Lasers in Orthodontics

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ABSTRACT

Brief background: This paper describes a treatment modality that an orthodontist should incorporate into his/her office. Soft tissue diode lasers, should be used for, exposure of unerupted teeth, frenectomy, and treatment of aphthous ulcers.

Materials and methods: Total of five cases have been described. All were treated with soft tissue diode laser (Sirona Advance) with average power setting of 1.0 to 1.8 W in peak pulsed frequency. Intraoral periapical X-rays were used to determine position of teeth wherever required.

Results: The article shows simple procedures which can be easily carried out by an orthodontist. Unerupted teeth can be successfully exposed by means of soft tissue diode laser. The single most advantage could be excellent postoperative healing, almost bloodless field for carrying out bonding procedures.

Summary and conclusion: Incorporation of lasers in an orthodontic practice requires thorough learning process on the part of the orthodontist. Attending various workshops and certification programs will help in mastering the science and art of laser dentistry. Needless to say, proper case selection will pave way for the successful long-term result.

Keywords: Unerupted teeth, Frenectomy, Soft tissue diode laser, Quicker healing process.


INTRODUCTION

Dental lasers have revolutionized treatment delivery systems. Laser technology is aiding orthodontists perform various procedures like exposure of unerupted teeth, frenectomy or treatment for aphthous ulcers. It can also be employed for gingival contouring procedures post orthodontic treatment. The advent of laser treatment has enabled a convenient and less traumatic treatment for certain soft tissue surgical procedures in orthodontics.

Lasers offer numerous advantages when contrasted with traditional scalpel surgery. Soft tissue excision is more precise with a laser than a scalpel.1 A laser coagulates blood vessels, seals lymphatics and sterilizes the wound, maintaining a clear and clean surgical field.2 This is termed as biodressing.3 Additionally, minor aphthous and herpetic ulcerations can be vaporized. Laser surgeries are routinely performed by using only topical anesthetic, which is particularly beneficial in orthodontic practice.3 Laser applications have no need for irritating sutures or unsightly periodontal dressing.4 The minimal amount of bleeding is helpful in successfully achieving isolation necessary for direct bonding. A report suggested that laser excisions produce less scar tissue than conventional scalp surgery,5 although contrary evidence also exists.6,7 Postsurgically, patients report less discomfort and fewer complications.8 There is markedly less bleeding (particularly for frenal surgery), minimal swelling, and complications (speaking and chewing), and require fewer analgesics than do patients treated with conventional scalpel surgery.4 The benefits of laser surgery are best summarized by Sarver and Yanosky:2

‘Soft tissue lasers result in a shorter operative time and faster postoperative recuperation.’

DIFFERENT TYPES OF LASERS (TABLE 1)*

CASE REPORT

Different categories of patients were treated with soft tissue diode laser having wavelength of 980 nm, with size of the fiber being 320 microns. For all the different types of applications described in this article, power setting was kept at an average of 1.0 to 1.8 W with peak pulsed (PP) frequency in contact mode, except for aphthous ulcer treatment where PP frequency in noncontact mode was employed. Contact mode gives us the advantage of tactile sensation which is integral in achieving strikingly accurate results.

For anesthetic effect either lignocaine hydrochloride local anesthetic or topical anesthetic Mucopain (benzocaine gel USP-ICPA Health products Ltd) was utilized as a surface anesthetic. When applying topical anesthetic, following protocol was observed:

1. Dry the mucosa with 2 × 2 gauze;
2. Apply 0.2 ml (equivalent to 1 cotton swab head) of topical anesthetic to the mucosa for no longer than 5 to 7 minutes, because prolonged application can cause tissue irritation; and
3. Confirm anesthesia with a perioprobe, since peak anesthesia occurs after 7 minutes and lasts approximately 25 to 30 minutes.9

**Exposure of Unerupted Teeth**

In case 1 and 2, Figures 1 to 6 respectively, unerupted teeth were exposed with diode laser. Diode laser was utilized only for soft tissue. Postanesthetic effect, the unerupted tooth was felt with either an explorer or a probe. Enamel will feel very hard, compared to bone which will be more porous and tough in nature.10 Effective average power was 1.0 W, PP frequency, contact mode.

**Frenectomy**

Midline diastema is a cause of concern, beyond ugly duckling stage, more so when it is due to large, thick or inferiorly attached labial frenum. Case 3, Figures 7 to 9, frenectomy was performed to remove thick fibrous tissue and relocate labial frenum. Power setting was kept at 1.5 W, PP frequency, contact mode. The frenum should be gently stretched, and using brush strokes at the base of the fibrous attachment the tissue is excised. The key to successful surgery is removal of the interdental fibrous tissue without removing large portion of the frenum, but relocation of the frenum superiorly.11

**Gingival Recontouring**

Occasionally, orthodontic treatment can result in gingival hyperplasia. Excessive gingival growth can be tackled by diode laser without delaying treatment progress. Case 4, Figures 10 to 13, depicts a case where interdental papillae palatally were removed with diode laser in two stages. Average power was 1.2 W, PP and contact mode. Patient responded immediately showing marked improvement.

**Aphthous Ulcer**

Case 5, Figures 14 and 15, a young female undergoing orthodontic treatment was treated with diode laser with average power of 0.8 W, in noncontact mode. In these situations anesthetics are not required. Laser fiber is guided about 2 to 3 mm around the lesion in a wavy motion covering the entire area.

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Table 1: Different types of laser

<table>
<thead>
<tr>
<th>Laser type</th>
<th>Construction</th>
<th>Wavelength</th>
<th>Delivery system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argon</td>
<td>Gas laser</td>
<td>488, 515 nm</td>
<td>Optical fiber</td>
</tr>
<tr>
<td>KTP</td>
<td>Solid state</td>
<td>532 nm</td>
<td>Optical fiber</td>
</tr>
<tr>
<td>Helium-neon</td>
<td>Gas laser</td>
<td>633 nm</td>
<td>Optical fiber</td>
</tr>
<tr>
<td>Diode</td>
<td>Semiconductor</td>
<td>635, 670, 810, 830, 980 nm</td>
<td>Optical fiber</td>
</tr>
<tr>
<td>Nd:YAG</td>
<td>Solid state</td>
<td>1,064 nm</td>
<td>Optical fiber</td>
</tr>
<tr>
<td>Er,Cr:YSGG</td>
<td>Solid state</td>
<td>2,780 nm</td>
<td>Optical fiber</td>
</tr>
<tr>
<td>Er:YAG</td>
<td>Solid state</td>
<td>2,940 nm</td>
<td>Optical fiber</td>
</tr>
</tbody>
</table>

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Fig. 1: 23 before exposure by soft tissue laser (case 1)

Fig. 2: Exposed with diode laser by soft tissue laser (case 1)

Fig. 3: 47 not erupted (case 2)
DISCUSSION

All patients described were in the age group of 13 to 16 years. Proper and selective usage of diode soft tissue laser can work wonders for an orthodontic office. Diode laser delivers light energy in either pulsed (gated) or a continuous mode. In the pulsed mode, periodic alterations of energy are created by a mechanical shutter that permits intermittent cooling of the tissues between the pulses of light energy. In the continuous mode, thermal relaxation does not occur, hence resulting in greater heat to the tissue.\textsuperscript{12} Soft tissue surgery done by super pulsed diode laser is more reasonable as compared to performing the same with continuous mode.\textsuperscript{13} For all the cases depicted here, PP mode of operation was selected. It is advisable to prime or condition the fiber before the procedure. Priming is the process of concentrating heat energy at the tip of the laser fiber. This is simply done by tapping the fiber on
articulating paper while laser is energized. During the procedure, laser was used for few seconds and the site was regularly cooled off with wet sterile cotton swab. Ulcers can be most irritating complication in an orthodontist’s office. Topical anesthetic can offer temporary solution. Diode laser presents great alternate. Low power laser energy in noncontact mode for few seconds works wonders for the healing process. Another advantage of soft tissue diode laser is their affinity to melanin pigmentation. This helps in greater absorption of light energy by soft tissues without damaging teeth and bone.

This property can have great application in dark, hyperpigmented gingival tissues. Acceleration of orthodontic tooth movement by 810 nm laser therapy can be considered as future direction of research. It causes no side effects on
the vitality or the periodontium of the teeth.16,17 The advantages of the diode laser include the following:18
1. They have excellent soft tissue absorption and hemostasis
2. It is difficult to damage hard tissues
3. They can be used in contact mode, or noncontact mode
4. They can also be used for tooth bleaching.

CONCLUSION

Before the introduction of lasers in our practice, we used to depend on specialists for frenectomy or for uncovering unerupted teeth. Soft tissue diode laser has opened an entire new horizon for all of us. There is obviously a learning curve involved. The settings indicated are guidelines and they will vary from patient to patient. The entire focus is patient comfort. They are very pleased that they are not referred to any other specialists for minor surgical procedures. It is our belief that soft tissue diode laser can definitely facilitate smooth progression of the treatment.

REFERENCES