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The use of lasers in fixed prosthodontics

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Treatment planning considerations

The use of lasers in dental treatment often is adjunctive to the fabrication of fixed prosthodontics and, among many patients, this may be their first experience of such devices. Although an explanation of the use and benefits of laser treatment often enhances the patient's appreciation of the standard of care being delivered, care needs to be exercised so as to not engender expectations that are difficult to meet. Certainly, anything that expedites or controls the management of the case only can add to the patient–dentist relationship.

Equally, for the dentist, it should not be forgotten that soft tissue manipulation always involves a period of healing; the precision and coagulative benefits of lasers often can allow restorative treatment phases to proceed with greater confidence, but the ability of tissue to respond to any form of surgery always must be treated with respect.

A thorough grounding of knowledge of the laser wavelength in its interaction with target tissue always must take precedence in the delivery of care to the patient. One of the essential elements of success in fixed prosthodontics is the care and accuracy of the component treatment stages, and the laser often can confer minimal collateral tissue damage through proper consideration of the use of minimal laser energy of the correct wavelength [1].

The final aspect of treatment planning is to guard against any claim or expectation that is unachievable. For example, employing a near-infrared wavelength laser such as a diode or Nd:YAG laser to perform a frenectomy with very fibrous target tissue might require so much incident energy that the risk of periosteum or bone damage is high [2]. In such a case, it may be prudent to use a scalpel to sever the fibrous band first and then complete the procedure with a laser.

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Biologic considerations

Oral tissue is composite in nature, which can compromise the ideal interaction of a given laser wavelength with a target tissue site. The underlying principles of tissue management always apply, whether a laser or conventional instrumentation is used.

The biologic mechanisms that allow healing to take place always follow the same pathways, irrespective of whether tissue injury is due to a scalpel, thermal, chemical, or traumatic cause. Wound protection—blood clotting and plasma retention, elimination of bacterial infection, and other aspects of classic inflammatory response—is followed by an ingrowth of epithelial and endothelial cell types, which then proceeds to maturation of wound healing over time. Scar tissue formation can be affected by the type of tissue, the cause of the wound, and whether healing is by primary or secondary intention.

In an ideal situation, the postsurgical healing restores form, function, and stability to the tissue. When appropriate, the aesthetics of the tissue will be maintained or improved, as is often the desired outcome with fixed restorations. In a "best-practice" scenario, the preservation of biologic width must be kept in mind during surgery. The 2- to 4-mm free-gingival margin, the several millimeters of attached gingiva, the depth of soft tissue overlying alveolar bone, together with other examples, provide the clinician with strict and limited zones of operation, and the result must not be compromised by poor or unexpected healing, poor aesthetics, or loss of tissue function.

Whenever soft tissue is incised using a scalpel, there is a succession of events that dictate tissue management:

1. Bleeding: most intraoral soft-tissue procedures associated with prosthodontics normally involve the cutting of small-diameter vessels (arterioles, venules, and capillaries)
2. Dressings: the aim of any dressing is to stabilize the cut margin to allow healing, to arrest bleeding, to allow clot formation, and to prevent possible disturbance of the incision
3. Contamination: the ingress of bacteria into the incision site, sutures, and dressings is inevitable and acts to compromise the inflammatory response. This event often adds to any postoperative pain or discomfort
4. Short-term follow-up: removal of sutures or dressings
5. Long-term: re-organization of collagen structure with possible shrinkage

Laser–tissue interaction

When soft tissue is incised with a laser (assuming correct laser wavelength per tissue site and appropriate power parameters), the healing often is termed *uneventful*. Almost always, the need for dressings or sutures is avoided. Irrespective of the wavelength, all soft tissue healing is by secondary intention, in that it will be impossible to appose the cut tissue edges to their original alignment. Of note, however, is the phenomenon of lack of postincisional contamination by bacteria due to possible sterility of the cut surface [3] but certainly through the protective layer of coagulum of plasma and blood products, a tenacious film that allows early healing to take place underneath [4]. In addition, studies using longer wavelengths show that there is a lack of fibroblast alignment associated with the incision line and consequent reduced tissue shrinkage through scarring [5]. Such findings often are borne out in the clinical setting and are used to advantage in determining, for example, the level of a gingival margin relative to a crown or veneer.

The action of surgical cutting lasers, whereby the tissue effect is direct, instantaneous, and ablative, is due to a photothermal interaction between the incident beam and target tissue [6]. The coherent nature and, hence, the power of laser light waves lead to a rapid and precise rise in temperature. In a soft tissue target, after this temperature exceeds 60°C, the protein component of the tissue begins to undergo morphologic change. At 100°C and above, inter- and intracellular water vaporizes. Both of these effects cause irreversible changes in the tissue that, if desired and controlled, lead to predictable tissue management. These two effects, when combined, lead to soft tissue shrinkage. In addition, the rise in temperature also leads to sealing of cut blood vessels and initiates the release of factors associated with blood clotting. In hard tissue, the vaporization of the water component leads to explosive disintegration of structure [7].

In consideration of the photothermal effects of laser energy with tissue, there are primary and secondary effects. Primary interaction effects include absorption, transmission, scattering, and transmission. Secondary effects include laser wavelength, tissue (composition), tissue thickness, surface wetness, incident angle of beam, incident energy of beam, emission mode, and exposure time.

It is essential, therefore, for the clinician to choose the laser wavelength that will be absorbed maximally by the target tissue and to regulate the power parameters to create maximal surgical effect while not producing any unwanted collateral damage [8].

With respect to the chromophores for any wavelength, the anatomic structure of oral tissue determines whether interaction with laser energy is on the surface or is deeper into the tissue. For example, carbon dioxide laser energy interacts with its preferred chromophore, water (a component of all tissue cells), to ablate the surface of the tissue. Comparatively, the preferred chromophore of the Nd:YAG laser is pigment, such as melanin or hemoglobin, which is present in deeper cell layers.

Shorter wavelength instruments (488–1064 nm) interact with protein components, causing denaturation and long molecular chain disintegration. This interaction leads to tissue contraction, heat containment, and local conduction; whereas longer wavelengths cause expansive destruction through water vaporization. Seen in cross-section, the cleave profile of a short-wavelength laser is near spheroid; the longer wavelengths produce a narrower, "V" shape that remains shallow through a comparable energy/time scenario [9].

With shorter wavelengths, there is a conductive effect of heat build-up within the tissue, which can lead to distant, unwanted changes, seen often as peripheral tissue edema. This effect is of concern when thin tissue components overlie a deeper, nontarget tissue (eg, thin mucosa tissue over alveolar bone).

With longer wavelengths, there is a less-spherical, more funneled configuration, and heat dissipation is achieved through vapor escape away from the incision site. There is less risk of deep heat effects but greater risk of tissue desiccation due to water vaporization.

The clinician must consider emission modes of the various lasers. These different modes influence the desired laser–tissue interaction and thermal relaxation.

Carbonization occurs when temperatures exceed 200°C, through abuse of any of the parameters governing correct laser–tissue interaction. Carbon's preferential absorption of all laser wavelengths leads to localized heat generation and the occurrence of conductive damaging events [10]. During soft tissue ablation, the surgeon must identify the presence of any carbonized material, commonly called "char," and periodically must use damp gauze to remove such build-up during the ablative procedure.

Throughout any laser procedure that encroaches into the gingival sulcus, adequate protection of the adjacent tooth or implant is important. With shorter wavelengths, damage can be expected through cracking and carbonization; with longer wavelengths, there can be additional hard tissue ablation. Consequently, the employment of any suitable physical barrier (eg, plastic instruments and copings or dulled metal matrix bands) extending into the gingival crevice proves useful to avoid unwanted sequelae. This concept is especially important when using a noncontact handpiece, which often is available with many carbon dioxide lasers.

In summary, predictable tissue cleavage without collateral damage can be obtained by using the correct laser wavelength commensurate with the target tissue composition and used within minimal power parameters to achieve a desired effect, by allowing for thermal relaxation factors within the target tissue, and by avoiding a build-up of char or carbonized products. With such care, predictable healing can occur.

Laser procedures

In everyday practice, the patients' clinical needs are varied and unpredictable. Essential to the running of a successful practice is the recognition of the dentist's capability and ability of meeting the patient's expectation. Each preparation is rendered unique through individual clinical demands. Not least of these is the demand on soft tissue management, from the desire to remove hyperplastic overgrowths that hide a finish line and the desire for predictable gingival retraction to the elective resection of soft tissue as part of a complex cosmetic procedure. The correct use of laser wavelengths as an adjunct to prosthetic restorative procedures can enhance the predictability, accuracy, and speed of case management [11].

Gingival management

Normal gingival tissue is moderately pigmented and predominately composed of collagenous tissue, with minor blood vessels. Inflamed gingival tissue demonstrates some disorganization of collagen structure, the bulk being representative of increased blood supply and intracellular water-suspended proteins. As such, both tissues respond well to most laser wavelengths; however, care should be exercised to establish the risk of unwanted damage to underlying structures.

Gingival management is employed to remove excess or intrusive tissue relative to restorative margins, to enhance the aesthetics of a pontic space, or to establish increased clinical crown length electively.

Case 1: combination of crown lengthening and upper labial frenectomy

This case shows the use of the carbon dioxide laser in the management of excessive or intrusive soft tissue adjunctive to the prosthetic restoration of the upper labial segment.

The patient, a 50-year-old woman, was dissatisfied with the appearance of her upper front teeth. She presented with a high lip-line that revealed short clinical crowns and incisal wear. Teeth numbers 7 and 10 were congenitally missing, numbers 6 and 11 had migrated mesially, and the space between number 5 and 6 had been restored with a fixed bridge. The lip was restrained medially by the presence of a low frenum (Figs. 1 and 2).

The agreed treatment plan involved replacement of the bridge, crown lengthening of teeth numbers 8 and 9, and frenectomy to free the upper lip. Treatment alternatives were explained and consent was given.

Fig. 1. Preoperative view.

Fig. 2. Preoperative view.

Although not ideal, the imposition of time constraints demanded a combined soft tissue/hard tissue treatment. The oral hygiene was excellent, and the comparative low pigmentation of the gingival margins, together with the fibrous nature of the frenum, indicated the use of the carbon dioxide laser [12]. Radiographic and probing assessment revealed sufficient sulcular depth to allow sufficient gingival margin tissue to be removed, consistent with the desired outcome. Following local anesthesia (2% lidocaine, 1:80,000 epinephrine), the laser energy was delivered using the 90° handpiece. The noncontact mode, together with the operating distance of 1 cm, placed demands on the accuracy of the laser cutting. The laser operating parameters were as follows:

Wavelength: 10,600-nm carbon dioxide (Sharplan 20 W; Israel)
Beam diameter: 400 μm
Emission mode: continuous wave
Delivery: hollow wave guide/noncontact hand-piece
Average power: 2.0 W
Exposure time: 45 seconds

The possibility of direct interaction between the laser energy and tooth structure demanded low power. This approach allowed visual appraisal of near-total excision of the gingival margin. Final separation was accomplished with a sharp curette (Figs. 3 and 4).

The frenectomy was performed, using a horizontal cut 0.3 to 0.5 mm above the inferior insertion of the frenum, perpendicular to the facial aspect of the attached gingiva. The lip was extended to apply tension and the incision angle was changed to be parallel to the gingival tissue until sufficient release of the frenum was achieved (Fig. 5).

The laser power parameters were as follows, using the same delivery:

Emission mode: continuous wave
Average power: 3.0 W
Exposure time: 1.0 minute

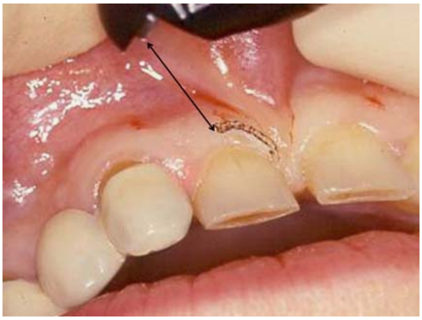

Fig. 3. Laser in use.

Fig. 4. Gingivectomy completed.

Fig. 5. Frenectomy.

At the same treatment session, the teeth were prepared for full-coverage crowns, and provisional restorations were placed. Soft tissue healing was assessed and final impressions were taken 1 week postoperatively (Fig. 6). The final restorations were fitted and, at a 6-month review, the stability of the soft tissue healing and aesthetics were confirmed (Fig. 7).

Case 2: elective procedure to establish greater clinical crown length before crown placement

This case presents similar clinical needs to case 1, but uses the 1064-nm Nd:YAG laser. The patient, a 38-year-old man, was dissatisfied with the appearance of his upper front teeth due to poor proportionality and intrinsic staining. An attempt had been made to mask the problems through direct-resin composite placement, and it was considered appropriate to present a more elaborate treatment option through full-veneer crowns at teeth nos. 6 through 11. The disproportionate size of teeth nos. 7 and 10 and their palatal position relative to the adjacent teeth were of concern (Figs. 8 and 9).

The patient declined orthodontic treatment. It was believed appropriate to raise the gingival margins of these teeth to complement the gum-line and to soften the emergence profile. This treatment was considered achievable in view of the probing depths of the gingival sulcus at each tooth. At least 1 mm of tissue should be retained and no attempt made to compromise the level of attachment. When there is insufficient free-gingival margin or attached gingiva, alternative treatments such as flap surgery should be considered.

Following infiltration local anesthesia (2% lidocaine, 1:80,000 epinephrine), the gingivoplasty procedure at teeth numbers 7 and 10 was performed using the following laser parameters:

Wavelength: 1064-nm Nd:YAG (Incisive Technologies, California)
Beam diameter: 320 μm
Emission mode: free-running pulsed (150 microseconds)
Delivery: quartz fiber–contact
Energy per pulse: 100 mJ

Fig. 6. One-week postoperative view.

Fig. 7. Follow-up at 6 months.

Fig. 8. Preoperative view.

Fig. 9. Preoperative view.

Pulse rate: 20 Hz
Average power: 2.0 W
Exposure time: 45 seconds per site

The use of the Nd:YAG laser was considered appropriate, bearing in mind the nature of the pigmented soft tissue [13] and the comparative absence of carbon deposits at each tooth site (Figs. 10–12), indicating that the chosen power parameters were correct for the procedure. The ideal clinical picture during tissue ablation is the progressive shrinkage of the excised tissue as complete cleavage is approached. The use of the Nd:YAG laser wavelength now is considered contraindicated for dental hard tissue and, when there is risk of interaction, such as in this case, the characteristic gingival margin shrinkage can allow the clinician to complete the separation through the use of a curette.

An interim 1-week period was allowed before the hard tissue procedure was commenced. At this stage, it was observed that the gingiva appeared firm and keratinized, with little erythema (Fig. 13).

The preparation for the crowns was performed for each tooth and fitted 1 week later. The completed case was reviewed at 1 month, at which time it was noted that the gingival tissues had assumed a normal color and structure, with no indication of any marginal shrinkage (Figs. 14–16).

Case 3: elective procedure to establish greater clinical crown length before bridge placement

This case, in similar fashion to the two preceding cases, illustrates the use of the 810-nm diode laser to establish clinical crown lengthening. This was a revision case for a 40-year-old woman in whom the long-standing fixed bridgework (replacing tooth number 4 with numbers 3 and 6 as abutments) would be replaced with a more cosmetic prosthesis. There was sufficient free-gingival margin to allow a simple gingivoplasty procedure at both abutments to offset the elongated pontic profile. Alternative soft tissue plasty procedures at the pontic space had been declined by the patient (Figs. 17 and 18).

Fig. 10. Laser gingivectomy, number 7.

Fig. 11. Laser gingivectomy, number 10.

Fig. 12. Immediate postoperative view.

Fig. 13. One-week postoperative view.

Fig. 14. One-month postoperative view right-side.

Fig. 15. One-month postoperative view left-side.

Fig. 16. One-month completed case.

Fig. 17. Preoperative view.

The treatment plan was presented and verbal consent given by the patient. It was deemed appropriate to remove 1 to 1.5 mm of gingival tissue, and the need for accuracy demanded the use of a contact-mode fiber delivery laser. The following parameters were employed:

Wavelength: 810-nm diode (Diolase, American Dental Technologies; USA)
Beam diameter: 320 μm
Emission mode: continuous wave
Delivery: quartz fiber–contact
Average power: 1.5 W
Exposure time: 1.0 minutes per site

Following infiltration local anesthesia (2% lidocaine, 1:80,000 epinephrine), the excess soft tissue was excised. At each tooth site, the gingival tissue was incised with the laser to a point at which separation was anticipated. The discarded tissue then was separated with a sharp curette to safeguard thermal damage to the underlying tooth tissue (Figs 19–21). At 1 week, the abutments were prepared and provisional restorations fitted. At 2 weeks, final impressions were taken, at which stage the soft tissue surgical sites appeared

Fig. 18. Preoperative view with periodontal probe.

Fig. 19. Laser in use.

Fig. 20. Laser in use.

Fig. 21. Immediate postoperative view.

Fig. 22. Soft tissue status at 2 weeks.

healed, firm, and healthy (Fig. 22). The prosthetic stages proceeded as per normal restorative treatment and a 6-month postoperative view of the final bridge showed good adaptation of the gingival tissues at the crown margins (Fig. 23).

Case 4: removal of gingival overgrowth before recementation of bridge

The patient, a 45-year-old man, had sustained a traumatic fracture of tooth no. 6 (which was the nonvital abutment for a two-unit fixed bridge replacing tooth no. 7) and loss of the distal composite restoration at tooth no. 8. The patient had been advised by the emergency practitioner that the existing bridge was rendered unusable, yet this case typifies the usefulness of a laser to accommodate the changing circumstances in the patient's mouth. Because the patient was away from home, he declined any further treatment at this stage, which allowed the in-growth of gingival tissue at the fracture site (Fig. 24).

As the treatment shows, the fit of the abutment was unaffected by the fracture and, through the use of a stock post and pins, was recemented to extend the life of the bridge.

The nature of the hyperplastic tissue, together with increased blood perfusion, makes the choice of the 810-nm diode laser ideal. Following

Fig. 23. Six-month postoperative view.

Fig. 24. Preoperative view.

infiltration local anesthesia (2% lidocaine, 1:80,000 epinephrine), the excess soft tissue was excised. The presence of coagulated blood products is transitory during temporary fixation of the bridge and is witnessed in the excellent tissue response at 1 week.

Preoperative radiographs and visual assessment are crucial to allow correct appraisal of the condition. Given that the gingival overgrowth was due, in large part, to the nature of the tooth fracture and the time interval, it was considered appropriate to remove the excess tissue with the laser, to reassess the accuracy of fit, and to recement the bridge with temporary cement to allow postsurgical soft tissue healing (Figs. 25 and 26).

The laser operating parameters were as follows:

Wavelength: 810-nm diode (Diolase, American Dental Technologies)
Beam diameter: 320 μm
Emission mode: continuous wave
Delivery: quartz fiber–contact
Average power: 1.5 W
Exposure time: 1.0 minute

At 1 week, the healing of the tissue site was sufficient to allow accurate and correct placement of the abutment, and the bridge was fixed in place. The lost

Fig. 25. Laser in use.

Fig. 26. Immediate postoperative view.

filling at no. 8 was restored at the same visit (Figs. 27 and 28). Adequate reappraisal of the prosthetic stability is necessary to safeguard against further breakdown.

Case 5: soft tissue management adjunctive to crown placement

This case of a 57-year-old man, similar to case 2, illustrates the usefulness and accuracy of 810-nm diode laser treatment in removing gingival in-growth relative to a projected finishing margin for a full-veneer crown.

In this case in which coronal fracture has occurred with an existing indirect restoration, the small yet intrusive amount of soft tissue relative to the mesial aspect of the root face will compromise the management and accuracy of recording of the proposed new margin of the intended crown preparation. Despite the relatively small area involved, this soft tissue incursion represents significant problems for temporization and for final prosthetic replacement of lost tooth tissue (Fig. 29). Equally, the conventional management of such an in-growth can disrupt the expediency of restorative treatment, thus endorsing the usefulness of laser treatment.

Fig. 27. One-week follow-up.

Fig. 28. Bridge recemented.

Visual and radiographic assessment of the tooth (number 6), together with the amount of coronal tooth tissue loss, indicated the provision of a post-supported crown and the use of the laser to assist in tissue removal and provide simultaneous control of bleeding.

The laser operating parameters were as follows:

Wavelength: 810-nm diode (Diolase, American Dental Technologies)
Beam diameter: 320 μm
Emission mode: continuous wave
Delivery: quartz fiber–contact
Average power: 1.5 W
Exposure time: 30 seconds

Following application of topical anesthesia (20% benzocaine), power levels were kept to a minimum to safeguard against pain and collateral thermal damage. Because the tooth was endontically treated and the soft tissue phase preceded tooth preparation, any carbonization of root dentin was of little concern (Fig. 30).

At this initial treatment session, the root canal was prepared for a preformed post to be used as support for a direct composite resin core.

Fig. 29. Preoperative view.

Fig. 30. Immediate postlaser use.

A provisional crown was fitted (Fig. 31). The appearance at 1 week revealed predictable and accurate consolidation of the new gingival margin, relative to the coronal restoration. At this stage, the final preparation was performed and impressions were taken, with the final crown being fitted 1 week later (Figs. 32 and 33).

The predictability of laser-assisted gingival management remains the subject of anecdotal opinion. Research undertaken on cellular response to laser soft tissue incisions indicates that fibroblastic organization is nonlinear compared with scalpel incisions, resulting in minimal tissue shrinkage. This finding is borne out in the clinical situation, provided that correct power parameters are employed. To this end, the soft tissue/hard tissue treatment phases often can be performed simultaneously, without detriment to the final result.

Case 6: soft tissue management adjunctive to crown placement

By way of comparison, the use of the 1064-nm Nd:YAG laser can achieve similar results when tooth fracture has occurred beneath the gingival margin. In this case, the patient was a 48-year-old man who had sustained a fracture of the buccal cusp of tooth number 12 (Fig. 34). Again, as so often is the case,

Fig. 31. Provisional restoration.

Fig. 32. One week—final preparation.

Fig. 33. Final crown fitted.

Fig. 34. Preoperative view.

the accommodation of the soft tissue condition remains a prerequisite to restorative treatment of the tooth, and the use of the laser provides superior management compared with conventional instrumentation. Following infiltration local anesthesia (2% lidocaine, 1:80,000 epinephrine), the laser was used to ablate the overhanging gingival margin. Following this procedure, dentin pins were used to support a direct resin composite core (Figs. 35 and 36). The laser operating parameters were as follows:

Wavelength: 1064-nm Nd:YAG (Incisive Technologies)
Beam diameter: 320 μm
Emission mode: free-running pulsed (150 microseconds)
Delivery: quartz fiber–contact
Energy per pulse: 100 mJ
Pulse rate: 20 Hz
Average power: 2.0 W
Exposure time: 45 seconds per site

At 1 week, the tooth was prepared for a full-veneer crown and impressions were taken. The final restoration was fitted 1 week later and reviewed at 3 weeks (Fig. 37).

Case 7: the use of a quartz fiber delivery laser wavelength as adjunctive to gingival cuff retraction during impression taking

In this case, the patient requested replacement of existing full-veneer crowns on teeth nos. 7 through 10 to improve the anterior aesthetics. Existing clinical signs of marginal gingival inflammation were deemed to be more associated with a poor emergence profile or marginal fit of the current crowns than any deficiencies in oral hygiene (Fig. 38).

Contemporary use of retraction cords in the determination of finishing margins of crown preparations, although time-consuming, often is associated with inappropriate amount of force, resulting in crevicular bleeding and shrinkage of marginal tissue [14].

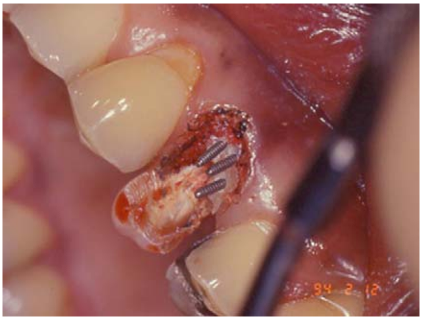

Fig. 35. Laser treatment completed.

Fig. 36. Core build-up.

Fig. 37. Three-week postoperative view.

Fig. 38. Pretreatment.

The 320-μm fiber and especially the 200-μm fiber used in the diode and the Nd:YAG wavelengths allows the delivery of subablative power levels to open the gingival crevice (100 mJ/10 pulses per second) and power levels to coagulate bleeding points (150 mJ/10–20 pulses per second). Often, the use of these power levels can be accomplished without additional anesthesia or with the use of topical gel (20% benzocaine) (Fig. 39). At this time, the impression can be taken to record sufficient marginal detail for the technician to establish correct finishing line for each crown (Fig. 40).

The case shown illustrates the changes in the appearance of the marginal gingival tissues at 1 week when the final crowns were fitted (Fig. 41).

Any attribution of these wavelengths in bacterial reduction at the treatment site [15,16] can be seen in the improvement in gingival margin health at 1 week when the permanent crowns are fitted.

Case 8: the use of an Nd:YAG laser in defining the emergence profile of abutment and pontic space in a combined natural tooth/implant–supported fixed prosthesis

The potential for direct damage to implant surfaces with the 1064-nm wavelength has been shown to be greater compared with other commonly used wavelengths [17]. In cases such as these, there are important and overriding considerations; namely, to minimize heat transfer to the metal implant and to assess radiographically the relationship of the pontic alveolus to the clinically evident profile of the overlying soft tissue. Management of the latter demands correct power levels of the laser beam, whereas the former allows an innovative use of protective acrylic copings to insulate the implant and transmucosal elements from direct laser exposure.

Treatment planning of the use of the laser should be sequential and interrelated as follows:

1. Determination of marginal gingival tissue to be removed to establish correct emergence profile, aesthetics, and ease of post-treatment oral hygiene protocols

Fig. 39. Laser gingival retraction.

Fig. 40. Impression.

2. Determination of amount of pontic tissue to be removed commensurate with the proximity of underlying bone, ultimate aesthetics, and emergence profile of the pontic unit
3. When ultimate results cannot be anticipated as achievable through this approach, consideration may need to be given to further specialist surgical intervention, soft tissue grafts, and osseous tissue removal

This case illustrates the use of the 1064-nm Nd:YAG laser in the management of gingival tissue in a 54-year-old woman. This treatment was part of a complex restorative procedure involving the use of natural teeth and implant abutments and fixed and removable prostheses to correct functional and aesthetic failure of the dental complex (Fig. 42).

Following exposure of the two implants in the anterior mandibular region, fitting of healing caps, and patient review, two acrylic copings were made to slightly overlap the perimeter of the implant analog (Fig. 43). This relationship was confirmed in the mouth by the compression of the gingival margin. The pontic at no. 23 region was deemed convex and the tissue thickness allowed

Fig. 41. Final crowns fitted.

Fig. 42. Preoperative view.

a reduction and flattening of this area to facilitate ease of post-treatment hygiene. Gentle probing of the soft tissue revealed a thickness of 3 to 4 mm. Using the quartz fiber delivery in contact mode, the outline of the tissue to be removed was created and, keeping the fiber parallel to the underlying tissue, the excess was removed using gentle traction (Figs. 44 and 45).

The transitional gold copings at nos. 22 and 27 provided protection for the endodontically treated teeth during osseointegration of the implants; as such, accidental heat damage to coping or tooth was deemed irrelevant. With the gold and the acrylic copings in place, the laser was used to excise excess marginal gingival tissue to leave a cuff that would allow ease of hygiene (Figs. 46 and 47).

The 1064-nm Nd:YAG laser (Incisive Technologies) was employed, using parameters as follows:

Delivery: quartz fiber–contact
Beam diameter: 320 μm
Pulse width: 150 microseconds
Implant abutments:
  Energy: 150 mJ per pulse
  Pulse rate: 20 Hz

Fig. 43. Acrylic copings in place.

Fig. 44. Pontic reduction.

Fig. 45. Excess tissue discarded.

Fig. 46. Gingivoplasty.

Fig. 47. Immediate postoperative laser treatment.

Average power: 3.0 W
Exposure time: 45 seconds per site

Pontic area:

Energy: 100 mJ per pulse
Pulse rate: 20 Hz
Average power: 2.0 W
Exposure time: 45 seconds

Following laser treatment, the healing caps and provisional restorations were refitted, impressions taken at 1 week, and final abutments constructed and fitted. The outcome of this part of the treatment was reviewed at 1 month (Fig. 48).

Summary

There is an understandable dogma worldwide toward the management of soft tissues as they interface with restorative procedures. Contemporary teaching at undergraduate and postgraduate levels recognizes the need for wound healing and stability based on scalpel-induced incisional therapy.

Fig. 48. One-month postoperative view.

The use of laser wavelengths, based on predictable evidence-based protocols, has redefined the management of adjunctive soft tissue to the benefit of the clinician in determining the outcome and the benefit the patient in achieving quality results.

The responsibility of the clinician is to choose the correct laser wavelength for the procedure and to use the minimal amount of power needed to achieve the desired result.

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