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Management of Oral Leukoplakia Using Diode Laser: A Pilot Study

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Aim: To evaluate the effectiveness of 810-nm diode LASER in the management of patients with oral leukoplakia.
Materials and Methods: A total of 10 cases diagnosed clinically and histopathologically as leukoplakia were included in the present study. All the cases were treated using 810-nm diode LASER at a power of 5 watts and followed up for 3 months and assessed for pain and healing post-operatively.
Results: All the lesions healed within duration of 3-4 weeks without scarring. Complications or recurrence has not been noticed in any of the patients except for mild pain during follow up period.
Conclusion: Patient acceptance was found to be high using 810-nm diode LASER without compromising health and function. Thus usage of diode LASER may indeed be the best choice in the management of oral leukoplakia.

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1. INTRODUCTION

Oral cancer is one among the Head and Neck cancer and it is the 10th most common cause of death. Usually 20% of oral cancer cases arise from a clinical visible precursor lesion known as potentially malignant lesion [1].

An oral potentially malignant lesion is defined as a morphologically altered tissue in which cancer is more likely to occur than in its apparently normal counterpart. Leukoplakia, erythroplakia, oral submucous fibrosis, oral lichen planus and actinic chelitis are some of the examples of potentially malignant lesions. The most common among all these is leukoplakia [2].

World health organisation in the year 2005 has defined leukoplakia as ‘‘a white patch of questionable risk having excluded all other known disorders that carry no increased risk for cancer”. This leukoplakia can occur at any site in the oral cavity with buccal mucosa being the most common [2].

Clinically leukoplakia can be either homogenous (flat or wrinkled, uniformly white in colour) and non-homogeneous (sometimes referred to as erythroleukoplakia and speckled, nodular or verrucous type). Usually homogenous is asymptomatic and non- homogenous type is often associated with pain or itching sensation [3].

Basically there are surgical and non-surgical means of management of leukoplakia. The common modality being surgical excision that includes conventional surgery using scalpel, LASER surgery, cryosurgery, and electro surgery [3].

LASER is alternative to conventional surgery in the treatment of oral leukoplakia. Based on wavelength range these therapeutic lasers can be divided into high and low level lasers. Low level lasers have higher depth of penetration and more bio-stimulation abilities when compared to high wavelength lasers. With this background the main aim of the present study was to evaluate the efficacy of Low Level Diode Laser in patients diagnosed with leukoplakia [4].

2. MATERIALS AND METHODS

A pilot study was conducted in the department of oral medicine and radiology, Vishnu Dental College, Bhimavaram, to know the efficacy of Fotona XD-2 810 nm diode LASER in the management of oral leukoplakia. The study procedure was duly cleared by the institutional ethical committee.

A total of ten clinically diagnosed and histopathologically confirmed leukoplakia patients were included in the present study. All the patients were informed about the treatment procedure and informed consent was obtained, patients with any systemic diseases that impair healing of the treated lesion were excluded from the study.

Pre-operative evaluation included thorough clinical history and photographs; treatment procedure was carried out using a Fotona XD-2 810 nm diode LASER at 5W power in contact mode under topical anaesthesia in a single appointment. Both the patient and operator used the LASER safety glasses during the time of procedure.

All the patients were advised an anaesthetic mouth wash (Benzydamine hydrochloride 0.15% twice daily 15 minutes before food intake) for a period of one week to prevent sensitivity of operated site post-operatively. Patients were recalled after the 7th, 14th, 21st day and later review check-ups were conducted for every 1 month for the next 2 months. The Visual Analog Scale (VAS) pain scores were recorded during this recall period which was graded from 0 to 10 as shown below [5].

0 to 2 — no postoperative pain
3 to 5 — mild postoperative pain
6 to 7 — moderate postoperative pain
8 to 10 — severe postoperative pain

3. RESULTS

The study included ten patients of leukoplakia treated with 810‑nm diode laser; no sutures were required, wound healing took place by epithelisation from the border of the wound. In almost all cases the healing was complete within 4 weeks. After healing, there was almost no clinically perceptible difference in appearance or elastic properties of the laser-treated mucosa to normal mucosa.

In all cases, there were no incidents of infection in the days following the procedure. There was

mild pain in seven cases and moderate intensity pain in 3 cases at the end of first week following laser treatment. At the end of second week, five out of ten cases showed mild pain. There was no pain in majority of the cases by the end of third week post operatively (Table 1).

Fig. 1. Leukoplakia seen over left Buccal mucosa

Fig. 2. picture showing ablated site immediately after treatment

Fig. 3. During 4th week follow up, completely healed lesion

Fig. 4. Picture showing operational procedure

Table 1. Table showing the improvement in VAS scores

	VAS score in the follow up periods			
	Mild pain	**Moderate pain**	**Severe pain**	**No pain**
1st week	7	3	-	-
2nd week	5	-	-	5
3rd week	2	-	-	8
2nd month	-	-	-	10
3rd month	-	-	-	10

4. DISCUSSION

Treatment of leukoplakia mainly includes medical therapy with antioxidants or surgical excision using scalpel, laser, cryoapparatus or electrocautery. Perhaps the general consensus is that surgical excision is the best treatment for this lesion [3]. So by using LASERS for surgical excision we can reduce bleeding and suturing post-operatively.

When a laser beam is produced and focused at tissue, at the biological interface one of four interactions will occur: Reflection, Transmission, Scattering, or Absorption. Among all these absorption is the most important interaction which 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.

The incident light photons are absorbed by specific chromophores; this absorbed energy is converted into thermal and/or mechanical energy that is used to perform the work desired. Near infrared lasers like diodes and Nd: YAGs are mostly absorbed by pigments such as haemoglobin and melanin. Erbium and CO2 lasers are predominantly absorbed by water, with erbium wavelengths also exhibiting some hydroxyapatite absorption. The shorter, near infrared wavelengths of diodes and Nd: YAGs lasers also penetrate tissue more deeply than the longer, mid infrared wavelengths of the erbium and CO2 lasers [6].

Furthermore, the haemostatic property of lasers is of great value and provides the surgeon with better visibility of the area of interest. Apart from these, lasers also show scar tissue reduction because of its decreased collateral tissue damage and fewer myofibroblastic cells in laser wounds [6].

Disadvantages of laser usage in soft tissue lesions mainly includes prolonged healing time due to the sealing of blood and lymphatic vessels, and also the expense of laser system when compared to conventional one [7].

In our present study we adopted the 810‑nm diode laser for our patients mainly because of the convenience of its application, the ability for large areas to be treated in a single application, and the possibility of precise control of laser fluence in all areas of the mouth. CO_2 laser usually produces narrower zones of damage in soft tissues than does the diode laser because of the greater absorption of the CO_2 wavelength by soft tissues. The average zone of damage caused by CO_2 lasers after laser incision in soft tissues is less than 0.6 mm where as in diode laser it is about 0.625 to 0.79 mm [8]. Since the depth of penetration is more with diode LASER, it completely ablates the epithelium owing to its less chance of recurrence. These findings, like the remarkable cutting ability and the tolerable damage zone with increased depth of penetration, clearly show that the diode laser is very effective compared to CO_2 laser.

All the ten patients included in the study were followed up for duration of 3months post-operatively and in almost all cases healing was complete within 3-4 weeks duration. There was mild pain in the majority of cases following laser therapy.

A study was conducted in 2005 by Mona et al. on patients with oral lichen planus using diode laser (980 nm). The patients were followed up for 9 months. At the follow up sessions, lesions were examined to detect any residual lesion. Lesions were exactly measured and digital photographs were taken at follow up session. Response rates were assessed clinically by amount of reduction in surface area of lesions. Complete healing of surgical site occurred after the second week, with recurrence occurred only in three patients by the end of six months follow-up [9].

Syed et al. [10] has evaluated CO2 laser for excision of leukoplakia in comparison with traditional method in a total of 8 patients and noticed increased patient acceptance and operators comfort levels, with minimal post-operative complications.

Nasiruddin et al., in the year 2007 has published a case report on usage of co2 laser in the management of diffuse leukoplakia lesion over the dorsal surface of tongue using 10,600 nm at 2W power, patient has been followed for 6 months and noticed complete healing with no functional or neural deficit. Author also proposed that areas with less water content are resistant to vaporization with CO_2 so utmost care should be taken to remove even the deeper layers to encourage the regeneration of new epithelium and so prevent recurrence [7].

Nilesh Raval et al. [4] conducted a study in 2011 on 10 patients with leukoplakia and lichen planus and were treated with laser ablation done in 6watts, in pulse mode , in non-contact mode, till the area of interest changed white (photocoagulation). Result showed recurrence in two patients and other patients responded well to laser therapy but in our present study none of them showed any recurrence post-operatively.

Hristina et al. implicated Nd-YAG diode laser at 10-15W power in a total of 17 patients diagnosed with leukoplakia. Complete healing was seen by the end of 4^{th} week in most of the cases with no swelling noticed in any of the patient, which was in accordance with the present study [11].

Nihat Akbulut et al. [12] has evaluated the effects of the 810‑nm diode laser in the treatment of 27 patients with various benign oral soft tissue lesions and noticed no complications in the surrounding soft tissue or hard tissue, with complete healing of white and vesiculobullous lesions noticed in duration of 6 weeks.

Kende Prajwalit et al. [13] used Diode laser for excising white patch on the tongue. The procedure was found painless and no sutures were necessary. It was finally concluded that the use of diode laser can be a promising aid for excision of oral premalignant lesion since it reduced both the operative time and patient discomfort.

Jajarm et al. [14] has conducted a study to compare the effect of low intensity laser therapy with topical corticosteroids in the management of oral erosive and atrophic lichen planus. In which he selected thirty patients who were randomly allocated into two groups. First group was treated with 630 nm diode laser whereas the second group used Dexamethasone mouth wash and noticed no significant differences found between the two groups regarding the response rate and relapse.

5. CONCLUSION

Diode laser had showed fruitful results in treatment of oral leukoplakia. The clinical benefits of the diode laser does not completely rely on preserving the blood volume or saving the time, but its ability to increase the depth of penetration when compared with CO_2 laser which helps in reducing the recurrent potential. Thus Diode laser can be an effective treatment option for oral leukoplakia with reduced rate of recurrence, and malignant transformation apart from reducing patient's discomfort.

Although diode laser showed effective results there are very few studies showing its efficacy so further studies are required to make it a standard treatment modality.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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