

Use of an 810-nm Diode Laser in a Gingivoplasty Procedure Associated with Restorative Dental Care

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SYNOPSIS

This article describes removal of hyperplastic gingival tissues prior to placing a new fixed bridge. An 810-nm diode laser was used.

PRETREATMENT

A. Outline of Case

1. Full Clinical Description

A 44-year-old female presented for her routine examination. She expressed a wish to review and update the presentation of the restorations in the upper right dental quadrant. The existing three-unit fixed bridgework had been provided many years previously and had functioned well. However, due to the passage of time and possible changes in the gingival condition, there had been some recession and loss of contour in the soft tissue margins at the bridge abutment teeth (Figure 1). During the previous 25 years, the patient had attended regularly for inspection and routine treatment, including prophylaxis and occasional restorative procedures.

MEDICAL HISTORY

The patient was in general good health. She had not received any medical treatment or medication for significant conditions.

DENTAL HISTORY

The patient had been a patient of the Practice since 1984. She was originally a nervous patient who was reluctant to undergo treatment and had consequently allowed significant deterioration in both

hard and soft tissue status. She had previously received some simple orthodontic treatment. Since that early time, confidence in dental treatment had improved and reparative procedures had been carried out as required.

2. Occlusion

During examination of the dental arches in occlusion and the underlying skeletal landmarks, it was noted that the patient had a Class I dental relationship; the Frankfort Mandibular Plane (FMP) angle appeared slightly lower than normal and the adult skeletal relationship was a moderate Class III. The path of closure was normal and overbite and overjet values were considered both positive and within normal limits.

3. TMJ

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

4. Radiographic Examination

Panoral and periapical radiographs were taken to establish both dental and alveolar bone status prior to treatment (Figure 2). These views



Figure 1: Preoperative view

were repeated at stages during the treatment, as required. With the exception of dental findings listed below, there was no sign of hard tissue pathology in either jaw or TMJ regions.

5. Soft Tissue Examination

General oral soft tissue:

Examination of all 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.

Gingival soft tissues: All natural tooth sites were examined with a periodontal probe and findings recorded. Of specific relevance to the treatment provided, there was some false pocketing at tooth sites #3 and 6, with recorded depths of 3 mm on mesial, distal, and facial aspects. In addition, the contour of the gingival tissue at these tooth sites was rather flat and detracted from what might be an ideal (Figures 3-4). Generally, the attached gingiva appeared of normal thickness, with little evidence of inflammation. The

general level of oral hygiene was considered good, with the patient having attended for regular hygiene appointments.

6. Hard Tissue Status

At the time of initial active-treatment assessment, the following teeth were charted as missing:

- Upper jaw: #1, 4, 6, 12, 16.
- Lower jaw: #17, 32.

All four wisdom teeth had been removed following pericoronitis and teeth #6 and 12 through orthodontic treatment. Tooth #4 had been lost due to fracture and infection, leaving a one-unit edentulous space.

There was a fixed / fixed porcelain-fused-to-metal (PFM) bridge to replace tooth #4, using teeth #3 and 6 as abutments. Teeth #28, 29 and 30 had been restored with PFM full veneer crowns. The remaining restored teeth had received a combination of amalgam and composite restorations.

Tooth vitality test: All teeth tested vital to ethyl chloride.

Mobility: There was no mobility recorded at any natural tooth site.

Percussion: Percussion testing of all tooth sites revealed no hyperesthesia.

7. Other Tests

Pertinent to the proposed treatment, no other tests were considered necessary.

B. Diagnosis and Treatment Plan

1. Provisional Diagnosis

Treatment for this patient to replace the existing bridge in accordance with her preferences would involve removal of the existing bridge. With regard to laser-assisted therapy, it was considered appropriate that some soft tissue manipulation would be required around the abutment teeth.

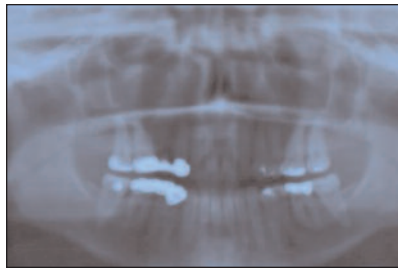


Figure 2: Pre-assessment panoramic radiograph



Figure 3: Occlusal view



Figure 4: Assessment of soft tissue

2. Final Diagnosis

Laser-assisted treatment could be assigned in accordance with the following clinical needs:

- Examination of radiographic evidence and direct periodontal measurement of the abutment teeth revealed false pocketing and poor contour of the gingival margins.
- Laser-assisted gingivectomy at these sites would facilitate some minimal crown lengthening and improved aesthetics without compromising the biologic width of the periodontal attachment. This would aid the success of the final treatment outcome.

3. Treatment Plan Outline

- General:* The existing bridge in the upper right posterior region would be removed and associated correction of crown margins carried out. A new PFM bridge would be fabricated and fitted.
- Specific:* In order to achieve some slight crown-lengthening and facilitate optimal soft tissue profiles, it was decided to use an 810-nm diode laser to remove hyperplastic gingival tissue associated with teeth #3 and 6.

4. Indication and Contraindications

INDICATIONS

Treatment: In the areas of soft tissue management within this treatment plan there is an ideal in achieving hemostasis, consistent with the need to provide access for hard tissue treatment and early abutment preparation. In addition, an optimal definition of a stable gingival margin at teeth #3 and 6 would allow early placement of a permanent coronal restoration. 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 is predominantly 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 of the hyperplastic keratinized gingival tissue in this case are melanin (tissue pigment), hemoglobin, and intracellular water. In addition, the prime needs

of treatment would be to achieve tissue ablation with hemostasis, indicating the optimum 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 clinical presentation, which would be at variance with the patient's wishes. Consequently, in view of the need to provide optimal retention for the crowns and maximize aesthetics, soft tissue manipulation is mandatory and there can be few if any contraindications for treatment. In addition, further considerations apply:

- a. Biologic width (i.e., the sum of the connective tissue attachment, epithelial attachment, and sulcular depth relative to the osseous crest) must be determined and considered when recontouring the periodontium with a subsequent placement of a restoration.
- b. Aesthetic considerations, including lip line height and other factors, must be taken into account in placement of the final gingival contour: Is the patient accepting of the contour, should it match the adjacent teeth, does the lip hide the contour anyway, and so on.

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

Wavelength: The choice of a longer wavelength would offer a more superficial level of tissue ablation.

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 wavelength in oral soft tissue is less, which would reduce the risk of collateral thermal damage. Nonetheless, the use of minimum power parameters, 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.

Gingivectomy: Whenever periodontal contouring and tissue removal is undertaken in association with natural teeth, attention must be given to the preservation of the biological width. In addition, preservation of a stable result is dependent on good patient home care. Further, it is essential that the internal and external contours of the periodontal attachment apparatus are mapped out, so that possible laser damage to the periosteum, bone, periodontal attachment, and root cementum can be avoided. Final tissue cleavage using a sharp curette and the placement of suitable material into the pocket can help to protect delicate nontarget tissue.

6. Treatment Alternatives

Alternative methods for soft tissue incision would include a scalpel or electrosurgery.

7. Informed Consent

The treatment plan was fully explained to the patient and all associated risks were 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 the 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 630-680nm, 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- μ m diameter) with conduit handpiece and disposable cannula tip
- Beam diameter: 320 μ m.

Laser settings:

- Gingivoplasty: 1.4 Watts CW / contact mode. Time taken per site: 1-2 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 (charting, X-rays, etc.)
- Patients 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 adrenaline) was administered.

Gingivoplasty teeth #3 and 6:
Laser power setting: 1.4 Watts CW.



Figure 5: Gingivoplasty on tooth #3 under way



Figure 6: Gingivoplasty on tooth #6 under way



Figure 7: Gingivoplasty procedure continuing on tooth #6

The soft tissue pocket at each tooth site was explored with a periodontal probe to establish internal architecture. The laser fiber was lightly initiated using articulating paper and, with the fiber held perpendicular to the surface, a series of points were developed on the labial gingiva to outline the incision line. With a light contact of the fiber with the tissue, the incision line was developed, with minimum depth. Any char on the tissue or fiber tip was removed with damp gauze. Successive sweeps of the fiber allowed precise tissue cleavage to be carried out (Figures 5-8), to a point where final excess tissue removal



Figure 8: Immediate postoperative view of gingivoplasty on teeth #3 and 6



Figure 9: One-week postoperative view



Figure 10: Two weeks post laser surgery

could be achieved with a sharp curette. In this way, direct contact with the underlying tooth was avoided. Final adjustments were carried out to refine the emergence profile of the buccal gingival tissues.

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 at fixed gingival sites



Figure 11: Gingival healing at two weeks



Figure 12: Provisional restorations at three weeks

at 3-5 days post-operation. The patient would be reviewed at one week and light toothbrushing was to be commenced at that time. 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



Figure 13: Final restorations



Figure 14: Three-month follow-up view



Figure 15: Three-month probing of tooth #3



Figure 16: Three-month probing of tooth #6

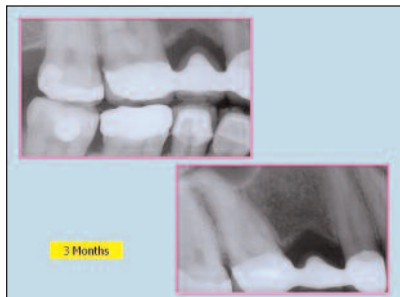


Figure 17: Radiographs at 3 months



Figure 18: Six-month follow-up



Figure 19: Six-month probing of tooth #3



Figure 20: Six-month probing of tooth #6

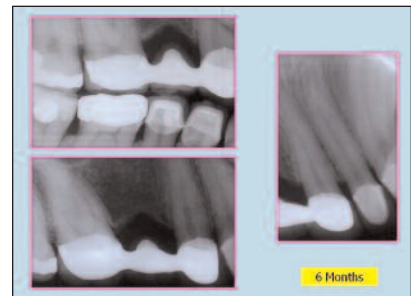


Figure 21: Radiographs at 6 months

the patient's treatment notes, along with the consent details, radiographs, and chartings. 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 (Figure 9), with successive treatment sessions thereafter at weekly intervals (Figures 10-13), to complete the bridge preparation. The soft tissue sites were therefore regularly reviewed initially and at 3 months (Figures 14-17), 6 months (Figures 18-21), and 1 year. The gingivoplasty incisions resolved rapidly during the initial two-week period and the tissue assumed a healthy appearance. The healing was as expected and normal oral function was maintained. The teeth were checked for stability, vitality was

tested, and a positive response recorded.

B. Complications

No long-term complications were observed. The postsurgical site tissue remained stable and normal in appearance. With the placement of provisional and final coronal restorations, it was possible to support the tissue and allow correct toothbrushing.

C. Long-Term Results

The long-term results are in keeping with the objectives of the original treatment plan. The restorative phases of treatment were satisfactorily completed and the patient was very satisfied with the outcome.

D. Long-Term Prognosis

The long-term prognosis of the treatment provided should be considered as good. The patient continues to

maintain good oral hygiene and attends for assessment as required. She is pleased with the aesthetic and functional result obtained.

AUTHOR BIOGRAPHY

Dr. Steven Parker studied dentistry at University College Hospital Medical School, University of London, UK and graduated in 1974. He maintains a 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.

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Disclosure: *Dr. Parker has no current commercial affiliation.* ■