Diode Laser and White Lesions: A Clinical Study on Postoperative Recovery, Depth Control and Wound Healing

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ABSTRACT

Laser dentistry has always been a subject of interest. Among hard and soft tissue lasers, the latter finds much more acceptance in terms of clinical applications. Diode lasers have found much acceptance in all the branches of dentistry. Compact size and financially viable—diode laser has become a big practice enhancer tool. The difference in contact and noncontact mode in treating white lesions, in terms of various clinical parameters has been discussed.

Keywords: Laser, Diode.

INTRODUCTION

Laser is an acronym for ‘light amplification by stimulated emission of radiation’. Laser, therefore, is light reinforcement through stimulated radiation. The underlying principle of the laser goes back to a discovery of Albert Einstein in the year 1917, which was technically converted into the year 1960.

Einstein discovered at that time the so-called stimulated emission basis for the structure of an outstanding source of life and with it also a source of energy.

Technically, this discovery was, for the first time converted in the sixties. A ruby crystal served as a laser medium.

Today, one distinguishes, accordingly, the medium that is used in a laser for the light emission, between solid material lasers, semiconductor/diode lasers and electron lasers. 1

STRUCTURE AND CHARACTERISTICS OF LASER LIGHTS

Laser consists of energy units—The photons
A photon is sent out if electrons in the atomic shell fall back from stimulated level, i.e. high and unstable one into an energy poorer stable level.

Characteristics of Laser Lights

- Monochromatic: Photons possess a specific energy level and identical wavelength
- Monophasic: Individual wave move in the same phase therefore, agree timewise in their distraction
- Coherent: Wave move without scattering. 1

Diode Lasers

Solid active semiconductors as follows:
- Lasing medium: Aluminum, gallium and arsenide
- Wavelength: 810 to 980 nm
- Delivery system: Fibrooptically with hand piece
- Mode: Pulse and continuous
- Absorption: By pigmented tissues, water.

PORTABLE AND COMPACT

These devices are compact and portable in design. Diode lasers are used for soft tissue procedures only and wavelength is well absorbed by pigmented structures, providing good hemostasis and effective cutting of tissue.

Cutting is clean, having good coagulation with minor charring. Depth of penetration ranges from 2 to 3 mm into tissue, depending on wavelength.

With significantly higher absorption in water, 980 nm diode cuts more optically than thermally, meaning it is the absorption of laser energy more than thermal effect (i.e. heat) which is primarily responsible for cutting and coagulation. 2

With this wavelength there is no requirement to carbonize the tip of the optical fiber. The result is minimum penetration (< 300 microns).
Diode laser is also used for light activation of bleaching material. Its diversified functionality and unparallel control characteristics, make it extremely popular with all the branches of dentistry.

AIMS AND OBJECTIVES

A clinical study of white lesions which include leukoplakia and lichen planus, was carried out using contact and noncontact mode to evaluate postoperative recovery, depth control and wound healing. The diode laser was used at 6 watts.

PATIENTS AND METHODS

• Ten patients aged 40 to 65 years with oral symptomatic leukoplakia, lichen planus were enrolled in this study
• Patients under any treatment for the same were asked to stop treatment before 15 days of laser therapy
• Biopsy was taken before treatment as well as after complete healing.

PROCEDURES

• Infiltration with local anesthesia
• Patient special goggles were used
• Staff to wear goggles also
• Lesion was irradiated by diode laser of 6 watts, till area changed to white, i.e. photocoagulation (noncontact mode)
• Patients were put on ice application to decrease edema
• In pulse mode: Pulse duration 5 seconds on/1 second off.

For all the clinical cases, 400 μm diameter glass fiber was used as the delivery system. The procedure was performed under topical or local anesthesia. All the clinical cases were examined in first 3 days, 1, 2 and 4 weeks after the surgery (Table 1).

Postoperative complications, such as pain, bleeding, swelling, functional disturbance as well as wound healing, were evaluated.

SUBJECTIVE SCORING

Patients were examined after 3 days, 1, 2 and 4 weeks after laser irradiation using visual analog score (VAS). Postoperative complications such as pain, bleeding, swelling and functional disorder were graded 0 to 10 according to the following:

• 1 to 2 — no postoperative complications
• 3 to 5 — mild postoperative complications
• 6 to 7 — moderate postoperative complications
• 8 to 10 — severe postoperative complications

Sign and symptoms of lesions were recorded with subjective evaluation scale according to Gorsky and Raviv (1992).

RESULTS

Of the 10 patients, two patients (20%) complained of moderate pain (Table 2) during first 3 days following laser irradiation (Figs 1A to C), while rest of the patients (80%) complained of mild pain (Figs 1A to C). The pain disappeared at the end of first week. Edema occurred in all cases (Table 3). After 3 days edema in cheek was mild in one patient (10%), moderate in three patients (30%) and severe in four patients (40%). By the end of first week edema was absent in four patients (40%), functional disorder (Table 4), occurred in some patients and was mainly in direct relation to degree of pain and edema. In first 3 days two patients (20%) suffered mild, three patients (30%) suffered moderate and five patients (50%) suffered severe functional disturbance.

After first week, with improvement in pain and edema two patients (20%) showed return to normal function, four patients (40%) showed mild functional disturbance and there was no postoperative bleeding or scar formation and lased area was soft on palpation. On subjective evaluation of clinical complications according to Table 1

• Eight patients (80%) showed stage 4
• One patient (10%) showed stage 3
• One patient (10%) showed stage 2.

During the 3 months follow-up, out of 10 patients treated with diode laser (980 nm), two patients complained of recurrence, while no recurrence was detected in the rest of cases.

Diode laser possesses a deeper power of penetration reaching about 1.5 mm. Application of diode laser at 6 watts, in defocused continuous mode, will rise temperature of affected tissues to above 50º and less than 100º. This temperature will cause protein denaturation. The sign of protein denaturation is blanching of treated mucosa. Denaturation of protein at the affected area means destruction of the diseased epithelium.

In addition, cytotoxic protein subepithelial lymphocytes are all denatured due to its deeper penetration.

Denatured protein acts as a dressing layer for the treatment site that may decrease pain and enhances less risk of secondary infection. Due to the sealing of blood vessels and lymph vessels, ice packs should be applied to the treated area.

The technique is easy, fast and safe.

Looking at the amount of edema (i.e. severe) in four cases, makes it difficult to control depth of penetration in defocused
Table 4: Statistical study of VAS > of postoperative functional disturbance

<table>
<thead>
<tr>
<th>Functional disturbance</th>
<th>3 days</th>
<th>1 week</th>
<th>2 weeks</th>
<th>4 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>m mo s</td>
<td>m mo s</td>
<td>m mo s</td>
<td>m mo s</td>
</tr>
<tr>
<td></td>
<td>2 3 5</td>
<td>2 4 2</td>
<td>10 20</td>
<td>10 20</td>
</tr>
</tbody>
</table>

(–: no ); (m: mild); (mo: moderate); (s: severe)

CONCLUSION
Diode provides an alternative technique with marked clinical improvement and high degree of patient acceptance. Because of good coagulation, patients’ surgical period is reduced and are saved from high-risk infections.

It provides sterile blood-free operating field for controlled tissue sculpting.6-8

Exceptionally precise tissue ablation at low power settings, diode lasers of 980 nm wavelength, is neither absorbed too much nor too little in water and hemoglobin, enabling precise char-free soft tissue ablation and hemostasis.

The small portable size of the unit is of beneficial effect for the dentists.
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