

Neodymium:Yttrium aluminum garnet laser in the management of oral leukoplakia: A case series

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Abstract

Objectives: Oral leukoplakia is a non-scrapable whitish patch described as a potentially malignant disorder with high prevalence in India. Besides medicinal treatment, neodymium: Yttrium aluminum garnet (Nd: YAG) laser is also used for the management of oral leukoplakia. This study evaluated the role of Nd: YAG laser in the management of oral leukoplakia and also investigated postoperative complications along with long-term prognosis of the disease. **Settings and Designs:** The study is a prospective cohort study conducted for 24 months (June 2011 to May 2013) in Lucknow. **Materials and Methods:** The study comprised of 42 patients, both male and female of Indian origin and diagnosed with oral leukoplakic lesions. Patients with biopsy proven squamous cell carcinoma and medically compromised are excluded from the study. All patients have undergone ablation of lesion by pulsed Nd: YAG laser and were followed after 24 h, 72 h, 1-week and then successively for 1, 3, 6 months and then 1st and 2nd postoperative years. **Results:** Pain and slough were evaluated by Wilcoxon rank test ($P = 0.0001$ statistically significant) which decreased from 24 h to 1-week and became nil in subsequent follow-ups. Similarly, McNemar's test ($P = 0.001$ statistically significant) was used for evaluation of burning sensation, paresthesia, infection and recurrences. Recurrence was noted in 2 patients but following the second application, there were no recurrences over the period of further follow-up. None of the patients suffered from an infection, paresthesia or anesthesia. **Conclusion:** Hence, Nd: YAG laser was found to be effective in ablating leukoplakia. It is convenient, economical with minimum complications and morbidities.

Keywords: Ablation, neodymium: Yttrium aluminum garnet laser, oral leukoplakia

Introduction

Defined by World Health Organization (WHO) workshop (2005) as "A white plaque of questionable risk having excluded (other) known diseases or disorders that carry no increased risk for cancer".^[1] Oral leukoplakia has a higher incidence over Asian continent. Tobacco in the form of smoking,^[2] and smokeless is a prime etiological agent in the causation of oral leukoplakia.

Its incidence ranges from 0.2% to 4.9% in Indian subcontinent,^[3] with range of malignant transformation reported to be 4–20%.^[4,5]

Neodymium: Yttrium aluminum garnet (Nd: YAG) laser due to its low intra-operative and postoperative complication rates gives it a leading edge over other conventional treatment modalities.

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Materials and Methods

Forty-two patients (36 males and 6 females) with clinically diagnosed and histopathologically correlated leukoplakic lesions [Figure 1] were selected for the treatment. All patients were informed about the disease, and written consents were taken for the same. The study was conducted following clearance from an ethical committee of the university. Only patients with mild or moderate dysplasia were included for the study. Patients with severe dysplasia and definable white lesions such as linea alba, lichen planus, white sponge nevus, and biopsy-proven severe dysplasia including carcinoma *in situ* or squamous cell carcinoma were excluded from the study. Routine blood investigations were done prior to the commencement of treatment.

The 1064 nm Nd: YAG laser (Fotona d.d. Stegne 7, 1000 Ljubljana, Slovenia, EU) with a power range of 1–15 W was used for the study. Laser delivery was done through a 300 μ m fiberoptic system with R-21 handpiece. The operating

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Figure 1: Leukoplakic patch over left lateral surface of the tongue

surgeon, assistant and the patients eyes were protected with laser protection glasses. Nd: YAG laser was set at an average power of 2.5–3.5 W in free running pulsed mode in most of the cases. The power is slightly raised up to a maximum of 5 W ($N = 10$) in cases of lesions involving the palatal mucosa, attached gingiva or lesions classified as verrucous leukoplakia. The power should always be customized for each patient based on the tissue characteristics of the lesional site. The beam was directed as perpendicular as possible onto the tissue with a suitable clearance margin of 5–6 mm [Figure 2]. Once the surgical outline is defined, parallel lines of application of laser was placed within marginal outline, using a process known as “rastering.” Constant speed was maintained to create uniform depth and to prevent heat accumulation at a single site. Wet gauze was used to mop the surgical site and also cleansing of the fiberoptic tip containing charred tissue. A pale pink base that does not bleed indicates removal of the epithelium at the level of basement membrane. The surgical site was left to heal by secondary intention [Figure 3]. All patients postoperatively were prescribed analgesics (tablet aceclofenac 100 mg) twice daily till 3rd postoperative day. All patients were followed 24 h, 72 h, 1-week and successively for 1st, 3rd, and 6th months, 1st year and 2nd postoperative year [Figures 4 and 5].

Results

The age of patients included in the study ranged from 25 to 60 years (mean: 45.7 years) with the disease showing a male predominance. Of 42 patients included in the study, 22 patients had lesions in buccal mucosa, eight patients had lesions in lateral border of tongue, six patients over gingival mucosa, two patients over palate and 2 each over labial mucosa and commissure of lip. 76.2% patients ($N = 36$) had a history of consumption of tobacco in smoking or smokeless form. During postoperative assessment, all patients reported of mild pain in the surgical site after 24 h which gradually



Figure 2: Neodymium:Yttrium aluminum garnet laser application to the lesional site

decreased during 72 h and 1-week postoperatively and became nil in subsequent follow-ups up to 2 years (Wilcoxon rank test $P = 0.0001$ statistically significant). Similar results were also derived from slough assessment which covers the surgical site.

None of the patients in the study group reported burning sensation, anesthesia or paresthesia. Postoperative infection was absent in all of the patients. There was recurrence of the lesion in two patients during the 1st month follow-up period (McNemar’s test $P = 0.001$ statistically significant). Following reapplication of laser, there were no recurrences over the period of 2 years follow-up period. No patients developed carcinoma adjacent to the site of laser application during the follow-up period.

Discussion

Leukoplakia has a higher incidence in South East Asian countries with India as no exception. Being termed by WHO in 2004 as “potentially malignant disorder,”^[1] malignant transformation of this disease ranges from as low as 4% to as high as 20%. Though several studies have evaluated the role of Nd: YAG laser and its role in oral mucosal lesions, the powers used were in a higher range of 10–15 W.^[6-10] Our study aims at management of oral leukoplakic lesions with lesser power (2.5 W–3.5 W). This is mainly aimed to lessen postoperative swelling and pain along with the inherent property of higher penetration of Nd: YAG laser compared to carbon dioxide laser. Such property has its role in the prevention of field cancerization.

Focusing of the laser beam in a small area results into a higher concentration of effective power to the lesional site. Hence, minimal tissue damage leading to less inflammation is the cause of mild pain following ablative therapy to the lesional site. In our study, all patients were managed with nonsteroidal anti-inflammatory drugs with total relief of pain



Figure 3: One week follow-up of the lesional site



Figure 4: Six months postoperative follow-up showing complete eradication of the lesion



Figure 5: Two years postoperative follow-up shows healed site with no recurrence of the lesion

by 1st postoperative week.^[9,11,12] Similar results were also seen for slough, which is a slimy layer covering the surgical

site. There was complete remission of it by 1st month which corresponds to complete healing of the lesion.^[6,7] But Vivek *et al.*^[9] reported complete healing of lesions by 5 weeks at a power of 15 W. This could be due to delayed healing at higher power due to more inflammation to the surgical site.

Damage of small lymphatic vessels in surgical site is the cause of postoperative swelling. But sealing of such vessels by laser is the cause of decreased swelling postoperatively in our patients.^[13,14] None of the patients reported of postoperative infection and anesthesia or paresthesia in our study. Recurrences were reported in two patients by the 1st postoperative month (10%). Recurrences were also reported by previous researchers in their study^[7,9,15] but Schoelch *et al.* reported it as high as 38.1%.^[6] The first case of recurrence occurred in a patient with a lesion over left lateral border of the tongue with diffused margin. The lesion was treated, and recurrence was observed in 1-month follow-up. Following second application of laser, there was no recurrence in subsequent follow-ups till 2 year. It could be due to incomplete removal of the lesion due to inconspicuous boundary. Kardos *et al.*^[16] suggested that the lateral surface of the tongue is characterized by marked proportion of dysplastic changes and high recurrence rate, suggesting that the lesion occurs widely in field cancerization.

The second case of recurrence occurred in a patient with previously treated verrucous leukoplakia with a well-defined margin. The lesion was retreated, and no recurrence was observed in subsequent follow-ups.

Finally concluding the results of our study we found that Nd:YAG laser in low power is an effective treatment modality for the management of mild to moderate dysplastic oral leukoplakia with lesser duration of pain and discomfort. The study also shows decreased healing period compared to previously reported studies. There is excellent wound healing by 4 weeks with no scarring, minimal postoperative pain, and no infections. Lower range of power caused decreased soreness which subsided by 1st postoperative week. But lesions with bigger dimensions and ill-defined margins have chances of recurrences. Hence, we suggest 2–3 sittings for larger lesions with close postoperative follow-up. Although a single cohort of patients was used in our study, the study might benefit from continued longitudinal assessment of future patients.

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