

# Gingival Depigmentation Using Surgical Scalpel and Sieve Method of Diode Laser Techniques - A Comparative Clinical Intervention Study

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## ABSTRACT

### BACKGROUND

This study was carried out to compare the treatment outcome after application of surgical scalpel and sieve methods of diode laser for depigmentation techniques with one year follow up period.

### METHODS

This was a comparative split mouth intervention study with follow up period of one year. A total of 5 systemically healthy patients, were enrolled in this study. Right and left quadrant were divided into Group A and Group B. In Group A, depigmentation with Sieve method of diode laser and in Group B depigmentation with surgical scalpel technique were used. Dummett Oral Pigmentation Index (DOPI) and Verbal Analogue Scale (VAS) Questionnaires were used to assess the intensity of gingival pigmentation and the pain intensity of the patients respectively. Data was analyzed using SPSS version 2.5 and P value of <0.05 was considered as statistically significant.

### RESULTS

The pain intensity in Group B (mean rank 1.60, 4.0) was high as compared to Group A (mean rank 0.0, 2.0) at 2 weeks and one month follow up and the results were statistically significant. Group A (mean rank 0.20, 0.80) showed better depigmentation outcome compared group B (mean rank 1.0, 1.80) at six months and one year and the results were statistically significant.

### CONCLUSIONS

Sieve method of diode laser therapy showed a significant improvement in gingival pigmentation as well as reduction in pain intensity as compared to surgical scalpel technique.

### KEY WORDS

Aesthetics, Gingival Pigmentation, Diode Laser, Regimentation

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## BACKGROUND

Aesthetics in dentistry is a crucial component and a challenge to the dental clinicians since, an acceptable and confident smile along with addressing functional as well as clinical problems requires an integrated approach. Apart from the well aligned dentition, the color of the gingiva also plays an important role for dental aesthetics. A beautiful smile involves interaction of various components of periodontium along with dentition. Hence periodontal procedures are considered as a comprehensive aesthetic treatment plan for addressing aesthetic concern.<sup>1</sup>

Gingival pigmentation is present in all races of the human community. The distribution and the intensity of colour are different not only among different races but also in different areas of the same oral cavity. The presence of pigmentation can be because of various factors, but melanocyte deposition in basal layer of oral epithelium is one of the main reasons for brown pigmentation.<sup>2</sup> Depositions of various colored pigments in the tissue leads to pigmentation. The color of the normal skin and mucosa is due to presence of melanin pigment which are produced by highly differentiated cells called melanocytes.<sup>3</sup> Although gingival hyperpigmentation doesn't pose medical problems it is unacceptable aesthetically due to dark complexion especially among those with a gummy smile and excessive gingival exposure.

Hyperpigmentation of gingiva was divided in to physiological and pathological hyperpigmentation. Various skin diseases can cause pathological hyperpigmentation, which may pose health hazard compared physiological pigmentation which is genetic by origin and it can also cause diffuse hyperpigmentation of gingiva. Pathological hyperpigmentation is caused by smoking, ingestion of heavy metals, Kaposi's sarcoma, endocrine disorders etc.<sup>4,5</sup> Pigmentation varies among different races. Pigmentation plays an important role in aesthetic appearance of individuals specially who are having the high smile line. Pigmentation is more in the gingiva of dark-skinned individuals due to deposition of higher quantities of melanin, which may not be suitable aesthetically. These melanin patches present on the gingiva can bring upon adverse psychologically effects. So, it becomes imperative to apply a proper method for the removal of excessive melanin pigmentation and converting the appearance of gingiva from dark colour to pink colour.<sup>5</sup>

The problem of hyperpigmentation of gingiva can be addressed with various modalities of treatment, which are broadly classified in to two categories: methods that remove pigments and methods that mask the pigment. Removal of pigment can be done by surgical and nonsurgical or chemical methods.<sup>6,7</sup> Surgical methods mainly include bur abrasion, scalpel surgery, electrocautery, laser ablation, cryosurgery, radiosurgery, gingivectomy, gingivectomy with free gingival autograft, application of chemical agents, abrasion with diamond bur, Nd: YAG laser, semiconductor diode laser and CO2 laser.<sup>8,9,10,11</sup> Nonsurgical method mainly refers to chemical cauterization. The methods that mask the gingival pigments include gingival grafting procedures and use of acellular dermal matrix allograft, etc.<sup>6,7</sup> All these treatment modalities have their own advantages and disadvantages. In addition to the known complications such as postoperative pain, bleeding, discomfort, the difficulty of the procedure, and delayed wound healing, the most common problem associated with the above

treatment modalities is the recurrence of the pigmentation. In recent days, laser ablation for gingival depigmentation is the most effective, less invasive and reliable technique. The affinity of diode laser towards hemoglobin and melanin helps in addressing deeper soft tissue problems more efficiently.<sup>12</sup> The laser diode can be irradiated either by conventional or sieve technique. In the sieve technique,<sup>1</sup> laser is irradiated Particularly on the pigmentation spots keeping the laser fiber perpendicular to the surface, so that there can be only point contact. However, there is very limited literature regarding the efficacy of this technique. Hence the study was designed to compare the efficacy of usage of conventional surgical scalpel method and Sieve method of application of diode laser in removal of hyperpigmentation of gingiva.

### Objective

The objective of this clinical split mouth intervention study is to compare clinically and statistically the outcome of two different depigmentation techniques using Dummett Oral Pigmentation Index (DOPI) and Verbal Analogue scale (VAS)<sup>13</sup> scores at regular intervals for one year.

## METHODS

This was a comparative clinical split mouth intervention study carried out for one year. A total of 5 systemically healthy patients with 10 bilateral maxillary quadrants, within the age group of 18 to 40 years with an aesthetic complaint of hyper pigmented gingiva were enrolled in this study from the outpatient department of periodontics. Sample size estimation was done by using G Power software (version 3.0). Sample size was estimated for difference between two dependent means. A minimum total sample size of 10 was found to be sufficient for an alpha of 0.05, power of 95%, 1.16 as an effect size. Inclusion criteria for the study were, patients aged between 18 to 40 years with physiological melanotic pigmented gingiva in relation to anterior region, having thick gingival phenotype, healthy gingiva and maintaining good oral hygiene. Whereas Patient under medication, chronic smokers, systemically compromised patients, pathological pigmentation other than physiological pigmentation, pregnant and lactating women, apprehensive patients, patients with history of periodontal treatment for past 6 months and post-surgical keloid were excluded from the study. 5 patients with 10 maxillary sextants were randomly divided in right and left quadrants as Group A and Group B. Group A was treated with diode laser and group B with surgical scalpel method respectively. Dummett Oral Pigmentation Index (DOPI)<sup>14</sup> was used to assess the intensity of gingival pigmentation. The criteria used were 0: Pink tissue, 1: Mild, 2: Medium brown, 3: Deep brown or blue/black tissue. Verbal Analogue scale (VAS)<sup>13</sup> Questionnaire was also used to assess the pain intensity of the patients. A scoring of 0-10 was used.

### Depigmentation with Diode Laser Technique

After obtaining informed patient consent, depigmentation procedure was done after topical application of local anesthetic gel (2% Lignocaine®). Diode laser (MDX®) with Settings of 980 nm, 1.2 W in pulsed mode was delivered

through a 300-micron fiber optic-initiated tip. Diode laser was irradiated to pigmented areas in stippled pattern. The epithelium at the tip of interdental papilla and the mucogingival junction were included without disturbing the marginal gingiva. Laser safety protocols were followed during the lasing process. Post-operative instructions were given and recalled at regular intervals for 1 year.

**Depigmentation with Scalpel Technique**

After obtaining informed patient consent under local anesthesia with 1:80,000 adrenaline, pigmented epithelium was excised with split thickness flap using no 15 surgical blade. Periodontal pack was placed, and post-operative instructions were given. Patients were recalled at regular intervals for 1 year.

**Statistical Analysis**

The data of 5 patients treated by scalpel surgical method and sieve method of diode laser were analyzed using SPSS software 2.5. Descriptive and Man Whitney U test done for subgroups comparison. Kruskal-Walli’s and Man Whitney U test were done for Inter group comparison of DOPI score and VAS scores. p value <0.05 was considered as significant.

**RESULTS**

For VAS scores patients were assessed at baseline, 2 weeks, one month, 6 months and one year. For DOPI scores patients were assessed at baseline, one month, 6 months and one year. Based on the VAS scores the Group A showed less scores compared to Group B at baseline, 2 weeks and 1 month, which were statistically significant. Statistically nonsignificant VAS scores obtained at 6 months and one year between groups. (Table No. 1) Based on DOPI score, Group A showed better depigmentation scores at 6 months and one year compared to Group B which were statistically significant. Statistically nonsignificant DOPI scores obtained at baseline and one month between two groups. (Table No. 2)

Duration	Group A		Group B		P Value
	Mean	SD	Mean	SD	
Baseline	3.40	0.55	6.60	0.55	<0.001**
02 weeks	0.00	0.00	1.60	0.55	<0.001**
01 month	2.00	0.71	4.00	0.71	0.002*
06 month	0.00	0.00	0.00	0.00	1 NS
01 year			0.00	0.00	1 NS
<b>P value</b>					<0.001**

**Table 1. Intergroup Comparison of VAS Score at Various Durations**

NS: Not Significant (p>0.05), \* Significant (p<0.05), \*\* Highly significant (p<0.001)

Duration	Group A		Group B		P Value
	Mean	SD	Mean	SD	
Baseline	3.00	0.00	3.00	0.00	1 NS
1 month	0.00	0.00	0.40	0.55	0.141 NS
6 month	0.20	0.45	1.00	0.00	0.004*
1 year	0.80	0.45	1.80	0.45	0.008*
<b>P value</b>	<0.001**		<0.001**		

**Table 2. Inter Group Comparison of DOPI Score at Various Durations**

NS: Not Significant (p>0.05), \* Significant (p<0.05), \*\* Highly significant (p<0.001)

**DISCUSSION**

A confident smile boosts the moral of an individual psychologically and socially. Esthetic dentistry not only meets the functional but address the aesthetic issues as well. Melanin that is synthesized by melanocytes, the active melanocytes convert tyrosine to melanoprotein mediated by tyrosinase enzymes is the cause for gingival color. The color of gingiva also depends on factors like the severity of melanogenesis, depth of epithelial and gingival vascularization. Melanin pigments gets accumulated in melanosomes and further transfer to prickle and basal cell layers.<sup>15</sup> Various factors that influence the production of melanin in the oral mucosa are trauma, hormone balance, radiation exposure and drug intake. The severity of pigmentation depends on melanosomes number and distribution, melanocyte counts, melanin uptake by keratinocytes and functional activity of melanocytes.<sup>16</sup> The unaesthetic appearance of gingival pigmentation demands depigmentation treatment. Various available techniques existing for gingival depigmentation are removal of pigmented layers by scalpel surgery, cryosurgery, bur abrasion, electrosurgery, laser therapy and use of chemical agents such as 90% phenol and 95% alcohol.<sup>17,18,19</sup> Gingival depigmentation by use of laser diode has many advantages over the conventional surgeries which includes reduced duration of treatment, quick healing, better hemostasis, reduced post-operative discomfort and optimal antimicrobial activity. The disadvantage of laser treatment is the relatively high cost and need for special equipment.

This study was carried out to assess the efficacy two depigmentation techniques namely conventional surgical scalpel method and Sieve method of diode laser technique. Our study design carefully eliminated patient related confounding bias of the results by incorporating a split-mouth design. Pain intensity and level of satisfaction was assessed using a 10-point VAS. Our study revealed that there was statistically significant difference present in mean rank of VAS score, DOPI scores at various durations from baseline. When compared between Group A and Group B in relation to VAS scores and DOPI scores, Group A had shown better results. Laser treated sites significantly reduced pain and increased the satisfaction of patients for one month compared to sites treated with surgical scalpel. Laser irradiation will result in less pain after depigmentation procedure due to formation of biological barrier as a result of coagulation on the wound surface. Sensory nerve endings are sealed, and pain transfer is inhibited due to irradiation by laser.<sup>20</sup>

Recurrence of gingival pigmentation is the major risk in some of the cases. The cause for recurrence is the migration of active melanocytes from adjacent pigmented tissues to the treated areas.<sup>21</sup> Hence to prevent recurrence melanin should be cleared entirely from free gingiva and interdental papillae.<sup>22</sup> Several lasers such as Argon, Er:YAG, ErCr:YSGG and semiconductor diode lasers have been proved successful in treatment of healing of wounds as they are devoid of major discomfort and complications. For depigmentation of gingiva, semiconductor solid state Diode laser operating in either continuous or pulsed mode is recommended. Method employed is, use of an optical laser fibre in contact with tissues for the irradiation over gingiva. Depigmentation using surgical scalpel is most commonly used, but it may cause lot of bleeding

during or sometimes after the procedure and the periodontal dressing has to be used to cover exposed surgical site for at least 8-10 days. On the other hand, diode laser has an advantage over conventional surgical scalpel method where it does not cause haemorrhage during the depigmentation procedure as it converts electrical energy to light energy. But healing of laser wound may be slower than that of surgical wounds. Not much known in the literature about the behaviour of melanocytes to irradiation of laser. When irradiated on melanin gingival pigmentation, laser removes entirely the overlying epithelium and creates sterile inflammatory bed, produces bactericidal effect and haemostasis. 980 nm wavelength laser is popularly known as surgical diode laser was used in this study as it has excellent cutting and coagulation properties due its wavelength and deep penetration ability into the tissues. At low power setting it does not cause harm to underlying adjacent roots of the teeth when used as an adjunct to nonsurgical periodontal therapy for sulcular debridement or curettage. It is also compact in design and cost effective which makes it a popular choice of laser in depigmentation procedures.<sup>23,24</sup>

Ganachari B.C. compared the results of depigmentation with scalpel and diode laser for a period of 9 months and reported that there was no significant difference observed for both treatment techniques in terms of wound healing and reappearance of gingival pigmentation. Authors stated that repigmentation depends on ethnicity and method of depigmentation<sup>25</sup> Lagdive et al and Mani et al. compared the two methods of depigmentation namely Diode laser application and surgical scalpel method. The duration of the study was for 3 months and results showed that patients were satisfied by both methods. Authors concluded that laser has many advantages such as easy to operate, causes very minimal trauma, available in dental clinics and could be used effectively in gingival pigmentation procedures.<sup>26,27</sup> Gupta et al reported that diode laser depigmentation treatment resulted in complete healing of gingiva at one month of interval and no recurrence of melanin pigmentation at 15 months follow up. Laser surgery did not result into any postoperative complications such as bleeding, swelling, infection etc. Authors concluded that laser is preferred for the soft tissue gingival surgeries.<sup>23</sup> Kher and Khan used 980 nm Diode laser for gingival depigmentation treatment. The follow up period was for 3 months. They reported that laser was an option for minimally invasive treatment of gingival melanin pigmentation.<sup>28</sup> The above methods used conventional method of application of diode laser. Sieve method was first used by Behzad Houshmand et. al.<sup>1</sup> They conducted a study to examine the conventional laser irradiation over Sieve method for gingival Depigmentation for 3 months and found no significant differences regarding the reduction of pigmentation scores and pain scores between the 2 groups. The results showed that diode laser irradiation successfully reduced gingival pigmentation in both methods. In comparison, the sieve method was equivalent to conventional technique, offering no additional advantage. Authors attributed these results to short follow up period, migration of adjacent viable melanocytes. Optimal efficacy of diode laser irradiation for gingival depigmentation has also been reported in other studies.<sup>29,30</sup> The conventional method of application of Diode laser as a way of treatment was not included in our

study, because literature shows ample of studies carried out using this method of treatment. Our study showed that Sieve method is better than conventional surgical scalpel method and possible reasons could be duration of follow up, wavelength and parameters of laser used compared to study done by Behzad Houshmand et. al. Limitations of our study remain small sample size and short duration of follow up to one year. Future perspective remains to conduct randomised controlled trial of longer duration of two years or more.

## CONCLUSIONS

Within the limitations of study, Sieve method was found to be superior to conventional surgical scalpel method in reducing the intensity of pain and repigmentation up to one year.

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