings being consistent with a cavernous hemangioma. As such, each lesion was discrete, with a nonpedunculated base and a thin epithelial cover (Figures 2-3).

6. Hard Tissue Status
Further to the comments above, the general hard tissue status was good, with multiple full-veneer crown restorations that were satisfactory.

7. Other Tests
In view of the age of the patient and presentation of the lesions, it was felt prudent to contact the patient's general medical practitioner. Although no tests specific to this proposed oral treatment were arranged, systemic conditions such as any blood dyscrasias were eliminated through her recent treatment of hypercholesterolemia and there was no report of any skin ecchymosis, suggestive of blood vessel fragility. It was concluded that the lip lesions were due to isolated capillary dilatation and probably traumatic in origin. Further questioning of the patient did not reveal any contributory factors such as lip-biting.

B. Diagnosis and Treatment Plant
1. Provisional Diagnosis
A provisional diagnosis was made of unsightly multiple raised hemorrhagic lesions of the lower lip.

2. Final Diagnosis
Following the investigations outlined above, it was felt that these lesions were isolated hemangiomata of possible traumatic origin. Laser-assisted treatment could be assigned in accordance with the need to excise these unsightly lesions with minimal tissue disruption or postoperative complication.

3. Treatment Plan Outline
It was felt that, with the use of a laser wavelength that would maximize the interaction with blood pigments, these lesions could be excised and contributory capillary supply sealed to prevent recurrence. In view of the need to anticipate unforeseen bleeding, it was felt prudent to administer an adrenaline-enhanced local anaesthetic, and to have hemostat instruments in case of hemorrhage.

4. Indication and Contraindications

INDICATIONS

Treatment: In all areas of soft tissue management within this treatment plan there is an ideal in achieving hemostasis, consistent with the need to provide unhindered access to the surgical site. The appearance of these lesions was cosmetically distracting and potentially hazardous due to the inherent fragility. A further indication would include the delivery of soft tissue surgery that provides minimal postoperative discomfort and complication for the patient. The use of a suitable laser wavelength would seek to meet these requirements.

Laser: It is recognized that all laser-tissue interaction in surgical procedures are predominately photothermal in nature. The conversion of incident laser light energy into heat will lead to primary and, through local conduction, secondary heat effects that would allow soft tissue surgery to be carried out through tissue ablation with a supportive hemostasis. As such, the use of laser energy to effect soft tissue surgery is justified.

Wavelength: The predominant chromophores in this case are melanin (tissue pigment) and hemoglobin. In addition, the prime needs of treatment would be to achieve tissue ablation with hemostasis, indicating the optimal need for using a near-infrared wavelength, such as the 810-nm diode laser.

CONTRAINDICATIONS

Treatment: The only absolute contraindication to treatment in this case would be to accept the original situation. However, in view of the recent etiology and a presumed wish to prevent further exaggeration, together with the presumed improvement in function and aesthetics, such inaction could not be justified.

Laser: Any surgery using laser energy carries some risk of tissue damage and this possibility must be borne in mind.

Wavelength: The choice of a longer wavelength would offer a more superficial level of tissue ablation. However, in view of the need for hemostasis, longer wavelengths would require greater power parameters in order to induce conductive heat effects and this may prove damaging. Other near-infrared or visible wavelengths such as Nd:YAG (1064 nm) or KTP (532 nm) would prove suitable for such surgery, subject to correct power parameters.

5. Precautions
The benefit of hemostasis offered by near-infrared laser wavelengths is accepted. In comparison to the Nd:YAG laser, the depth of penetration of the 810-nm diode laser wavelength in oral soft tissue is less, which would reduce the risk of collateral thermal damage. Nonetheless, the use of minimum power parameters, and time intervals to allow thermal relaxation and control of carbonization of the tissue and optic fiber, would all reduce the risk of primary and secondary thermal damage.

General precautions applicable to the use of the 810-nm diode laser wavelength would include the need to observe caution in continuous-wave laser energy delivery. Sufficient interaction to ablate structural components may not be sufficient to provide hemostasis, and power required to achieve control of blood flow may be injurious to

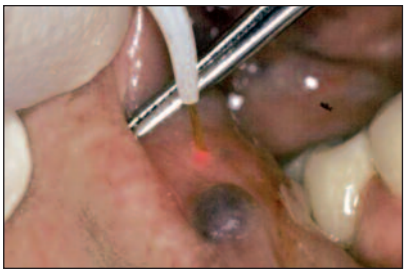

Figure 4: Diode laser being applied to lesion

Figure 5: Brisk hemorrhage as lesion is incised

Figure 6: Lesion excised

surrounding soft tissue. Consequently, the ability to accurately deliver laser energy through an optic fiber can do much to prevent unwanted tissue exposure. In addition, during such procedures as this, there will be a rapid accumulation of denatured proteinaceous material onto the fiber tip and care must be exercised to remove such accumulations in order to minimize carbonization of debris. Further care should be exercised to avoid the temptation of using the optic fiber as a scalpel; it is essential that, although in contact with the tissue, the fiber be used solely as the conduit of laser energy and therefore play no part in the incision of tissue through mechanical force.

Specific precautions relate to the precise delivery of laser energy to isolated soft tissue sites; wherever possible, nontarget tissue should be protected through the placement of damp gauze and positioning of a high-speed suction tube in the line of the laser beam. In addition, no reflective surfaces such as a mouth mirror should be used. The target lesion should be placed under tension, using tissue forceps to facilitate incision using minimal power parameters. Points of excessive bleeding should be treated with increased power, sufficient to induce coagulation without causing collateral damage.

6. Treatment Alternatives

Alternative methods for soft tissue incision would include a scalpel with possible associated suture placement or electrosurgery.

7. Informed Consent

The treatment plan was fully explained to the patient and all associated risks outlined. A written consent form was signed by the patient in the presence of a witness. The consent form was retained in the treatment notes.

TREATMENT

A. Treatment Objectives

The objective of this treatment would be to effectively remove or resect soft tissue at each of the treatment sites, with an 810-nm diode laser, with minimal peri- and postoperative complications.

B. Laser Operating Parameters

Laser:

- A diode laser (DioLase ST, American Dental Technologies, Corpus Christi, Texas, USA) was used. The operating features are as follows:
- Wavelength: 810 nm
- Co-axial aiming beam: Diode Class I laser 630-680 nm, 3 mW
- Emission mode: Continuous Wave (CW) with supplementary Gated CW, single pulse or repetitive single pulse
- Maximum power output: 12.0 Watts
- Delivery system: Quartz fiber-optic (320-µm diameter) with conduit handpiece and disposable cannula tip
- Beam diameter: 320 µm.

Laser settings:

- Excision of hemangioma: 1.7 Watts. Selective coagulation of bleeding points: 2.0 Watts.
- Time taken per site: 1-2 minutes, with intervals. Total time taken: 6 minutes.

C. Treatment Delivery Sequence

Preliminary to patient treatment

- Secure operating room, define controlled area, and place proper laser warning signs.
- Set up laser and test proper laser operation.
- Test-fire laser, employing all safety measures, using minimum power settings and directing beam onto articulating paper. The objective is to ensure correct laser operation, patency of delivery system, and emission of cutting and aiming beams. In addition, the fiber tip can be inspected to ensure a proper cleave has been carried out and the spot size is uniform.
- Dispense supplies, and arrange equipment and sterile instruments.
- Review patient information.
- Patient seated: review treatment plan and informed consent.
- Safety: place eye protection, patient first followed by operating personnel.

Treatment sequence

Individual treatment sites were isolated and infiltration local anaesthetic (2% lignocaine 1:80,000 adrenalin) was administered. The laser was programmed to deliver 1.7 Watts CW and the laser fiber was lightly initiated using articulating paper. Each lesion was treated in turn; using tissue forceps; each lesion was placed

Figure 7: Coagulum developed at surgical site

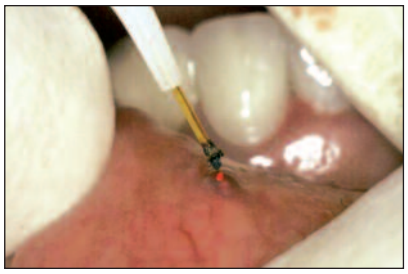

Figure10: Diode laser being applied to minor lesion

Figure 13: One-month postoperative view

Figure 8: Excision completed. Note build-up of debris on fiber tip

Figure 11: Excision of minor lesion complete

Figure 14: Three-month postoperative view

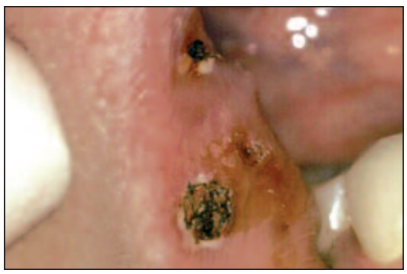

Figure 9: Immediately postoperative

Figure 12: One-week postoperative view

Figure 15: Six-month postoperative view

under tension and the fiber tip applied to the base. The laser energy was delivered to the tissue in a brush stroke to initiate an incision, with the fiber tip in contact mode with the tissue (Figure 4). This was developed to expose half of the lesion base. At this time, due to breach of the epithelium, some bleeding occurred which was controlled by increasing the power output to 2.0 Watts and applying the fiber tip within the bleeding site (Figures 5-6). With the absorption of energy, there was evidence of coagulation of the blood (Figures 7-8). Once controlled, the coagulum was wiped clear with a damp gauze and the process continued until a flat surface was obtained and the lesion excised, using a reverted 1.7 Watts setting. Finally, the fiber was cleaned and applied in a noncontact mode, 1-2 mm away from the surface, to define a protective coagulum (Figure 9). The process was repeated for the other treatment sites (Figures 10-11).

D. Postoperative Instructions

The surgical sites were shown to the patient and their appearance was explained. A chlorhexidine mouthwash was prescribed and the patient instructed to carefully apply this with cotton wool, avoiding disturbance of the coagulum; this was to be carried out three times daily during the five-day postoperative period. The patient was advised that the appearance of the treatment sites would change, with detachment of the coagulum and softening and hydration of the tissue at 3-5 days postoperation. The patient would be reviewed at one week. Postoperative analgesia was prescribed for use as required. There were considered no limitations on eating or drinking. The patient was instructed to call should any problem occur and was called by phone after 24 hours.

E. Complications

Complications that can be expected following laser soft tissue surgery can include pain, tissue swelling and deformation, bleeding, and infection. In this case, no such complications were encountered.

F. Prognosis
Laser-assisted soft tissue procedures, employing correct power parameters and technique, generally have a very good prognosis. It was felt that in this case a similar outcome could be expected.

G. Treatment Records
All procedural details, both generally and specifically with reference to the laser use, were entered in the patient's treatment notes, along with the consent details. As such, the treatment records would reflect the treatment outlined above.

FOLLOW-UP CARE

A. Assessment of Treatment Outcome
The patient was reviewed at one week, with successive examination thereafter at one month, three months, and six months (Figures 12-15). In all cases, the healing was as expected and normal lip function was maintained.

B. Complications
No long-term complications were observed.

C. Long-Term Results
The long-term results are in keeping with the objectives of the original treatment. The patient was very satisfied with the outcome. No further lesions appeared.

D. Long-Term Prognosis
The long-term prognosis of the treatment provided should be considered as good. The original etiology remained speculative.

AUTHOR BIOGRAPHY

Dr. Steven Parker studied dentistry at University College Hospital Medical School, University of London, UK and graduated in 1974. He is in Private Practice in Harrogate, UK. He holds Fellowship and Diplomate status with the International Congress of Oral Implantologists. Dr. Parker has been involved in the use of lasers in dentistry since 1990. Prior to joining the Academy of Laser Dentistry in 1993, he was President of the British Dental Laser Association. He joined the Board of Directors of the Academy in 1996 and became chair of the International Relations Committee. From 1999 through 2004, he was chair of the Committee for Proficiency Recognition and co-editor of *Wavelengths*, the former journal of the Academy of Laser Dentistry. He was awarded the Leon Goldman award for Excellence in Clinical Laser Dentistry by the Academy in 1998. In addition, Dr. Parker holds Advanced Proficiency status in multiple laser wavelengths and completed the Academy Educator Course at the University of California – San Francisco in 2000. He is an ALD-Recognized Standard Proficiency Course Provider. He has held consultancies with multiple laser companies and has presented courses, lectures, and workshops worldwide. He has authored numerous articles on the use of lasers in dentistry, including a chapter "The Use of Lasers in Fixed Prosthodontics" in the October 2004 *Dental Clinics of North America.* Dr. Parker was the 2005 President of the Academy of Laser Dentistry. Dr. Parker may be contacted by e-mail at thewholetooth@easynet.co.uk.

Disclosure: *Dr. Parker has no current affiliations with any company.*