The diode laser as an electrosurgery replacement

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In 2008, Dr. Gordon Christensen wrote an article in ADA comparing the soft tissue cutting abilities of diode lasers to those of electrosurgery (radiosurgery) units. 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 (amalgam and gold) as well as with dental materials.

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 anesthetics, and finally he mentioned that lasers were antimicrobial (antibacterial).

3. The acceptance and use of lasers, especially the diode laser, was increasing in dentistry, and that lasers attract patients because of their recognized and accepted role within the field of medicine (LASIK eye surgery).

4. Electrosurgery units were “far less expensive than the least expensive diode lasers” and he questioned whether “the advantages of the diode laser were significant enough to compensate for the additional cost.”

There are two basic types of electrosurgical units that can be purchased in dentistry:

- Monopolar, in which a single electrode exists and the current travels from the unit down a wire to the surgical site. The patient must be grounded with a pad placed behind the patient’s back (a part of the procedure that many patients find unpleasant).

- Bipolar, in which two electrodes are placed in very close proximity to each other. Bipolar units are more expensive than diode lasers and the electrical current flows from one electrode to the other, thus eliminating the need for a grounding pad. Bipolar units, because of the two wires, create less of a precise cut than the monopolar or diode laser.

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 operations in the 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.

Advantages of the diode laser over electrosurgery

Ability to work around metals intrinsically

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 tissue laser wavelengths in the absorption spectrum offer the dental clinician the ability to ablate soft tissues precisely while controlling hemo-stasis, 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).

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 intrinsically. 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, severe intraosseous burns, and that within three seconds of exposure to a dental implant electrosurgical unit can cause failure of osseointegration and loss of an implant.10

In clinical practice, with today’s emphasis on the more aesthetically pleasing composite resins and newer porcelains, there are still many metallic materials used intrinsically, including cast partial/lateral frameworks, gold amalgam, orthodontic brackets and semi-precious alloys.

Diode lasers, unlike their electrosurgical counterparts, show little interaction with metallic objects used intrinsically. It is important to remember that due to the diode 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 is most often 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 gingivectomies to safely remove and recontour the excess tissue and healing can be remarkable in a very short period of time (Figs. 2-4).

Ability to work around dental implants safely

Various laser wavelengths that are available today can offer the clinician who needs to expand an implant during second stage surgery an advantage over traditional methodologies. The ability of the diode laser to ablate tissue, at times without the need for local anesthetic, while controlling hemo-stasis, provides the clinician a great view of the surgical site.

In addition, the diode laser wavelength, like all laser wavelengths, provides for decontamination of the implant site through its anti-bacterial actions. Fast wound healing with the diode laser can lead to 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 biomimimatory effect on tissue, which enhances tissue quality, improves patient comfort, improves healing and shortens healing times while even improving early osseointegration.11

As an aside, there have been clinicians who routinely use monopolar electrosurgery units to expose implants. It is imperative to realize that although more expensive bipolar (two electrodes) electrosurgery units can be used safely around implants, that the more commonly purchased single electrode (monopolar) units may damage the implant surface and may lead to difficulties with osseointegration with resulting implant failure with contact times as short as three seconds.9,12 Lasers, in contrast, can be used safely with tremendous coagulation and re- duction in pain postoperatively for the patient2(Figs. 5, 6).

Reduced need for anesthetic

Monopolar electrosurgery units do not have the ability to be used routinely without local anesthetic. In contrast, diode lasers can often be used either with low voltages 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 anesthetic, and when the occasion allows for the procedure to be completed without the patient being numbed, the cooperation and comfort of patients are grateful for this. Situations such as laser gingival...
crown troughing for tissue management around endodontically treated teeth, exposure of partially erupted canines for orthodontic brackets and gingivectomy, or soft-tissue recontouring of lateral incisors and canines for orthodontic treatment. Exposure of parodontic brackets and gingivectomy, or crown troughing for tissue management around endodontically treated teeth, exposure of partially erupted canines for orthodontic brackets and gingivectomy, or soft-tissue recontouring of lateral incisors and canines for orthodontic treatment.

The diode laser becomes a popular technology as an alternative for tissue management compared to the traditional methodology 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.

Abnormalities of the diode laser are the ability to treat oral lesions, including: recurrent aphthous ulcers (RU), venous lake and oral lesions of the lips and herpetiform. The ability to treat oral lesions makes lasers effective and desirable in many areas in the oral cavity where the risk of postoperative infection may be reduced. Diode lasers do not typically possess the same ability to provide bacterial reduction as lasers do, but present research has shown that all lasers can help healing through decreasing the risk of infection through laser light alone (Figs. 25-27). In addition, growing research has demonstrated that the risk of high bacterial loads in periodontal pockets and in particular in endodontic canals 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. 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.

Conclusion

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

Laser procedures 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 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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