

Clinical Effectiveness of Gingival Depigmentation Using Conventional Surgical Scrapping and Diode Laser Technique: A Quasi Experimental Study

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Abstract

Excessive gingival pigmentation is a major aesthetic concern in modern society, though it is not a medical problem they consider it as a negative attribute. Patients with gingival hyperpigmentation usually complain and request cosmetic therapy, particularly if the pigmentation is visible during speaking and smiling. Various depigmentation methods, including burr abrasion, cryosurgery, electro-surgery, split thickness flap excision and surgical scraping techniques have been used with varying degrees of success. Recently, lasers have been used to ablate cells containing and producing the melanin pigment. The present study was undertaken to compare the clinical effectiveness and patient comfort of surgical scraping and diode laser technique used for gingival depigmentation for a follow up period of 6 months. 20 subjects participated in this split mouth study. The clinical evaluation parameters included Extent and Intensity of gingival hyperpigmentation, post-operative gingival bleeding and pain. On follow up examination at 6th month there was no statistical difference in repigmentation extent and intensity between diode laser and surgical scraping techniques. The mean pain scores for treated sites with diode laser were significantly lower than surgical scraping technique at 24 hours (t-value=2.430, p-value=0.02). The postoperative gingival bleeding at end of procedure was significantly lower with diode laser than surgical scraping technique (p-value=<0.0001). There was no statistical difference in postoperative re-pigmentation and clinical efficacy among the subjects between surgical scraping and diode laser technique at 6th month follow up. Diode laser technique provides better haemostasis and good visibility at the surgical site. The post-operative patient comfort is better at the surgical sites treated with diode laser than surgical scraping method. Hence, both the techniques are used for depigmentation procedures depending on the severity and gingival biotype and patient acceptance.

Keywords: depigmentation, diode laser, repigmentation, surgical scraping

1. Introduction

Dental esthetics has become a significant concern in modern society. A beautiful smile not only needs good dental profile but also an appealing gingival display. Gingival health and its appearance plays major role in achieving overall esthetics. The gingival colour depends primarily upon the number and size of vasculature, epithelial thickness, degree of keratinization and pigments within the gingival epithelium. (Nancio, 2008) melanin, carotene, reduced haemoglobin and oxy-haemoglobin are the prime pigments contributing to the normal colour of the oral mucosa. Excessive deposition of melanin located in the basal and supra-basal cell layers of the epithelium causes gingival hyperpigmentation (Dummett, 1979). Exogenous factors which influence gingival hyperpigmentation include drugs, heavy metals, long standing mucosal diseases and smoking. Several syndromes like Peutz-Jeghers syndrome, Addison's disease and certain neoplasms have been associated with hyperpigmentation of gingiva (Kauzman et al., 2004; Eisen, 2000).

The occurrence and distribution pattern of gingival hyperpigmentation has been diverse and most commonly

observed in African, Asian and Mediterranean populations (Gaeta et al., 2002). The tendency to develop gingival hyperpigmentation is genetically determined whereas the intensity of pigmentation is influenced by several acquired factors (Dummett, 1945). Its distribution also varies intra orally; highest being in the attached gingiva and interdental papilla compared to marginal gingiva and interdental papilla, the anterior gingival segments has highest pigmentation compared to the posterior sites (Ponnaiyan et al., 2003; Tamizi et al., 1996). Although gingival melanin pigmentation is not representing a pathologic problem, it is of esthetic concern particularly if the pigmentation is visible during speaking and smiling. Hence, there is a huge potential for cosmetic therapy of gingival melanin pigmentation. Various methods like surgical scraping, bur abrasion, electro-surgery, cryosurgery, and split thickness flap excision techniques including lasers have been used for gingival depigmentation with varying degrees of success (Cicek et al., 2003).

Though different surgical techniques employed for gingival depigmentation, conventional surgical and laser techniques are more popular.

2. Scalpel Surgical Technique

Advantages: The conventional scalpel deepithelization technique is simple, effective and most economical as compared to other techniques. The healing by scalpel & blade technique is faster than with diode laser. This technique does not require sophisticated equipment and can be repeated if necessary.

Disadvantages: However, it may cause rapid and more hemorrhage during or after surgery (Kathariya et al., 2011). It also has chances of infection or recurrence. It is necessary to cover the exposed lamina propria with periodontal dressing for 7-10 days (Mohan et al., 2012).

3. Diode Laser Technique

Advantages: Diode lasers have been used in a variety of soft tissue surgical procedures and have many advantages such as less pain, bleeding, scar formation and infection. Examined histologically, laser wounds have been found to contain a significantly lower number of myofibroblasts. This results in less wound contracture or scarring, and ultimately improved healing (Coluzzi et al., 2011).

Disadvantages: Depigmentation with lasers achieves good results but requires sophisticated equipment and occupies a large space (Mohan et al., 2012).

Majority of the previous studies in the past have evaluated the effectiveness of various gingival de-pigmentation techniques as case reports (Shah, 2012). The present study was undertaken to compare the clinical effectiveness and patient comfort of surgical scraping and diode laser technique used for gingival depigmentation for a follow up period of 6 months. The following clinical parameters were assessed between the two depigmentation techniques: (1) Post-operative pain among the subjects at 24 hours. (2) Post-operative gingival bleeding among the subjects at end of procedure and 1st week using Ishi and Kawashima index. (3) Post-operative re-pigmentation among the subjects at 1st, 3rd and 6th month using Dummet oral pigmentation index and Hedin Melanin Index.

In this study, diode laser and surgical scraping found equally efficacious in the final result. One should be care enough to select particular technique depending on the gingival biotype and severity of pigmentation and when the patient is more concerned about esthetics.

4. Methodology

4.1 Study Subjects

All patients visiting outpatient department of KSR institute of dental sciences and research, India were evaluated for their eligibility for the study. The inclusion criteria consisted of subjects with good periodontal health and highest scores for extent and intensity of gingival hyperpigmentation in the maxillary anterior regions as assessed by Dummet's Oral Pigmentation Index (mean scores above 2) and Hedin Melanin Index (mean scores above 3). Subjects with medically compromised conditions, pregnant and lactating women were excluded for this research. After consulting a statistician 20 patients were selected based on selection criteria. The purpose of research and outcomes were explained to the patients and a written consent was obtained from subjects who were willing to participate in the research. The ethical approval was taken from Institutional Review Board, KSR Institute of Dental Sciences & Research, India.

4.2 Study Design

The present research adopted a quasi-experimental study design. A quasi-experimental design by definition lacks random assignment. However, treatment versus no treatment or comparison is by means of self-selection (by which participants choose treatment for themselves) or administrator selection (e.g., by officials, teachers,

polymakers and so on) or both of these routes.

The subjects were not randomly allocated into groups; instead both interventional techniques for gingival depigmentation were carried out for all the subjects. The left anterior sextant for all subjects was planned for gingival depigmentation with Diode Laser technique (Zolar Technology & Mfg co. Inc, Canada; wavelength 800 and 980 nm) and right contra lateral sextant with conventional surgical scrapping technique. The use of low level diode laser (810-1064 nm) is decided in this study due to its popular and convenient use in minor periodontal surgeries like depigmentation procedures over Er: YAG and CO2 lasers. Small size, low cost and fiber optic delivery and ease of use in minor surgeries are the advantages of diode lasers over others. Each patient underwent supra gingival scaling one week prior to periodontal surgery. The depigmentation procedures were performed under local anaesthesia in compliance with standard principles of infection control and surgical protocol.

In laser technique, the fiberoptic laser tip having a 320 µm diameter at 2.5 W powers was kept in contact with the pigmented area and laser was emitted in a gated pulsed mode and operated between the wavelengths of 800 and 980 nm. Short light paint brush strokes were used in a horizontal direction to remove the epithelial lining.

In scalpel surgical technique, the pigmented gingival epithelium was scraped using a # 15 BP scalpel blade. Care was taken to include the epithelium at the tip of interdental papilla and at the mucogingival junction on the other end and any remnants of the pigmented areas that were left out.

The surgical area was covered with Coe-pack periodontal dressing for one week. Post-surgical instructions were given to the patient and anti-inflammatory analgesics prescribed for 3 days and 0.2% chlorhexidine mouth rinse for 1 week.

4.3 Data Collection and Statistical analysis

The research included 4 clinical evaluation parameters:

(1) Extent of gingival hyperpigmentation as assessed by Hedin Melanin Index. (Dummett, 1945) the scoring criteria are as follows: 0=No pigmentation, 1=One or two solitary units of pigmentation in the papillary gingiva, 2=More than three units of pigmentation in the papillary gingiva without formation of a continuous ribbon, 3=One or more short continuous ribbons of pigmentation, 4=One continuous ribbon including the entire area between the canines.

(2) Intensity of gingival hyperpigmentation as assessed by Dummet Oral Pigmentation Index. (The Hedin CA., 1977) scoring criteria are as follows: 0=Pink tissue (no clinical pigmentation), 1=Mild, light brown tissue (mild clinical pigmentation), 2=Medium brown or mixed pink or brown tissue (moderate clinical pigmentation), 3=Deep brown or blue/black tissue (heavy clinical pigmentation). The gingival hyperpigmentation intensity score for an individual is sum of all area scores divided by all sites graded.

(3) Post-operative gingival bleeding as assessed by (Ishi.et.al.2002) the scoring criteria are as follows: 0=No bleeding, 1=Isolated bleeding, 2=Mild bleeding, 3=Moderate or severe bleeding.

(4) Post-operative pain on a 10 point Visual Analogue Scale. (McCormack HM.et.al.1988) from '0=No pain' to increasing pain intensity at '10=Worst pain'.

The extent and intensity of gingival pigmentation was recorded at baseline, 1 month, 3 months and 6 months. Gingival bleeding was evaluated immediately after completing the procedure and post-operative pain at 24 hours. A single investigator was trained for recording the clinical parameters. The collected data was entered into the computer (MS-Office, Excel), after which was subjected to statistical analysis by using Mann Whitney U Test. Statistical package-STATA 20 software was used for the analysis. The level of significance was set at 5%.

5. Results and Discussion

The clinical research included a total of 20 adult subjects. Among total subjects, 8 were females and 12 were males. The subjects were in the age group 18-30years. The left anterior sextant for all subjects was planned for gingival depigmentation with Diode Laser technique and right contra lateral sextant with conventional surgical scrapping technique. The depigmentation procedure by scalpel technique is simple, easy to perform and cost effective. Whereas the major advantage in using diode laser is effective haemostasis which aids the operator with a relatively clean and dry field (Lagdive et al., 2009).

It was found that the mean pain scores for treated sites with diode laser were significantly lower than surgical scrapping technique at 24 hours (t-value=2.430, p-value=0.02). The severity of pain levels were also lower at the sites treated with diode laser (Table 1).

Table 1. Comparison of post-operative pain among the subjects at 24 hours

Pain Level	No Pain		Slight Pain		Moderate Pain		Severe Pain	
	N	%	N	%	N	%	N	%
Surgical Scrupping	11	55	7	35	2	10	0	0
Diode Laser	16	80	4	20	0	0	0	0

Negligible pain and no patient discomfort in contrast to the surgical scrapping procedure is by the protein coagulum formed on the wound surface which seals the sensory nerve endings and acts as a biologic dressing (Simsek Kaya et al., 2012; Tal et al., 2003). Other previous studies have observed greater patient comfort with diode laser technique (Atsawasuwan et al., 2000; Hasuni et al., 2006; Perlmutter et al., 1986).

Table 2. Comparison of post-operative gingival bleeding sites at end of procedure

	After Procedure	
	Surgical Scrupping	Diode Laser
Mean	2	0.7
SD	0.79	0.65
U Value	46	
P Value	0.0001*	

Note. *Mann Whitney U test, at 5% Significance level.

Table 3. Comparison of post-operative re-pigmentation intensity at respective treated sites during 1st, 3rd and 6th month using Dummet oral pigmentation index

	Baseline		1 st Month		3 rd Month		6 th Month	
	Surgical Scrupping	Diode Laser	Surgical Scrupping	Diode Laser	Surgical Scrupping	Diode Laser	Surgical Scrupping	Diode Laser
Mean	3	3	0	0	0.2	0.2	0.35	0.5
SD	0	0	0	0	0.4103	0.4103	0.6708	0.8271
U value	200		200		200		186	
P Value	1.000*		1.000*		1.000*		0.718*	

Note. *Mann Whitney U test, at 5% Significance level.

Table 4. Comparison of post-operative re-pigmentation extent at respective treated sites during 1st, 3rd and 6th month using Hedin Melanin Index

	Baseline		1 st Month		3 rd Month		6 th Month	
	Surgical Scrupping	Diode Laser	Surgical Scrupping	Diode Laser	Surgical Scrupping	Diode Laser	Surgical Scrupping	Diode Laser
Mean	4	4	0	0	0.2	0.2	0.3	0.5
SD	0	0	0	0	0.4103	0.4103	0.5712	0.8885
U value	200		200		200		185	
P Value	1.000*		1.000*		1.000*		0.698*	

Note. *Mann Whitney U test, at 5% Significance level.

It was also observed that post-operative gingival bleeding at end of procedure was significantly lower with diode laser than surgical scrapping technique (p-value=<0.0001) (Table 2). On follow up examination of the treated sites at 6th month, the mean intensity and extent scores were slightly higher with sites treated with diode laser than surgical scrapping, although no statistically significant difference were found (Tables 2 & 3, Figures 1 & 2). The diode laser treatment results in photocoagulation of blood vessels leading to thrombus formation and collagen shrinkage at the operating site (Salah, 2001).

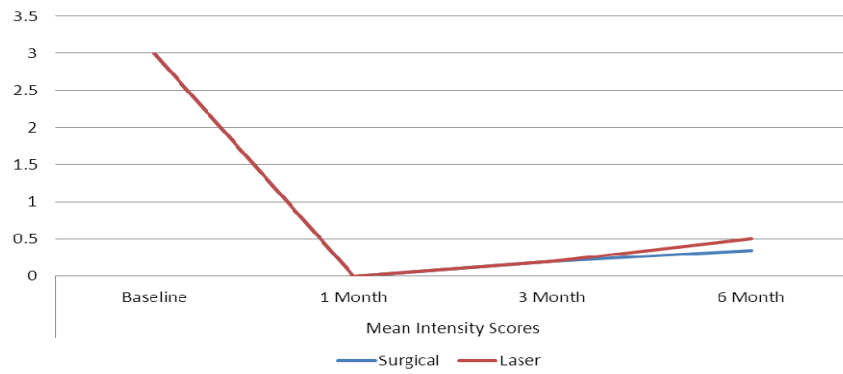


Figure 1. Distribution of mean gingival pigment intensity scores between two techniques at follow ups



Figure 2. Distribution of mean gingival pigment extent scores between two techniques at follow ups



Figure 3. Preoperative View.



Figure 4. Surgical Stripping (Right Side)

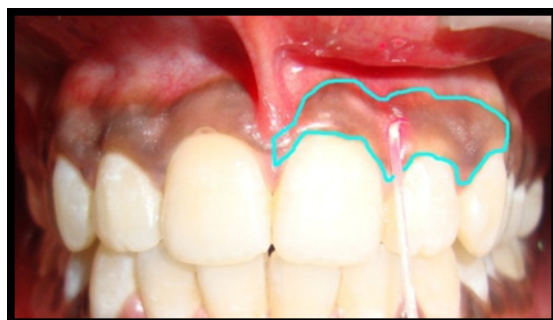


Figure 5. Laser Technique (Left Side)

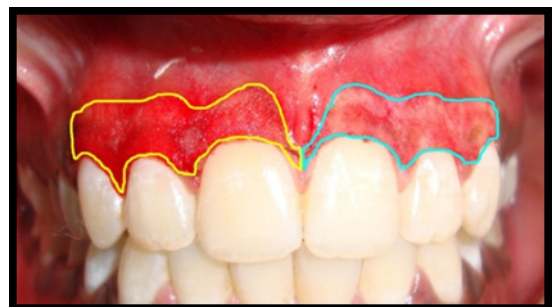


Figure 6. Immediate Postoperative View



Figure 7. Operated area covered with Coe-Pak

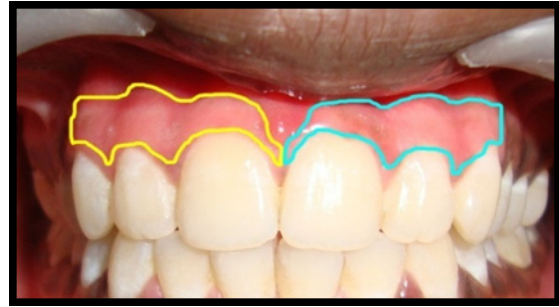


Figure 8. 1 Month Post-Operative View

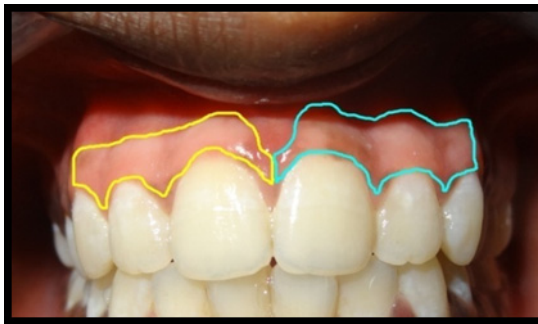


Figure 9. 3 Months Post-Operative View

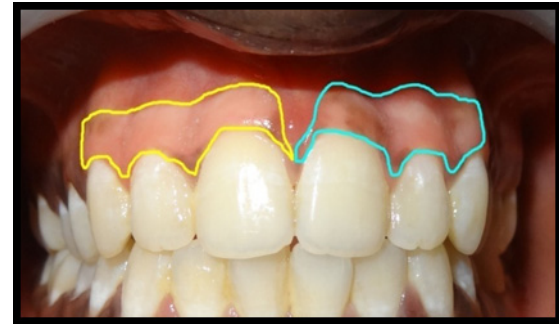


Figure 10. 6 Months Post-Operative View

Our study observed re-pigmentation in both sites treated with diode laser and surgical scraping at 6th month follow up. Several studies have shown that chemical agents for cauterization, bur abrasion technique, or the use of a scalpel have inferior results compared to the use of lasers (Lin et al., 2014).

On the contrary it was also found that surgical stripping resulting in absolutely no sign of recurrence of pigmentation among 48 patients on a 30 month follow up (Shah, 2012). Although the definite mechanism of re-pigmentation is not clear it is attributed to the fact that there could be migration of active melanocytes from surrounding tissues due to lack of complete elimination of melanin cells from the basal cell layer (Perlmutter, 1986). Understanding the histological architecture of gingiva is of utmost importance in regard to final clinical outcomes of depigmentation procedures. Melanin is mainly deposited in the basal and supra-basal layers of the epithelium. The average thickness of epithelium in hard palate is approximately 0.31 ± 0.05 mm and in vestibular gingiva is approximately 0.30 ± 0.07 mm thick (Schroeder, 1981). This theoretically implies that regardless of the de-epithelialisation technique the average depth of epithelial dissection for treating gingival pigmentation must be more than 0.31 mm deep. Furthermore the authors suggest advancement of surgical area towards posterior extent as to prolong re-pigmentation rate.

The strength of this research lies in the study design, in which both interventions for depigmentation was done for the same patient hence the results are more reliable. The present study did not appreciate significant clinical difference in gingival re-pigmentation between the 2 interventional techniques at 6 months. This probably could be due to short term follow up of the subjects. Such studies might require a long term follow-up up to 1 year and more. This research adds an important dimension i.e. '*the depth of epithelial dissection*' in any gingival de-pigmentation procedure as critical in attaining treatment success.

6. Conclusions

There was no statistical difference in postoperative repigmentation and clinical efficacy among the subjects between surgical scraping and diode laser technique at 6th month follow up. Diode laser technique provides better haemostasis and good visibility at the surgical site. The post-operative patient comfort was better at the surgical sites treated with diode laser than surgical scraping method. Hence, both the techniques are used for depigmentation procedures depending on the severity and gingival biotype and patient acceptance.

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Competing Interests Statement

The authors declare that there is no conflict of interests regarding the publication of this paper.

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