The diode laser as an electro surgery replacement

In 2008, Dr. Gordon Christensen wrote an article in JADA comparing the soft tissue cutting abilities of diode lasers to those of electrosurgery units (radiofrequency units).1 In comparing these two technologies against each other, he found that both dental lasers and the less expensive electrosurgery units have advantages and disadvantages, and he summarized with several key points:

1. Although there was considerable overlap in their uses and both technologies were effective, Christensen found that diode lasers were able to be used around metal (alumina and gold) as well as with dental crowns

2. He stated that lasers did not harm dental hard tissues (bone) or soft tissues (pulp), and that the clinician could use the laser with less anesthetic, and finally he mentioned that lasers were antimicrobial (antibacterial).

3. The acceptance and use of lasers, especially diode lasers, was increasing in dentistry, and that lasers attract patients because of their recognized and potential clinical benefits.

4. Electrosurgery units were “far less expensive than the least expensive bipolar (two electrodes) electrosurgery units to those of electrosurgery units” (Table 1). Perhaps the greatest benefit of these lasers is that they allow the clinician to work safely around metals. The literature has shown that monopolar electrosurgery units can accidentally create catastrophic results when touching metal introrally. Published reports have shown that contact for very short periods of time with the electrodes of a monopolar electrosurgical unit can cause both pulpal and periodontal problems, bone loss,7 severe intrasural burns,8 and that within three seconds of exposure to a dental implant electrosurgical unit can cause failure of osseointegration and loss of an implant.9

5. In clinical practice, with today’s emphasis on the more esthetically pleasing composite resins and newer porcelains, there are still many metallic materials used introrally, including cast partial dentures, frameworks, gold, alumina, orthodontic brackets and semi-precious alloys. Laser diodes, unlike their electrosurgical counterparts, show little interaction with metallic objects used introrally. It is important to remember that due to the laser’s ability to reflect off mirrored surfaces and potentially cause eye damage, that all members of the dental team as well as the patient must wear laser safety glasses for eye protection if they are within the nominal hazard zone (NOHZ) during laser operation. This zone must often be kept between 3 and 7 feet, but some diodes can have extended NOHZ ranges of 40 feet. Orthodontic patients will often exhibit gingival hyperplasia when brackets that can make it difficult to work on them. This overgrowth of tissue can be due to poor oral hygiene, space-closing mechanics, excess cement or a combination of factors. The diode laser can be used for gingivectomy procedures to safely remove and reconstruct the excess tissue and healing can be remarkable in a very short period of time (Figs. 2-4).

Ability to work around dental implants

Diode lasers in the range of 810-1,064 nm are well absorbed in hemoglobin, melanin (pigment) and to some degree water (Fig. 1). These mid infrared wavelengths in the absorption spectrum offer the dental clinician the ability to ablate soft tissues precisely while controlling hemostasis, providing the clinician with an excellent view of the surgical site with a reduced reliance on sutures. Diode lasers have features that make them attractive as mentioned earlier, but they also have several advantages in function over electrosurgical units (Table 1).

Advantages of the diode laserr over electro surgery

Ability to work around metals introrally

Although electrosurgical units are inexpensive, require no safety glasses and can remove large amounts of tissue quickly, diode lasers have become much more common in dental operatories in the last four years since Christensen’s article was published. The primary reasons for their increased popularity are that diode lasers have a small footprint, are reliable and durable lasers, and are portable. Where a few short years ago, diode lasers could cost in the range of $10,000 to $15,000, they are now cost effective and can be purchased for less than $2,900.

Ability to work around metals introrally

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Ability to work around dental implants safely

Various laser wavelengths that are available today can offer the clinician who needs to expose an implant during second stage surgery an alternative to traditional methodologies. The ability of the diode laser to ablate tissue, at times without the need for local anesthetic, while controlling hemostasis, provides the clinician a great view of the surgical site. In addition, the diode wave- length, like all laser wavelengths, provides for decontamination of the implant site through its anti-bacterial actions. Furthermore, revascularization with the diode laser can lead to an almost sterile operative field (98 percent reduction of pathogenic bacteria). Finally, there is a growing body of evidence that suggests that lasers used at lower energy settings can have a bioim- munomodulatory effect on tissue, which can turn out to be therapeutic, provide comfort, improve healing and shorten healing times while even improving early osseointegration.

As an aside, there have been clinicians who routinely use monopolar electrosurgical units to expose implants. It is imperative to realize that although more expensive bipolar (two electrodes) electrosurgical units can be used safely around implants, that the more commonly purchased single electrode (monopolar) units may damage the implant surface and result in a detrimental de- seointegration with resulting implant failure with contact times as short as three seconds.10,11 Lasers, in contrast, can be used safely with tremendous cooperation and reduction in pain postoperatively for the patient (Figs. 5,6).

Reduced need for anesthetic

Monopolar electrosurgical units do not have the ability to be used routinely without local anesthetic. In contrast, diode lasers can often be used either with low wattages or in pulsed modes to remove minor to moderate amounts of soft tissue with only topical anesthetics. Although at times this may not seem significant to the clinician, there are many instances where soft tissue acts as a barrier to ideal restorative treatment, and if local anesthetic can be eliminated it becomes a big selling point to patients.

Many patients are looking for alternative to local anesthetics, and when the occasion allows for the procedure to be completed without the patient being numb, the overwhelming majority of patients are grateful for this.

Table 1: Comparison of diode laser versus monopolar electrosurgical units

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Table 1: Comparison of diode laser versus monopolar electrosurgical units

Figure 1: Absorption curve of various tissue components shows diode lasers to be well absorbed in melanin (pigment), hemoglobin and to some degree water (Images Provided by Glenn A. van As, BSDc, DMD

Table 2: Comparison of diode laser versus monopolar electrosurgical units.
crown troughing for tissue management around endodontically treated teeth, exposure of partially erupted canines for orthodontic brackets and gingivectomy to uncover soft tissues can be safely and precisely completed on the same day as the preparation and impressions of these teeth. The risk of recession and exposure of margins can be far less with a diode laser than with other techniques, particularly when nadir equate magnification (e.g., 4.0X loupes) and cautious settings (0.6-0.9 w continuous wave) are used for the recontouring.

When biologic width is respected, and adequate attached and keratinized tissue exists, then judicious recontouring of the gingiva on the same day as the preparations can yield stunning results (Figs. 17-19).

The diode laser has become a popular technology as an alternative for tissue management compared to the traditional methodologies of placing a single or double retraction cord in the sulcus. The diode laser can be used in almost all instances to produce gingival retraction as an alternative to cord with excellent results both in terms of gingival retraction and margin delineation for the laboratories.

Unlike electrosurgical units where recession can be an issue, as can postoperative pain, diode lasers offer the clinician the ability to precisely remove overhanging, inflamed tissue while creating a gingival trough that is not likely to cause damage to bone, cementum or pulp tissue like electrosurgical units can. In addition, there is research that suggests that the lateral thermal damage done with lasers is significantly lower than that with electrosurgery.

Ability to photoablate vascular lesions and treat oral lesions

One of the advantages of a diode laser is the ability to treat oral lesions, including: recurrent aphthous ulcers (RAU), venous lake lesions of the lips and herpetic lesions. Research has shown that lasers can be safely used to treat these lesions,26-28 and in addition it is possible that if caught early during the prodromal stage that herpetic lesions can be aborted or significantly reduced in terms of length of time they are present. In addition, it has been the author’s experience that, once treated operatively, the lesions are often less likely to reappear in the same area. In fact some evidence suggests that herpetic lesions treated in the early stages with the diode laser can cut the healing time in half and create a remission period that is twice as long before it recurs.29

Vascular lesions called venous lakes or hemangomas can occur on soft tissue areas including the upper and lower lips, buccal mucosa, and palate. These lesions can be difficult to treat with traditional methods where significant bleeding in occurring. The diode wave lengths are rapidly absorbed by hemoglobin and therefore can be used to coagulate and eradicate these esthetically undesirable purplish lesions often with only topical anesthesia. Literature has shown that the diode can be used in almost 100 percent of cases to eliminate these lesions, most often in only a single session lasting only a couple of minutes30-35 (Figs. 20-22).

Anti-bacterial capabilities of lasers

Many articles in the literature have demonstrated the tremendous ability of all lasers with respect to the reduction of bacterial and even fungal contaminants.36 The excellent antibacterial capabilities make lasers effective and desirable in many areas in the oral cavity where the risk of postoperative infection may be reduced. Electrosurgical units do not typically possess the same ability to provide bacterial reduction as lasers do. Particular interest is now occurring with the role of lasers in endodontic, periodontic and peri-implantations cases where there is need to reduce bacterial loads without such a great reliance on antibiotics.

Although more research is needed on how the bactericidal capabilities of the diode laser might be beneficial in these areas, there is no debating that all lasers can help healing through decreasing the risk of infection through laser light alone (Figs. 25-29). In addition, growing research has demonstrated that the risk of high bacterial loads in periapical pockets and in particular in endodontic cases may be reduced by lasers.

This latest research has implications for improving traditional methodologies locally where used, and in helping to reduce the potential greater systemic health risks generally. The role of lasers continues to be researched today, but present research has shown that diode lasers can be used safely within root canals with minimal fear of developing iatrogenic complications when conservative settings are used.36-43

Conclusion

The diode laser has become the “soft-tissue handpiece” in many dental offices. The advantages of being able to work around metals including dental implants, a reduced need for anesthetic, a reduced risk of recession post-operatively, the ability to reduce bacteria, and to use the diode to photoablate vascular lesions has given all dentists a new alternative for soft-tissue surgery.

Lasers have two added benefits in that they do not require a pad to be placed under the patient for grounding, and they can be used safely with pacemakers. Diode lasers have found their place in dentistry. Once considered an application looking for a purpose, these small, cost-effective and reliable lasers have discovered their niche as the new go to solution for many soft tissue problems in our daily dental practices.

References


Full list of references is available from the publisher.

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