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CASE REPORT

Implant Uncovery and Soft-tissue Modification Utilizing a Diode Laser

[1]Gregori M Kurtzman, [2]Lanka Mahesh

ABSTRACT

Diode lasers have become more widely used in dental clinical practice and have demonstrated a safe effective method for treatment in and around implants that require soft-tissue modification to either expose the implant for the restorative phase or reshape the gingival margins for esthetics. The article will discuss the methods that have been employed for soft-tissue modification around implants traditionally and compare these to use of the diode laser.

Keywords: Diode laser, Implant, Second stage surgery, Uncovery.

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INTRODUCTION

Soft-tissue modification to uncover dental implants to initiate the prosthetic phase of treatment can be accomplished by several methods. Traditionally, cutting instruments, such as a scalpel blade or tissue punch has been utilized to incise through the soft-tissue to the underlying implant exposing it for the restorative phase.[1] The resulting bleeding edge can interfere with impressions that may be taken at the same appointment. Postoperative sensitivity can also result due to the fresh cut edge and typically a delay of 2 weeks is required before impressions can be taken so that bleeding does not hamper the accuracy of how the soft-tissue is captured.

An alternative to the blade has been offered, electrosurgery which can cauterize the cut edges and decrease postoperative bleeding. But electrosurgery presents with two negatives to their use in and around dental implants. Electrosurgery requires a circuit to be formed between the monopolar tip intraorally and the surgical unit, via a grounding plate which is placed on the patient a distance from the oral cavity. When the unit is activated, current flows between the electrosurgery tip through the soft-tissue to the grounding plate, completing the circuit. When an implant is being directly treated or near the area being treated, the metallic implant conducts the current along the path completing the circuit.[2] As temperature increases over a threshold of 10°C at the osseous interface between the implant and surrounding bone may lead to bone loss and possible deintegration of the implant. The practitioner is also advised with its use around crowns with metallic bases or amalgam restorations as these also can conduct current and can transfer this as the circuit is completed to any implants in that quadrant leading to either a short-term failure or devitalization of the bone around the implant that can cause a long-term failure. A general recommendation is to avoid electrosurgery units in and around dental implants. Electrosurgery has a deeper penetration, affecting 300 to 500 cell layers deep to the surface. This combined with the temperature increase reported at the area cut leads to tissue shrinkage which necessitates waiting for healing of 2 weeks or more before an impression can be taken so that the gingival margin is in a stable position.[3]

When we think of lasers, we initially think of instruments for cutting, specifically soft-tissue. Diode lasers are efficient tools for cutting and surgically modifying soft-tissue and have been in wide use for procedures, such as soft-tissue crown lengthening, troughing for improved impressions and gingivectomy to gain access to caries on the root as well as esthetic recontouring. Aside from these mechanical/functional applications, lasers have also been proven to aid in periodontal treatment not only to improve healing, but also allow the host system to repair the damage from the periodontal disease. With their clinical benefits, the diode laser is ideally suited for implant uncovery and tissue modification around implants.

DIODE LASERS: HOW, WHAT AND WHY

Diode lasers are becoming increasing utilized in dental practices both due to lower costs to implement this technology then the more expensive CO_2 and ND:YAG lasers and the wide range of effective treatment afforded by these devices. Diode lasers, such as the Picasso (AMD Lasers, Indianapolis, IN, www.amdlasers.com) provide sufficient power to modify soft-tissue in and around the

[1,2]Private Practitioner

[1]Private Practice, Silver Spring, Maryland, United States

[2]Private Practice, The Dental Center, Panchshila Park, New Delhi, India

Corresponding Author: Gregori M Kurtzman, Private Practitioner 3801 International Drive, Suite 102, Silver Spring, Maryland 20906 United States of America 301-598-3500, e-mail: drimplants@aol.com

dental implant for uncovery or alteration of the gingival margin to improve the esthetics while operating within the temperature range recommended so that negative effects do not occur to the bone around the implant.[4] Additionally, coagulation can be controlled allowing impressions to be taken at the time of uncovery without fear of blood interfering with the accuracy of the gingival aspect of the impression. As cutting the tissue with the diode does not affect deep layers of cells in the gingiva, unlike an electrosurgery unit, tissue shrinkage is not a concern and gingival healing does not need to complete before impressions can be taken.[5-9]

Energy from the diode laser is absorbed by hemoglobin, melanin, pigmentation and water. Dentin, enamel and titanium as they do not contain these factors are unaffected by the diode laser. Yet gingival tissue does contain these factors and the diode has the benefit of cutting, coagulation and enhanced sterilization within the soft-tissue at the site of laser contact. The advantages of the diode laser compared to electrosurg are more precise results due to significantly reduced zone of necrosis at the contact (diode laser = 3–5 cells deep, electrosurg 300–500 cells deep), shorter healing times due to the lower number of cells effected. Which yields less tissue shrinkage upon healing (recession is virtually eliminated from healing) and elimination of tissue charring (common when electrosurg is utilized) (Fig. 1).

Diode lasers are used primarily in a contact application when cutting or coagulation is required.[10] The tip of the diode laser can be used in either an initiated state or an uninitiated state. Initiated refers to the tip has been coated with a blocking material so that energy from the diode when activated heats the tip causing cell ablation (vaporization) and cutting results.[11] The light energy is converted into heat by refraction of the blocking material on the diodes tip creating a 'hot tip'. This secondary thermal effect of the heated tip allows cutting or incising of the soft-tissue. At the border of the vaporization, an area of carbonization results. Tissue is coagulated bordering this zone of carbonization as a result of contact with the overheated tip rather than by the laser energy itself. An unitiated diode tip is useful for bacterial decontamination either on the implants surface or within the periodontal sulcus/pocket.

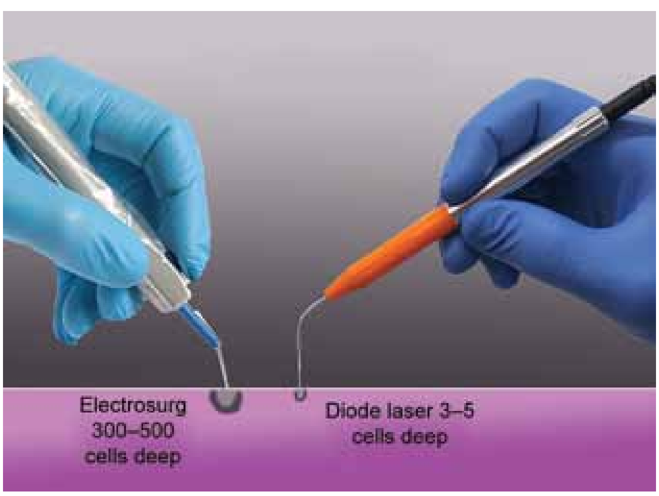

Fig. 1: Comparison of depth of the zone of necrosis of an electrosurg and diode laser

To initiate the tip, the diode is set at 0.5 watts and touched to a piece of blue articulating paper (Bausch Ref BK05) then activate the foot pedal for 1 second. This is repeated 6 to 8 times contacting different areas of the tip so that when finished the entire tip and 3 to 4 mm of the sides has been marked with the articulating paper. Articulating ribbon should be avoided for this as it will ignite and is ineffective in initiating the tip. A properly initiated tip should glow orange when the foot pedal is depressed.[12] When cutting fiberous tissue it may be necessary to reinitiate the tip during the procedure when the tip appears to not be cutting well. Additionally, the tip should be wiped with a piece of dry gauze to remove debris periodically as it is being utilized to maintain efficiency.

The higher the wattage, the faster the soft-tissue is vaporized, but the greater the other zones of unwanted lateral thermal damage may be. It is advised to use the lowest wattage to accomplish the task to avoid the risk of thermal damage within the adjacent tissue. During usage the assistant uses the HVE near the site to remove any odors and periodically can spray water on the site to aid in cooling the tissue and minimizing thermal issues which improves healing initially. A setting of 0.8 to 1.0 watts in a continuous mode is usually sufficient to remove the soft-tissue covering the implants cover screw or reshape the tissue for esthetics. A 400 micron diode tip (orange) is utilized and these are designed for oral surgical applications. A 300 micron tip (purple) is designed for periodontal applications, such as laser assisted periodontal treatment (LAPT).

The area of vaporization is surrounded by a thin area of carbonization which signifies the extent of the ablated tissue where it has interacted with the diodes tip (Fig. 2). Beyond the carbonization is an area of hemostasis (coagulation) that the diode has caused and typically sites treated with the diode laser will demonstrate little to no bleeding depending on the condition of the tissue prior to treatment. With these coagulation affects immediate implant impressions can be taken without hemorrhaging affecting the impressions marginal accuracy.

The laser will also create an area of biostimulation adjacent to the coagulation area. Tissues and cells following irradiation, have a biostimulatory effect that allows faster or more favorable wound healing, as

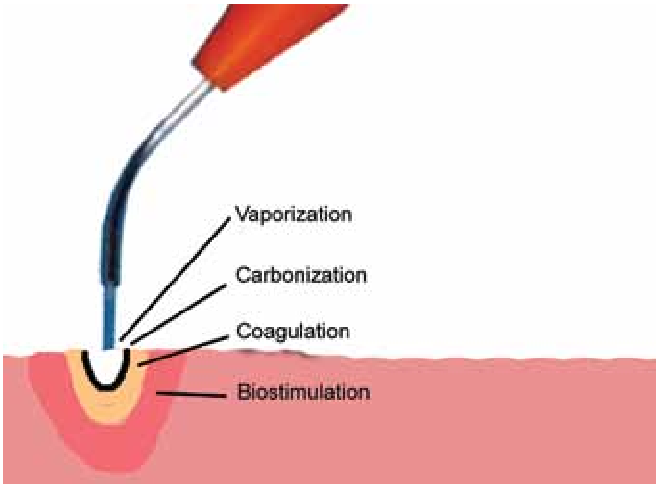

Fig. 2: Tissue reaction upon contact with an initiated diode laser tip demonstrating the effect as one moves away from the tip

compared to tissue treated with a scalpel or electrosurgical unit. The laser irradiation stimulates the proliferation of mesenchymal stem cells without causing DNA alterations in the affected cells.[13] Wound healing is enhanced and the soft-tissue at the cut edges demonstrates faster healing then when treated with a scalpel or other methods by stimulation of gingival fibroblasts inducing growth factors.[14,15]

Other authors report that biostimulation via the diode laser also has a positive affect on the bone cells and can be stimulatory to the bone cells at the crest around the implant.[16,17] When compared to conventional methods tissue healing as well as postoperative sensitivity was less with the diode laser than with other methods.[18]

TECHNICAL CONSIDERATIONS

The width of attached gingiva remaining will dictate how the implant is uncovered (Fig. 3A). When a wide band of attached gingiva is present and a sufficient amount (3 mm ideally) will be present after uncovery on both the buccal and lingual then the diode laser is activated and inserted at the center of the site and worked in a spiral pattern outward until the entire cover screw is exposed (Fig. 3B). It may be necessary to use a curette or other instrument to loosen the tissue over the cover screw as the periosteum during implant healing becomes adherent to the titanium cover screw. Sites that present with a narrow width of attached gingiva of 3 to 5 mm to the buccal and lingual of the crests center will require some conservation of the remaining attached gingiva. In this instance, the diode is utilized to remove an elliptical piece of soft-tissue over the cover screw and then the tissue is pushed buccally and lingually to preserve the attached gingiva (Fig. 3C). If less attached gingiva is present on either side of the center of the crest then the practitioner will need to preserve all of the attached gingiva present and a conventional flap is recommended to be able to position the tissue in a more apical direction. When this is necessary incisions can be made with the diode laser as an alternative to a scalpel.

CASE REPORT

A 30-year-old female patient presented with severely malposed maxillary central incisors tipped facially and a desire for esthetic improvement. A cone-beam computed tomography (CBCT) was taken and noted minimal bone was present over the facial of the central incisors. Options for treatment were presented to the patient which included: orthodontics to correct esthetics or extraction of the central incisors, placement of implants at these sites and restorations on the anterior teeth. The patient indicated that she did not wish to pursue a orthodontic treatment option due to the time involved.

The patient presented for surgery and the central incisors were atraumatically extracted under local anesthetic. The adjacent teeth were prepared for crowns, which would support a provisional bridge during the healing/integration period. A 4 mm wide 24° co-axis implant (Keystone Dental, Burlington, MA) was placed into the osteotomy at each central incisor orienting the prosthetic axis to a vertical position while the implants body followed the trajectory of the premaxilla. A healing screw was placed and osseous graft material (NovaBone, Jacksonville, FL) placed on the facial to thicken the resulting bone. The soft-tissue was closed with resorbable

Figs 3A to C: Implant to be uncovered (A) presents with two options depending on width of attached gingiva available. Wide band of attached gingiva will remain after removal of tissue over cover screw, the diode is utilized in a spiral pattern starting at center until fully exposed (B). Narrow band of attached gingiva present, an elliptical cut is made with the diode and tissue is pushed buccally and lingually to preserve the attached gingiva (C)

PGA sutures. A stent created over the wax-up of the study models that had been modified was filled with an auto-cure provisional resin (Perfectemp 10, DenMat, Lompoc, CA) and seated over the anterior and allowed to set. Upon setting the stent with provisional was removed intraorally and trimmed and polished. The material at the implant sites was shaped to a bullet shape to assist in forming an emergence profile in the soft-tissue and preserve the papilla's.

Six months post implant placement, the provisional bridge was removed and preservation of the papilla's was confirmed with a natural emergence profile within soft-tissue (Figs 4 and 5). Local anesthetic was administered. The Picasso diode laser (AMD Lasers, Indianapolis, IN, USA www.amdlasers.com) was set at 0.8 watts and increased slowly to 2.5 watts in continuous mode until the fiberous tissue overlaying the implant cover screws cut. An initiated tip was placed at the center of the depression from the pontics of the provisional bridge in the soft-tissue above the implants cover screw and moved in an increasing circular motion moving outward until the entire cover screw was exposed (Fig. 6). The diode cuts the desired soft-tissue and coagulates any bleeding from the cut edges. This was then repeated on the second implant (Fig. 7) cover screws were removed from both implants (Fig. 8). Open tray implant impression abutments were placed into the implants and seating verified radiographically. An impression of the maxillary arch was taken utilizing Aquasil heavy body VPS (Caulk, Milford, DE) in a Mira Advanced Implant tray (Hager Worldwide, Hickory, NC) and Aquasil Ultra syringed around the preparations and implant abutment heads. Healing abutments were placed into the implants (Fig. 9). The previously placed provisional bridge was tried in and modified at the pontics to allow the bridge to fully seat over the healing abutments and luted with a provisional cement (Fuji Temp LT, GC America, Alsip, IL).

Two weeks later, the prosthetics returned from the lab (DenMat Labs, Lompoc, CA) and the provisional bridge was removed. The healing abutments were removed and the soft-tissue demonstrated a lack of inflammation and a good periodontal health where it had been modified by the diode laser (Fig. 10). Ceramic crowns were tried in on teeth 7, 10 and 11 and the screw retained zirconia

Fig. 4: Buccal view of the anterior maxilla demonstrating preservation of the papilla due to the provisional bridge

Fig. 5: Occlusal view of the anterior maxilla demonstrating preservation of the papilla due to the provisional bridge

Fig. 6: Picasso diode laser removing soft-tissue to uncover the implants cover screws

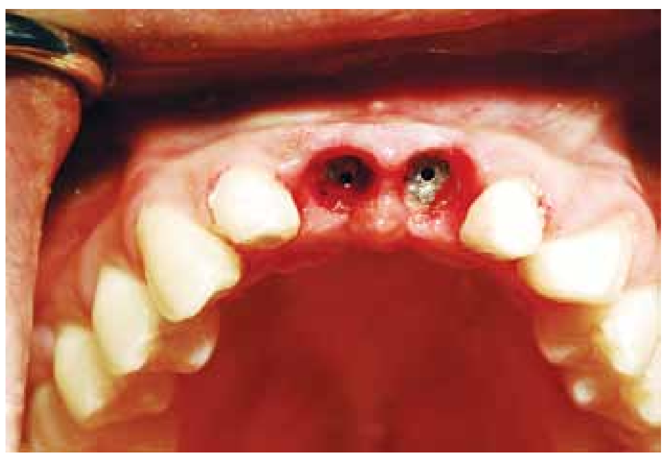

Fig. 7: Uncovery of the implants and healing screws exposed

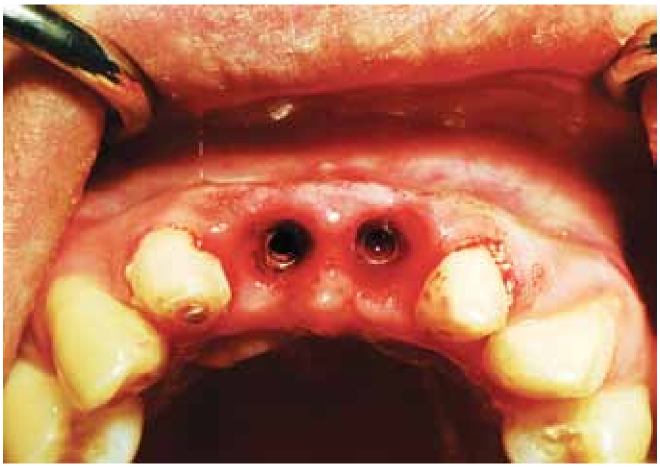

Fig. 8: Uncovery of the implants and healing screw removal

Fig. 9: Healing abutments placed into the implants

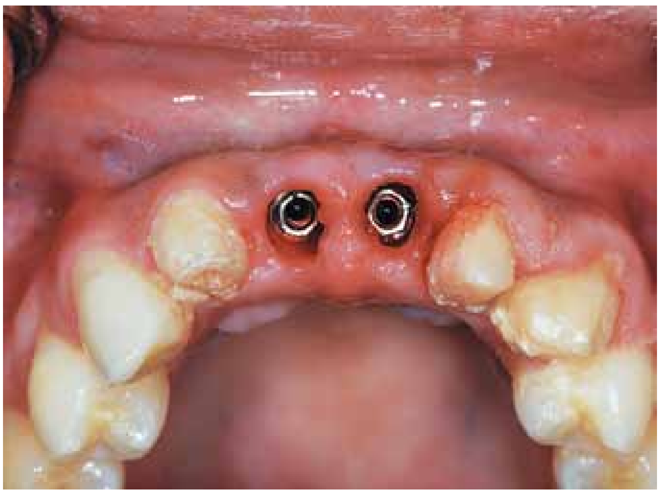

Fig. 10: Removal of the healing abutments at 2 weeks post uncovery demonstrating a lack of inflammation of the modified soft-tissue

based implant crowns inserted. A radiograph was taken verifying fit of the implant prosthetics. A torque wrench was utilized to tighten the fixation screws on the implants to 30 Ncm and the ceramic crowns were luted with Panavia SA resin cement (Kuraray, NY). Occlusion was checked and adjusted where needed.

CONCLUSION

Diode lasers are a useful adjunct to soft-tissue modification to uncover dental implants or esthetically recontour the gingival margin. Providing better safety than electrosurgery, while maintaining a temperature profile within the safety range of bone. Additionally, they do not cause tissue shrinkage that can affect the esthetic outcome. As the diodes tip provides simultaneous cutting and coagulation (hemostasis), it offers a clear advantage to the use of a scalpel or tissue punch permitting immediate impressions without site bleeding affecting the accuracy of the captured soft-tissue contours and position.

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