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CASE STUDY

CLINICAL AND HISTOPATHOLOGICAL VARIANCE IN HEALING OF LEUKOPLAKIA WITH DIODE LASERS VERSUS SCALPEL: EVIDENCE BASED COMPARATIVE STUDY

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ABSTRACT

Introduction- Leukoplakia's are premalignant lesions with a significant 0-20% potential for malignant transformation. There are various ways to prevent malignant transformation, surgical interventions are amongst one are recommended for their removal. Laser ablation is one of the favored procedures with sequential histopathology using one of the many types of lasers. The efficacy of such procedure with respect to the lesion location is, however, unclear. Many studies are contradictory. Some shows laser ablations as prevention of malignisation other see it as increased risk. Aim and **Objectives-** To compare the a) efficacy of diode laser versus scalpel; b) clinical healing and; c) histopathological changes.

Material and Method- Ablation of the leukoplakia lesion by 810nm diode laser in outpatients (Group A) or excising the leukoplakia lesion using conventional method [scalpel] (Group B) from different region including buccal mucosa, tongue, alveolar ridge. In total 20 lesions were treated under local anesthesia in altogether 20patients. Initially, all lesions were histopathologically confirmed by taking punch biopsy from the encountered lesion. Follow up was done in the interval of 7days, 3weeks, 6months, 9months and 12 months.

Results- Conventional method found to be more beneficial in all aspects though laser ablation has proved to have patient compliance, faster healing and no scar formation but malignant transformation is found to be more in laser ablation procedure.

Conclusion- Higher risk of reoccurrence and malignant transformation of leukoplakia is observed, especially verrucous type.Thus scalpel method overshadows the laser ablation method as per the current study. Hence more studies are required to confirm its pros and cons.

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INTRODUCTION

The expression leukoplakia was coined by Shwimmer in 1877. In 1994, it was classified by the World Health Organization (WHO) thatindicates a clinical entity which is defined as "a white patch or plaque that cannot be characterized clinically or histologically as any other disease". (WHO 1978) Oral leukoplakia is the utmost usual pre-malignant or "potentially malignant" lesion of the oral mucosa. (Petti, 2003) It is contemplated as a preponderant white lesion of the oral mucosa that cannot be clinically or pathologically pondered as any other demarcated lesion (Petti, 2003). The definition has been further protracted as certain leukoplakias are potential to transform into carcinoma. Hence it is a lesion of the oral cavity which has a high premalignant potential. Malignant transformation is not the same for all leukoplakias; it depends on the form, characteristic features like the presence and degree of epithelial dysplasia, location, clinical features, and etiological factors of the lesion. Leukoplakia with its malignant potential is classified as a premalignant, pre-carcinogenic or potentially malignant lesion. Precarcinogenic lesions are defined as morphologically altered tissues with higher possibility of developing into carcinoma than in the healthy population. Most common influential factors causing premalignant lesions to transform into malignant lesions are especially environmental factors including are smoking and alcohol abuse, viral infections, and poor dietary habits. In North America and Europe smoking tobacco causes leukoplakia while in Asia chewing tobacco plays a key role for

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initiating leukoplakia. (Marek and Roman Smucler, 2013) The incidence rate in India of cancerization of oral leukoplakia, one of the most common pre-cancerous diseases, is three-times higher than in western populations while incidence of oral leukoplakia in state of Gujarat is 11.7% and above which is mainly because of Gutka chewing and smoking. (Petti, 2003; Marek and Roman Smucler, 2013; Vivek *et al*., 2008) The rate of malignant transformation in the age group of 70-89 years is about 7.5% in 5yrs. After 10 years, as much as 6% of leukoplakia can become malignant, while the risk can increase to as many as 42.2% after 20years. (Chris de souza *et al*., 2009) The stated incidence of leukoplakia ranges from 1.1-2.4/1000 inhabitants/year in males and 0.2- 1.3 in females (Petti, 2003), while according to analysis in 2003 it shows pre-malignant lesions affects males three times more often when compared to females. (Martorell-Calatayud *et al*., 2009) Association with a higher risk of malignant transformation are noticed in women, when compared to males. (PardeepGoyal *et al*., 2012; Gupta *et al*., 1989; Gupta *et al*., 1980)

In different parts of the world the incidence and prevalence of leukoplakia vary. In general the prevalence ranges reported from 0.2 to 5%. The prevalence ranges from 0.2-4.9% in India (Gigi Thomas *et al*., 2012) Sweden (3.6%), Germany (1.6%), Holland (1.4%). (Adriana SpinolaRibeiro *et al*., 2010) In developed nations majority of leukoplakia occurs in 4^{th} and 7^{th} decades of life while in developing countries it occurs, 5 to 10years earlier. It is present most frequently in middle-aged and older men. It tends to advance more after the age of 30 years, with the highest proportion after 50 years of age. (Marek and Roman Smucler, 2013) High-grade dysplasia had a considerably higher incidence of malignant change than low-grade dysplasia (5-year oral cancer-free survival 59% compared to 90.5%). (Marek and Roman Smucler, 2013) The risk of malignant transformation is 7times more in non-homogeneous type of leukoplakia when compared to homogeneous type of leukoplakia. The risk is 5.4 times much more in lesions exceeding 200mm. (Petti, 2003; Marek and Roman Smucler, 2013; Gupta *et al*., 1989) Leukoplakia can occur at almost all places in the oral cavity. However, they are most commonly found in buccal mucosa, mandibular mucosa. Two-third of oral leukoplakia may occur in vermillion, buccal mucosa and gingival surface (Marek and Roman Smucler, 2013). Almost all leukoplakia in India occur in tobacco users. In Gujarat, where Gukta chewing and Smoking is 43.9%, the most common place of occurrence of oral leukoplakia are buccal mucosa while 35.4% at commissure, (Marek and Roman Smucler, 2013) In Kerala 64.8% on buccal mucosa, 24.3% at commissures and 6% on tongue due to habit of chewing tobacco; while in Andhra Pradesh where smoking is common, 71.3% occur on palate. (Marek and Roman Smucler, 2013; Vivek *et al*., 2008)

The aetiology for lesions of leukoplakias is still not being clearly established. Although, tobacco seems to be the major stimulating factor, its association cannot be determined in all cases. The variation in smokeless tobacco habits has been reported as leukoplakia inductors: e.g. snuff, chewing. The larger malignant transformation rate has been specified in Candida-infected leukoplakias. (Martorell-Calatayud *et al*., 2009; Gupta *et al*., 1989) The possible allegation of human papillomavirus (HPV) and others virus has also been studied. High probabilities HPV (16 and 18) have been correlated with proliferative verrucous variant and were also coupled with potential oncogenic transformation.The most studied HPV types include 6, 11, 16, 18, 31, 33, and 35; using in situ hybridization techniques. Allied to the normal epithelium; 2-to-3-folds of higher incidence of HPV infection and 4-to-5 fold greater incidence of squamous cell carcinoma were revealed in oral precancerous lesions, are being confirmed in recent studies. Recently, even Epstein Barr virus (EBV) have been recognized as cofactors that may affect the prognosis of established leukoplakia. (Singh *et al*., 2013; TousifFaridSyeda and NareshThukralb, 2009; NihatAkbulut *et al*., 2013) Added considerations such as alcohol, poor diet, vitamin insufficiency (e.g. vitamin A,B12, E and C), areca nut (betel), different mouthwashes, chronic traumatic irritation, poor oral hygiene, poor socio-economic status, galvanism, and even genetic factors have been considered and studied in leukoplakia. (Petti, 2003; Vivek *et al*., 2008; Martorell-Calatayud *et al*., 2009; Gupta *et al*., 1989) High doses of vitamin E and vitamin A are associated with the growing risk of premalignant lesion development. Smoking along with higher doses of vitamins A and E increases even more risk of premalignant lesion development.

With a view of potentially malignant condition, primary prevention of leukoplakia is very important for which timely examination of the oral cavity is necessary in which at least annual preventive examination with the dental surgeon should not be neglected. To this in addition to the targeted examination teeth, always proper attention should be paid to the potential signs of mucosal conditions. A number of diagnostic inspectiontechniquesbased upon several principles comprising of chemical surface reaction ultrasound, electrical resistance etc. which may aid in diagnosis. One of the methods used for its simplified screening was auto-fluorescence with direct visualization. The system avails of different tissue auto-fluorescence, when fluorophores after excitation with light of adequate wavelength (blue light) emit light with longer wavelength (green light), which helps to detect changes in cellular, structural or metabolic activity. Though this method is not suitably precise and specific for final diagnosis but can be used to simply screeing. (NileshRaval *et al*., 2011; PíaLópez-Jornet and Fabio Camacho-Alonso, 2010) If a pathological lesion is appreciated in the oral cavity, which fails to heal within 2-4 weeks of observance, it is indispensible to perform a histological verification of the concerned lesion which can be done by taking a punch biopsy of the corresponding area. (Paolo Vescovi *et al*., 2010; Anand Kumar Luke *et al*., 2013) Leukoplakias are conditioned by keratosis, hyperkeratosis, para-or hyperparakeratosis, hyperorthokeratosis. The histopathological aspects of leukoplakias may differ from atrophic form to the hyperplastic one. Epithelial dysplasias may be of mild, moderate and severe degree. Dysplasia is an ambiguous term used to refer an abnormality of development or an epithelial anomaly of growth and differentiation exhibiting at least 2 of the following signs: irregular epithelial layering, depository layers of hyperplasia, globular drop-shaped rete-pegs, mitosis multiplication (with low number of abnormal mitoses), loss of basal cell polarity, increase in nucleus-cytoplasmicratio, nuclear polymorphia, hyperchromatic nuclei, anisonucleosis and anisocytosis. (PrajwalitKende *et al*., 2011) Though most leukoplakias are asymptomatic, amongst the several therapeutic measures; eliminating the causative factors is the prime preventative measure applicable for all the patients followed by treatment covering chemo-prevention, (vitamins C, A, and E) with retinoids and carotenoids, surgical excision, laser therapy,

cryotherapy, photodynamic therapy, the application of bleomycin or 5-fluorouracil are significant.

In case of surgical treatment modalities of leukoplakia, recurrence ranges from 20-35%. The most widely used cutting instruments in surgery; Scalpel because of its precision, control, preservation of tissue integrity, and superior associated wound healing. However, Scalpel incisions are prone to bleeding that obscures the operative field. Scalpel excision is done by making an incision which should be deep and wide and the area should be undermined and dissected, followed by sutures are taken. (Waldron and Shafer, 1975) Post-laser therapy recurrences are reported as ranging from 7.7- 38.1% and malignant transformations as ranging from 2.6-9%. The most often used lasers for leukoplakia therapy to date have been: the CO_2 laser, Diode laser, Nd:YAG laser, and KTP laser. (Silverman *et al*., 1976; Shafer 6th edition) The benefits of using laser therapy includes heamostatic effect which improves the clarity and gives the clear operative field, minimal distruction of adjacent tissues which results reduced inflammatory reaction and post-operative pain, no secondary bleeding and low level scar formation. The disadvantage of the laser intervention is partial thermic destruction of the removed lesion, which restricts the histopathological assessment, and delayed epithelial regeneration directly in the wound compared to surgical excision along with suture. Till lately, the major limitation for the dissemination of the method was the price of the laser. The goal of this study was to determine the clinical and histopathological healing efficacy of leukoplakia treated using diode laser or scalpel in various parts of oral cavity.

MATERIALS AND METHODS

The study was conducted after taking approval of Institutional Ethics Committee and patients consent form. The armamentarium used for the study is mentioned bellow

Armamentarium: (FIGURE)

- Mouth mirror probe.
- Towel clips.
- Surgical towels.
- Eye protecting goggles
- Gloves.
- Tooth forceps.
- Curved and straight artery forceps.
- Diode Laser- with curved or straight tip.- We will 810 nm wavelength contact mode diode LASER equipped with Maximum power as 8 watts but we be operating on 3 to 6 watts for all cases on continuous mode. Disposable tips – used were curved tips with 10mm length. The Picasso Lite diode comes standard with a multi tip handpiece which is a fiber optic bundle that carries the laser energy from the back of the laser to the surgical site. Many diodes have a strippable fiber. This strippable fiber is economical, and available in 200 micron (endo) and 400 micron (surgical diode dentistry) sizes for all Picasso lasers.
- These tips come in 3 shapes (straight, 45 degree and90 degree angles) and two lengths (5 and 10 mm).
- Topical & local anaesthesia (1:10,000 adrenaline)
- Punch Biopsy- Punch biopsies are usually taken of a larger lesion. The biopsy should be taken with the lesion at its centre. Larger core biopsy (punch biopsy) should be 4mm eccentrically. This permits the initial paraffin sections to sample the centre of the core and ensures these lesions aren't missed. Bisecting the core of a small biopsy (2mm) may cause damage.
- Scalpel – no. 15 BP blade and no. 3 Handle.
- Curved and Straight Artery forceps.
- Dissecting forceps or Adson Forceps with teeth and Mosquito Forceps
- Needle holder
- Silk sutures with needle.

In a 12 months study, a total of 30 subjects (29 males and 1 female) with the age group of 16 to 85 years diagnosed with leukoplakic lesions clinically and after histopathological verification were included in the study. Out of which 16 subject in total were treated using diode laser of the wavelength of 810nm (Picasso Dental Diode Laser from AMD LASERS), whereas 14 patients opted for traditional method of surgical excision. The procedures were conducted by a single handed doctor with several years of experience with these modes of procedures in order to prevent complications caused with inadequate knowledge of methodology. The therapeutic protocol was identical for all the subjects, that included Blood investigations like RBS, CBC, HIV, HbsAg. No subjects with history of Diabetes, Hypertension, Pregnancy HIV and Medically Compromised were included in this study.

The subjects were distributed randomly into two groups GROUP-D (Diode laser ablation group) and GROUP-S (Scalpel excision group). The objective of dividing into two groups was to compare the clinical and histopathological healing using the two treatment modalities. All subjects were treated on the basis of outpatient therapy under local anesthesia (Lidocaine 1:200,000). Using infiltrate technique, the procedure was carried out using diode laser or scalpel. The therapy performed using diode laser with the wavelength between 3-4W. Depending on the location and depth of location it was feasible to apply higher output for laser vaporization like on buccal mucosa and tongue while lower output was possible for treating alveolar process where the mucosa is thin.

Using conventional method of scalpel for excision of the lesion, the procedure was carried out under infiltrate technique using No. 15 Blade. The lesion was excised using scalpel including 3 to 4mm of clinically normal mucosa adjacent to the lesion. The lesion was detached from the underlying tissue structures by blunt dissection at a depth of 4 to 5mm. After achieving hemostasis the wound was closed using 3-0 silk suture. The influence upon the location of leukoplakia post-laser and post-scalpel was observed for its proper healing periodically which was conducted at time intervals of 7days, 3weeks, 6months and 12months. The risk of reoccurrences and malignant transformation of leukoplakias into carcinomas was also examined during these follow ups. The final histopathological examination was carried out after 12months of periodic follow up, by taking the punch biopsy from the specifictreated area. Subjects were advised to take oral antibiotics (Cap.Mox 500mg) and analgesics (Tab. Dan-P) 1hour after the excision for 5days and betadine mouth wash. They were also recommended for ice application if bigger edema develops and persists longer. Master chart was prepared in Microsoft excel 2007 and were sent for statistical analysis. Chi test, ANOVA test, T-test was performed on the collected Data.

Clinical Representation

Figure 1. Clinical representation of ablation of Lesion using Diode laser

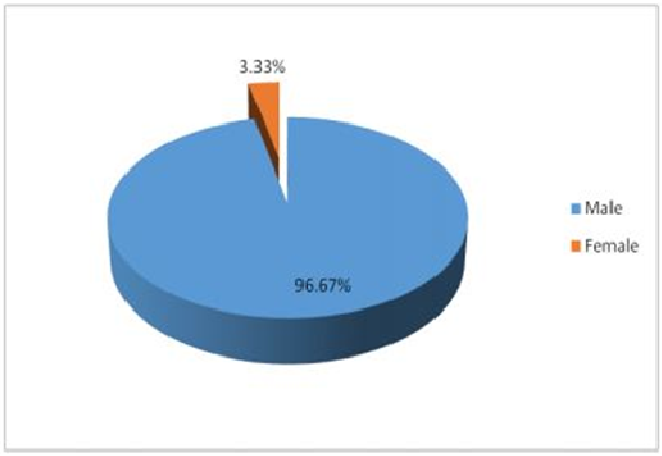
Figure 2. Clinical representation of lesion been surgically removed with conventional scalpel technique

RESULTS

There were total 30 patients with 29 males and 1 female, from which 13 males were operated with scalpel and 16 males were operated with diode laser.

Table I. Sex Distribution Ratio

Sex	Scalpel	Diode Laser
Male	13	16
Female	1	0

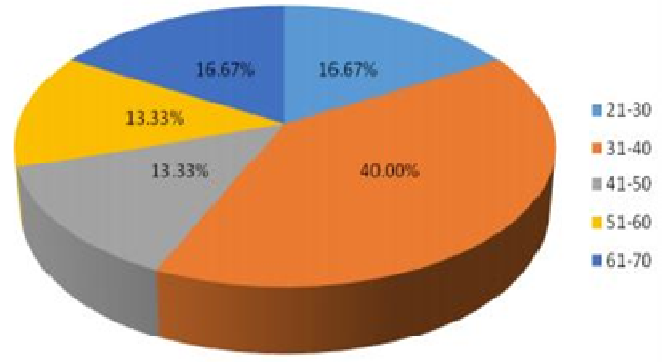


Graph 1. Sex Distribution graph

There were total 96.67% males and 3.33% females in the current study.

Table II. Age Distribution

Age Groups	Scalpel	Diode Laser
21-30	1	4
31-40	7	5
41-50	2	2
51-60	1	3
61-70	3	2
Total	14	16

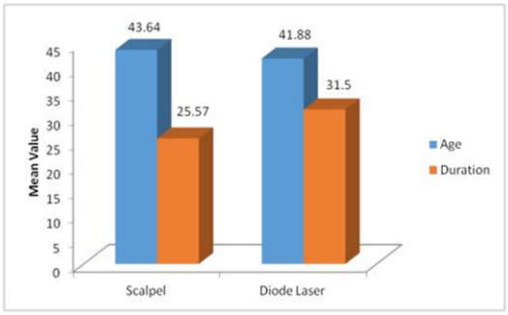


Graph 2. Age Distribution Ratio

Out of all 30 participants, maximum numbers of participants were from the age category of 31 to 40 years.

Table III. Age and Duration

	Group	N	Mean	p-value
Age (years)	Scalpel	14	43.6429	0.731
	Diode	16	41.8750	
Duration (mins)	Scalpel	14	25.57	0.059
	Diode	16	31.50	

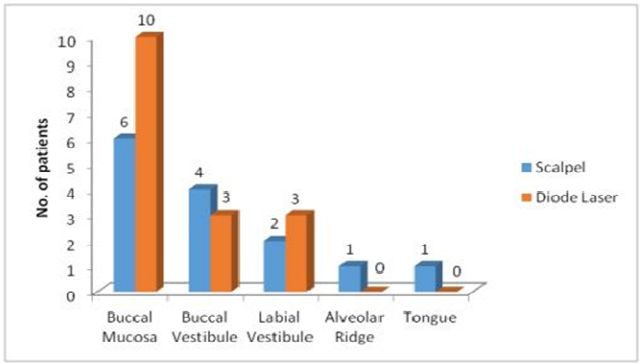


Graph III: Age and Duration graph

Table III and Graph III shows the age and duration of surgery in both the groups: scalpel group and diode laser group which shows significant p value in relation to age ($p>0.05$) and not significant p value ($p<0.05$) in relation to duration when compared with two groups.

Table IV: Distribution of leukoplakia in oral cavity

Site	Scalpel	Diode laser
Buccal Mucosa	6	10
Buccal Vestibule	4	3
Labial Vestibule	2	3
Alveolar Ridge	1	0
Tongue	1	0
Total	14	16

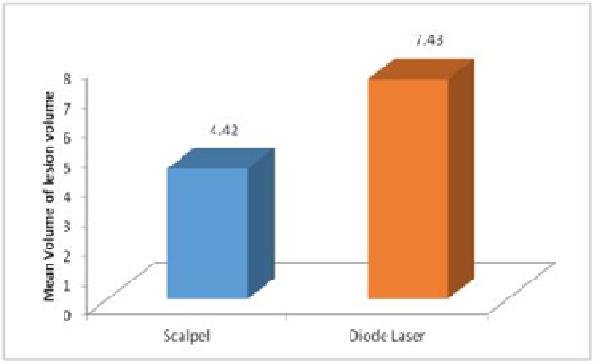


Graph IV. Distribution graph according to site of leukoplakia

Table IV and Graph IV describe that out of 30 patients, total 14 patients were included in scalpel group: among which most affected side was buccal mucosa(6) followed by buccal vestibule (4), Labial Vestibule (2) and alveolar ridge and tongue (1). Where as in Diode group, there were total 16 patients included, in whom the most affected site was buccal mucosa (10), followed by buccal vestibule (3) and Labial Vestibule (3).

Table V: Size of Lesion

	Group	N	Mean	p-value
Size lesion	Scalpel	14	4.4211	0.412
	Diode	16	7.4316	



Graph V: Size of Lesion

Table V and Graph V shows the size of lesion which was excised in scalpel group and diode laser group which gave significant p value (p>0.0)

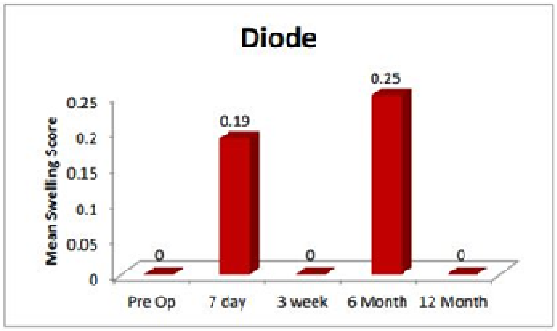
Table VI: preoperative punch biopsy

Punch biopsy before surgical Excision	Scalpel	Diode Laser	Total
Confirmation of Leukoplakia by Biopsy	14	16	30

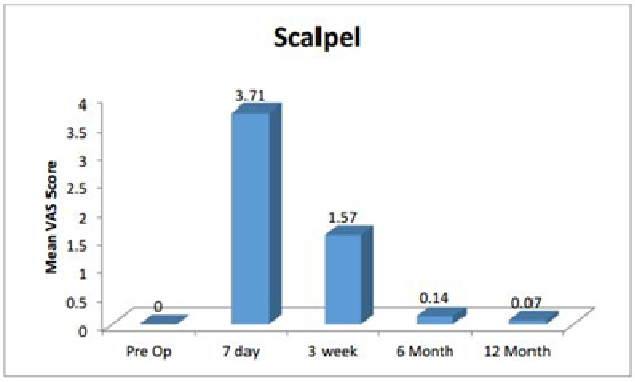
Pre-operative and Post-operative pain score: it was recorded on Visual Analogue Scale for the patients.

Table VII: Post-operative pain distribution after excision

Variables	Scalpel		Diode Laser		p-value
	Mean	SD	Mean	SD	
Pre-operative	0	0	0.94	2.144	0.114
7th Day	3.71	0.726	2.31	1.302	0.001
3rd Week	1.57	0.852	1.75	1.065	0.619
6th Month	0.14	0.535	0.14	0.363	1.000
12th Month	0.07	0.267	0	0	0.327



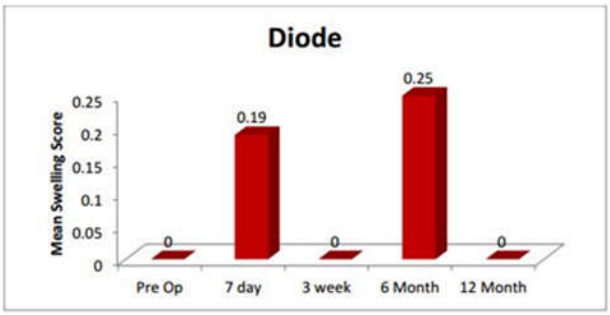
Graph VII: Diode LASER Post-operative pain score



Graph VII: Scalpel group Post-operative pain score

Table VIII: Post-operative swelling after excision

Variables	Scalpel		Diode Laser		p-value
	Mean	SD	Mean	SD	
Pre-operative	0	0	0	0	NA
7th Day	0	0	0.19	0.544	0.209
3rd Week	0	0	0	0	NA
6th Months	0	0	0.25	1.000	0.359
12 Months	0	0	0	0	NA



Graph VIII: Diode laser Post-operative Swelling

Table IX: Healing after scalpel excision versus diode ablation

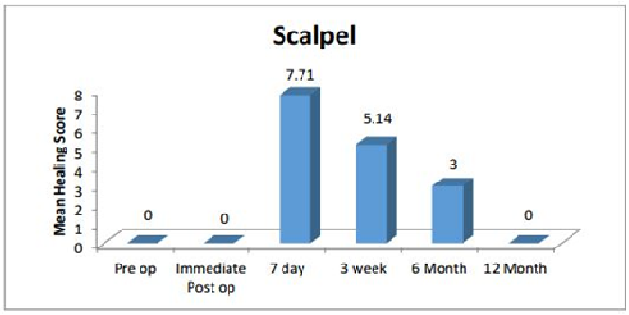
Healing	Scalpel (n=14) mean	Diode (n=16) mean
Pre-op	0	0
Immediate post-op	0	0
7th Day	7.71	7.40
3week	5.14	4.86
6month	3.00	2.28
12month	0	0

Table IX a: Healing after scalpel excision versus diode ablation: Wilcoxon signed rank test

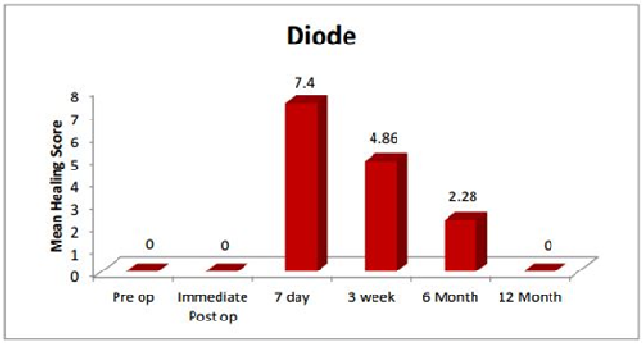
	Healing Immediate Post op - Healing Pre op	7 day - Healing Immediate Post op	3 week - 7 day	6 week - 3 week	12 week - 6 week
Z	0	-3.324	-3.186	-3.225	-3.332
p-value	1.000	0.001	0.001	0.001	0.001

Table XI and Graph XI: Normal mucosa 13 (scalpel excision) 11(diode laser ablation). (2) Fibrous tissue with dysplastic changes in Diode laser ablation; (0) scalpel excision. (1) CA

well differentiated Squamous Cell Carcinoma of Buccal Mucosa in Diode Laser Ablation. (1) angular Chelitis in Diode Laser ablation and (1) with Scalpel excision. (1) Mild dysplastic changes with scalpel excision.



Graph IX a: Scalpel Group healing of tissue



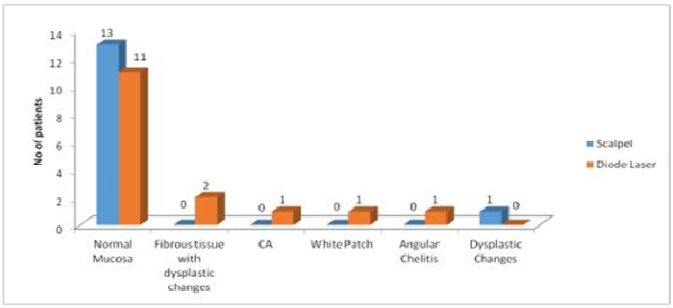
Graph IX b: Diode laser Group healing of tissue

Other complications		Groups		Total
		Scalpel	Diode Laser	
other complications	NAD	10	11	21
	Reduced mouth opening	4	5	9
Total		14	16	30

Graph X: Other complications

Table XI: Post-operative Biopsy after 12 months

Healing Of Tissue Histopathologically		Group_C		Total
		Scalpel	diode laser	
Healing Of Tissue Histopathologically	Normal mucosa	13	11	24
	Fibrous Tissue With Mild Dysplastic Changes	0	2	2
	CA- Well Differentiated Squamous Cell Carcinoma of Buccal Mucosa	0	1	1
	White patch- Homogeneous Leukoplakia	0	1	1
	Angular Chelitis	1	1	1
	Mild Dysplastic Changes	1	0	1
Total		14	16	30



Graph XI: Punch Biopsy after 12 months

DISCUSSION

The phrase leukoplakia was derived from two expressions, leuko which signifies white and plakia which suggests patch. Oral leukoplakia is the utmost usual pre-malignant or "potentially malignant" lesion of the oral mucosa. (WHO, 1978; Petti, 2003) It is contemplated as a preponderant white lesion of the oral mucosa that cannot be clinically or pathologically pondered as any other demarcated lesion (Marek and Roman Smucler, 2013). It has been recently redefined as "a predominantly white lesion of oral mucosa that cannot be characterized as any other definable lesions: some oral leukoplakia will transform into cancer". (Marek and Roman Smucler, 2013) The term preleukoplakia is sometimes used when the whiteness is not very distinct and should not be mystified with leukoedema (a hereditary malformation of the oral mucosa). With a view to the malignant potential, initial inhibition is essential in leukoplakias, i.e. the timely diagnostics of new leukoplakia lesions on the mucosa of the buccal cavity. (Marek and Roman Smucler, 201; Vivek *et al*., 2008) Although most leukoplakias are asymptomatic, the objective of primary therapy is the prevention of potential malignant transformation. (Gupta *et al*., 1980; Gigi Thomas, 2012) Oral cancer has a lingering and evident preclinical phase entailing of potentially malignant disorders; such as leukoplakia, erthroplakia and oral submucous fibrosis. The foremost purpose of recognizing oral precancerous lesions is to avert its malignant transformation by initial adequate treatment and with concurrent control of tobacco and alcohol use and other specific etiological factors. (Gigi Thomas, 2012) Oral leukoplakia (OLEP) is contemplated as a common precancerous lesion of the oral mucosa. (Marek and Roman Smucler, 2013) It delineates as a white patch or plaque that cannot be characterized clinically or pathologically as any other disease. As perceived in contemporary study in Kerala, in India and another study in Gujarat, India, including industrial workers tobacco chewing in the form of betel nut, "pan" or "supari" was found to be the most incriminating factor. Other forms of tobacco, hyperacidity, lipstick and ill-fitting dentures were found to be the contributory factor; which shows that socioeconomic status and lifestyle are involved in causing premalignant lesions. (Gupta *et al*., 1989; Gigi Thomas *et al*., 2012) A clinical staging system for oral leukoplakia (OL-system) on the lines of TNM staging was recommended by WHO in 2005 taking the size (L) and the histopathological features (P) of the lesion into consideration (Shafer 6th edition).

- Lx: Size not specified.
- L1: Single or multiple lesions together 4 cm.
- Px: Epithelial dysplasia not specified.

- P0: No epithelial dysplasia.
- P1: Mild to moderate epithelial dysplasia.
- P2: Severe epithelial dysplasia.
- Stage I: L1 P0.
- Stage II: L2 P0.
- Stage III: L3 P0 or L1/ L2 P1.
- Stage IV: L3 P1 or Lx P2.

WHO classified the cellular and architectural changes for grading of leukoplakia: Batsakis *et al*. reduced the number of histologic stages to four with intermediates:

Grade 0: Clinical flat leukoplakia without dysplasia
Grade 2: Verrucous hyperplasia
Grade 4: Verrucous carcinoma
Grade 6: Conventional squamous cell carcinoma with intermediates.

Classical surgical soft tissue treatment by scalpel has it`s relevancy, but in the last years soft tissue surgery using lasers is in advancement. In comparing the handling properties between scalpel, and laser, it was perceived that scalpel has advantages of:

- Ease of use,
- Precise incision with well-defined margins,
- Relatively fast and uneventful healing, -no unwanted lateral tissue damage can be used to bone proximity and economic. Disadvantages of scalpel are need of anesthesia, excessive bleeding, inadequate visibility caused by blood in the operating field, non-sterilized incision cut.

There are a lot of advantages for the surgeon in using Diode. They are compact and portable in design with efficient and reliable benefits for use in soft tissue oral surgical procedures. Lasers:

- Efficient and precise cutting with a calculated depth of cut with no harm to dental hard tissue
- Good haemostasis- so nearly or completely without bleeding- and therefore better visibility of the place of interest.
- Mostly no sutures needed
- Only minimal destruction of the adjacent tissue (in pulsed mode)
- Uncomplicated handling due to fibre and variety of parameters
- Shorter treatment time. The patients have a lot of advantages also:
- They mustn`t be sutured
- No or only little post op oedema
- Bactericidal reduction of the wound area
- No secondary bleeding
- Low level of scar forming
- Patients with haemorrhagic diathesis can be treated without or with only little substitution
- Shorter treatment time
- Bio stimulation of the surrounding area
- Reduced application of drugs because of pain reduction intra- and post op.

The use of diode laser was used in order to avoid any painful needle injection and to avoid bleeding during the procedure as lesion was located anywhere in the oral cavity. The whole procedure was performed without pain and no sutures were necessary. Homeostasis was obtained immediately after the removal of the lesion. The patient was pleased with the laser surgery due to the painless procedure intra-operatively or postoperatively. Diode lasers for dentistry operate in the near infrared region. The most commonly used wavelengths are 810, 940 and 980 nm, because these wavelengths are very well absorbed by pigmented tissues, haemoglobin and melanin, which makes the diodes suitable for soft tissue surgery, Endodontics, Periodontics and LLLT. During the first years of diode laser treatment in dentistry only cw mode was possible. Several studies at that time showed that cw mode and 1 W was enough to reach a bactericidal effect on and in roots and root canals, so as on implant surfaces.

Application of 3-4 W incw mode led very fast to carbonization of the soft tissue; the carbonization caused higher absorption followed by a heavy thermal damage and necrosis of the tissue. To approach better results in soft tissue treatment without much carbonization it was necessary to interrupt the cw mode. That was done by chopping the cw mode. Pulses down to several 100 µs were realized. The peak power of the pulses was in fact not higher than the peak power of the cw mode pulse, but the applied dose was decreased and the carbonization and thermal damage was reduced. The known cutting competence of an 810 nm diode laser is enhanced than it is with a 980 nm diode. The 810 nm diode has less penetration into the depth, a lower absorption in water, a lower absorption in HbO2 and nearly the same absorption in Hb as a 980 nm diode. The 980 nm diode creates more thermal energy at the surface and penetrates more into depth. The zone of necrosis is larger and it is more dangerous for cutting. Discussing the results of our study certain thing has to be remembered. The first group (scalpel excision) encompassed 13 males and 1 female with age range between (21-65) years and mean age of (43.64±14.123) years. The second group (diode laser excision) also embodied of 16 male patients (66.7%) while no female patients and age ranged between (21-65) years with mean age of (41.87±13.676) years. Amongst the sites affected by leukoplakia noticed in Scalpel Group; most common site affected was Buccal Mucosa (6) followed by Buccal Vestibule (4), Labial Vestibule (2) and lastly Alveolar Ridge (1) and Tongue (1). In Diode Laser Group; amongst most affected site was Buccal Mucosa (10), followed by Buccal Vestibule (3) and Labial Vestibule. In the first group (scalpel group) the mean of the lesion size that had been excised was (4. 42cu.mm). The mean duration of surgery in this group was (25.57 minutes) which showed statistically not significant p value ($p>0.05$). In the second group (diode laser wound group), the mean of the size of the lesion was (7.43cu. mm). The mean calculated for duration of the surgery in this group was (31.50 minutes) and significant difference observed was 9.238, and In correspondence amongst the two groups: the amount of pain in both the groups (scalpel group and diode laser group) statistical significant difference was observed at p value which came to 0.114 pre-operatively, 0.001 on 7th post-operative day, 0.619 at 3rd week follow up whereas 1.000 at 6th month and 0.327 at 12th month follow up.

The mean duration of surgery in the diode laser group was more than the mean duration using scalpel; time was statistically significant at p value 0.005), at the 7th post-operative day it presented statistically significant at p-value (P0.005) between the two groups as shown in Table. V In

comparison between two groups for swelling; the statistically significant p-value was 0 pre-operatively, 3rd week and at 12th month follow up; whereas the mean and significant difference noticed at 7th post-operative day and 6th month follow up was more in diode laser group then in scalpel group, swelling was statistically not significant at p-value >0.05. The illustration of the swelling is given in the table below. There are a lot more parameters apart from the wavelength, power, frequency, pulse duration, fibre diameter and mode of operation that will influence the cutting ability, so as e.g.: kind of tissue, pigmentation, race, blood circulation in tissue, applied dose, treatment time etc. but these parameters are of subsidiary relevance in this study. It is important to view the Carbonization of the Tissue. Carbonization is changing the absorption of the treated tissue; it is increasing due to the dark color which absorbs the diode laser light much better than light colors do.

Diode lasers in contact application showed low thermal tissue effects in depth, resulting from a high power loss caused by the development of large carbonization zones at the surface of the tissue (Janda *et al*., 2003). If there is a lot of carbonization and the destruction of the surrounding tissue is large; which means, there is more thermal energy applied in the surface and necrosis of the adjacent structures is created. In 1999 Goharkhay *et al*. stated that the horizontal and vertical dimension of the tissue destruction is neither addicted to the diameter of the fibre, nor related to the mode of operation but is only depending on the average power used. Both assumptions could be rebutting until today. The authors concluded that the remarkable cutting ability and the tolerable damage zone clearly showed the diode laser to be very effective and a useful alternative in soft tissue surgery in the oral cavity. Next aspect to discuss is the Coagulation ability of both modes of operation. The blood vessels were sealed better by the influence of the larger amount of thermal energy delivered when compared to conventional method. Swelling is a result of the inflammation reaction of the body and, often described in literature, the inflammation reaction is more serious using diode laser surgery than it is by using a traditional scalpel (ArunaTambuwala *et al*., 2014; Aline Rose Cantarelli Morosolli *et al*., 2010). According to our study significantly no swelling was observed at wound area (excised area) and adjacent tissues on using conventional method. The mean of swelling calculated in cms remained 0 at all follow up; whereas; the mean of swelling for laser excision was also calculated in cms which was observed at 7th day (0.19±0.544) and 6th month (0.25±1.00) follow up. This revealed that the postoperative swelling was not statistically significant on 7th day and 6th month (P>0.05) A second characteristic sign for inflammation is Pain.

During and directly after scalpel or laser treatment there was no pain because all patients had been given local anesthesia before surgery. Surgical treatment with a diode laser always requires anesthesia, because the thermal energy applied always generates pain. In literature classifications as mild pain, less pain, reduced pain, minimal pain and no pain are found and all authors agree that the degree of pain is reduced after laser treatment in comparison to classical treatment by scalpel. (Minati Mishra *et al*., 2005) The pain was calculated using independent t-test test for both the groups (scalpel excision group and laser excision group). In the 1st Group (Scalpel Excision Group) mean of the pain score calculated pre-operatively was (0) while at the 7th postoperative day using visual analog scale was (3.71±0.726); whereas it was (1.57±0.852) at 3rd week, and (0.14±0.535) and (0.07±0.267) at 6th month and 12th month respectively. The four mentioned parameters in this group were illustrated in Figure (2) Table (1). For the 2nd Group (Laser Excision Group) mean of the pain score calculated pre-operatively was (0.94±2.144) while at the 7th postoperative day using visual analog scale was (2.31±1.302), whereas the mean calculated was (1.75±1.065) at 3rd week, and (0.14±0.535) and (0) on at 6th month and 12th month. The mean for these constraints in this group was presented in Figure (3) Table (1). Traditional scalpel produces fewer changes in the epithelium when compared to Diode Lasers. Scalpel wound allows extravasation of blood and lymphatics, resulting in more swelling and inflammatory response, which takes longer to resolve. When Compared with scalpel wounds, which mostly Heals in 7–10 days, laser wounds may take 2–3 weeks to heal completely while scarring with laser excision is reduced when compared to scalpel. On one year follow up when Re-biopsy was taken for confirmation of healed site and changes occurred at the region; in 1st Group (Scalpel Group) only 1 patient showed mild dysplastic changes, although 2nd Group (Laser Group) 3patietns showed fibrous tissue with dysplastic changes. We have used 810 nm wavelength contact mode diode LASER with Maximum power as 8 watts but we operated on 3 to 6 watts for all cases on continuous mode. Disposable tips used were curved tips with 10mm length. There was no complains of burning sensation, dryness or infection in any patient. Despite few complications occurred that caused swelling which was reported to the Department by altogether 4-5patients at or after 6th month after the surgery. Out of these; 1 patient showed restricted mouth opening associated with pain at the treated area, (Right lower buccal mucosa and vestibular region extending from retromolar pad region to 2nd premolar region). On examination, white cauliflower like overgrowth was appreciated, submandibular lymph nodes were palpable.

On taking detailed history, patient had quit habit of smoking and tobacco chewing. So, when re- biopsy was taken from the area which suggested of Differentiated Squamous Cell Carcinoma of Buccal Mucosa. Another patient showed Angular Chelitis on right and left side of the corner of the mouth and dysplastic changes on left side at the buccal mucosa region. 1 more patient showed white patch and came with complain of pain at the treated area and sensitivity on consumption of cold and hot beverages at 9th month; which was suggestive of poor periodontal condition on evaluation for which definitive treatment was given to the patient by Department of Periodontics at KMSDCH. The building of Fibrin is a part of the secondary haemostasis, a part of the plasmatic haemostasis. The thrombocytes were connected by a dense network of fibrinousfibres. The grade of fibrin layer relies in a certain extent to the grade of healing. The faster the fibrin layer is removed, the faster the wound healing is in progress. 2-4 hours after trauma the extravasation starts, a coagulum is built with blood- and plasma cells on the wound surface. Fibrin fibres are connecting the thrombocytes and build a dense network of fibres. This normally lasts to the 4th day. Then proliferation starts, granulated tissue is build and the fibrin fibres are reduced. From the 5th day on regeneration starts and there is no more fibrin layer. The faster the fibrin layer is removed, the faster the wound healing is in progress. In comparison to healing after conventional surgical treatment there was a delay of healing time, because fibrin layer building started later and needed more time to cover the wounds. The

observed results regarding the fibrin layer differed from the normally seen wound healing after classical treatment by scalpel. According to the studies by Thuaksuban and Nuntanaranont, Sinha and Gallagher, and Horch and Deppe, the presence of this hyaline material is a result of the denaturation of the proteins and helps the tissue to contract. Other authors have reported that this hyaline layer of denatured collagen, observed on the irradiated surface at the beginning of the repair, acts as a biological waterproof dressing, reducing the irritation of the tissue and, consequently, reducing the intensity of the inflammation process and acting like a biomechanical barrier against microorganisms and haemorrhages. Re-epithelization was observed almost at 14th postoperative day and had been completed by the 21st day. This phenomenon was not well shown in the 7-day period after lesion removal, due to the extent of the necrotic tissue associated with the bacterial colonies and due to the effects of the toxicity of the inductive drug. After the treatment using scalpel excision or laser treatment, the patients had been supplied by antibiotics and analgesic drugs (Cap. Mox 500mg and Tab Dan-P for 5days TDS). Patients were even advised for cold packs for immediate pain relieve. They were prescribed with mouth washes (Betadine Mouth Wash) and later (Chlorohexidine Mouth Wash TDS) to maintain oral hygiene.

Closely the good oral hygiene was maintained by all the patients in both the groups. Our review literature illustrates; that the study done in 2013; by M.Vlk *et al*.with the follow up of 3years demonstrated the similar results towards minimal degree of pain, oedema and healing after laser ablation while this study mentioned that the risk of malignant transformation is less in two years when compared to aforesaid done studies; whereas the risk of malignant transformation is higher in one year as per result showed in our study and so a long term regular follow up of at least 5 years is necessary. Our study even revealed the similar outcomes, with the study done in 2013, by Akbulut, *et al*. (2013); in which author's also used the similar diode laser 810nm which also showed safe abolition of soft tissues of the oral tissue lesion with no complications and according to patient's convenience for its use and application, the ability for the large areas with single application, though our study do not supported nor got satisfactory results on laser ablation.

According to the above study, author's say usefulness of laser surgery precludes not only reoccurrence and malignant transformation, but also postoperative dysfunction. In our study patients who were treated using LASERS came with reoccurrence or malignant transformation. Our study also supported the similar results obtained from the study done in 2012, in Kerala by Gigi Thomas (2012); which revealed that surgical excision is the viable management approach in patient with good accessibility, and localized oral leukoplakia. Our study even discovered similar results, as in study taken up by Minati Mishra in 2005, which showed not only premalignant changes but also outspoken malignancy in patients treated for excision of leukoplakia. Even the study undertaken in 2014; by Arunatambuwala *et al*; confirmed the similar results when compared with our study in context with healing and scaring of the excised lesion using conventional method and CO2 laser.

Conclusion

Our review of literature for treatment of Oral Leukoplakia yielded high risk of reoccurrence and malignant transformation. In all our cases, comparative study was undertaken in which clinical and histopathological healing of oral leukoplakia was Scalpel versus Diode Laser with 12month follow up. Surgical treatment is the method of choice in patients with premalignant lesions to avoid risk of malignant transformation. Recurrence and malignant transformation was found to be higher in laser ablation when compared to traditional scalpel method of excision of lesion. Many parameters have been kept in mind and efficacy of use of laser for oral leukoplakia was analysed and not found to be very beneficial; though it is simple easy surgical technique with quick healing and no scar formation without affecting facial aesthetics and patient's compliance was another advantage for its use. Long term follow up is mandatory after excision of precancerous lesion.

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