ABSTRACT

Objectives: To compare the efficacy of scalpel, laser and cryotherapy (tetrafluoroethane) techniques in depigmentation of gingiva.

Materials and Methods: 30 systematically healthy subjects with the chief complaint of hyper pigmented gingiva, were considered if they matched the study criteria and were randomly divided into three groups (Group I-scalpel, Group II- laser, Group III-TFE). The clinical parameters (Dummetts oral pigmentation index (DOPI), Plaque index (PI), gingival index (GI) were recorded at baseline, 3and 6 months and Visual analogue scale (VAS) score post one week of surgery. Statistical analysis: Intragroup comparison was done using Paired t test and intergroup comparison done using ANOVA and Post hoc Bonferroni with confidence interval of 95%.

Results: The depigmentation techniques of gingiva when compared, scalpel and laser group showed insignificant changes between baseline to 3 months, 3 to 6 months and baseline to 6 months (p value 1.00). When DOPI scores of TFE were compared with Laser group and scalpel group the mean changes were significant between baseline to 3months and baseline to 6 months (0.0001) and insignificant between 3 to 6 months (1.00).

Conclusion: Gingival depigmentation with scalpel and laser showed no difference on intergroup comparison and were found equally effective in gingival depigmentation and occurrence of repigmentation when compared to cryotherapy technique.

Keywords: TFE, laser, scalpel, depigmentation.

I. INTRODUCTION

Aesthetics is one of the crucial aspects of modern dentistry and clinicians have to face the challenge to improvise gingival aesthetics and functional problems. In Modern era, periodontal esthetics has been considered to play a significant role in overall esthetic program since the harmony of smile is not only determined by shape, position, color of teeth, but is also governed by gingival colour and its dimensions. Melanin is the key pigment responsible for the diverse pigmentation found in animal and human skin, hair and eyes. Melanin is synthesized by melanocytes, which are the specialized dendritic cells, originating from neural crest cells (NCCs).
Gingival hyperpigmentation is seen as a genetic characteristic, which is more commonly called physiological or racial gingival pigmentation. It's also been suggested that although pigmentation under normal conditions is genetically determined, its particular distribution within the mouth is also the result of the secondary influences and environmental factors. High levels of oral melanin pigmentation are normally observed in individuals of African, East-Asian or Hispanic ethnicity.

The degree of melanin pigmentation depends on the number and distribution of melanocytes and their capacity to transfer melanin and melanin uptake by keratinocytes. The highest rate of gingival pigmentation has been observed in the area of incisors. The rate of pigmentation is low in the posterior region.

Classification of gingival pigmentation has been initially proposed by Dummett and Gupta (1964) a scoring criterion for oral pigmentation (DOPI). Subsequently in 1967 Dummett et al classified pigmentation into primary oral, secondary oral, oral non-melanin and oral melanoclasis. Brocheriou et al (1985) categorized lesions into non-tumoral, non-melanin pigmented tumors, benign pigmented lesions and malignant melanoma. An extensive classification was put forth by Kauzman et al (2004). Takashi et al (2005) also proposed index to measure gingival pigmentation. Another system was put forward by Meleti et al (2008) who categorized pigmented lesions into melanin and non melanin associated lesions. Peieran et al (2014) gave gingival melanin pigmentation and pigmented lesion index. Later Patil S et al (2015) classified pigmented lesions into different groups like endogenous and exogenous lesions were classified further into three groups i.e. melanin, hemosiderin and haemoglobin whereas exogenous included amalgam tattoo, metals, drugs etc.

The gingival depigmentation can be achieved by various methods, most commonly used is surgical technique. Gingival-abrasion technique, Split thickness epithelial excision or a Combination technique (gingival abrasion and split thickness epithelial excision).

Scalpel surgical technique is first, and most popular, techniques to be employed for surgical removal of undesirable pigmentation by scalpel. The procedure essentially involves surgical removal of gingival epithelium along with a layer of the underlying connective tissue and allowing the denuded connective tissue to heal by secondary intention. The new epithelium that forms is devoid of melanin pigmentation.

Laser is one of the sophisticated and efficient method used in gingival depigmentation, it provides bloodless field and the procedure is comparatively painless. Re pigmentation is less compared to other techniques. This 980nm laser has energy and wavelength characteristics that specially target the soft tissues. It has an affinity for haemoglobin and melanin.

Cryotherapy (TFE) is another method for carrying out gingival depigmentation. The technique involves controlled destruction or removal of living tissues. The effect of ultralow temperature of cryogen on gingival tissue causes the epithelium to undergo cryonecrosis, which helps to eliminate gingival pigmentation.

Therefore the present study has been taken to compare the efficacy of three techniques for over 6 months period.

II. MATERIALS AND METHODS

A total of 30 systemically healthy subjects, from the both sexes, age group between 18-40 years with a chief complaint of hyper pigmented gingival who came to the OPD of Department of Periodontology, meeting our inclusion criteria were randomly allocated to three groups. A written informed consent was obtained from subjects willing to participate in the study, approved by Institutional ethical committee. Inclusion criteria was subjects with esthetic concerns having physiological melanotic pigmented gingiva (DOPI score of ≥2), thick gingival phenotype (gingival thickness >2mm) and healthy gingiva. Subjects under medication, systemically compromised, pathological pigmentation other than physiological pigmentation, pregnant and lactating women, smokers, history of allergies was excluded from the study. Subjects were allocated after computer randomization to three study groups.

Subjects maintaining good oral hygiene were included in the study GI1, PI12, DOPI13 were recorded at baseline, 3 and 6 months. VAS14 was recorded after 7 days post surgery.

Group I treated with scalpel (Figure 1-3), group II using laser (Figure 4-6), and group III (Figure 7-9), with cryotherapy. Surgical protocol were performed for all the groups. Extra orally surgical area was thoroughly
cleaned with 5% w/v povidone iodine swab for 90 seconds. Anesthesia was obtained by infiltration of selected site with 2 ml syringe with 24-gauge needle using 2% xylocaine HCL with adrenaline (1:80000) solution.

For group I scalpels technique was used to remove pigmented epithelium along with a layer of connective tissue which was excised surgically by splitting the epithelium using BP blade no.15 and no.11. Coepak was placed. Healing occurred by secondary intention and new epithelium formed was free of pigmentation. Group II diode laser of 980 nm wave length, with a power setting of 0.6 W in continuous contact mode, using pre initiated fibreoptic tip of 320 microns was used. The pigmented gingival epithelium was ablated using direct contact mode in painting strokes. The fibre tip was continuously moved across the site to avoid heat painting strokes accumulation. Group III cryosurgery technique The tetrafluoroethane (TFE) was used in this study, which consisted of 160ml w/v of TFE (norflurane or 1,1,1,2-tetrafluoroethane)** and the air to gas ratio was about 1:3. The pressure in the Can is about 55 kpa or 150 psi. Before cryosurgical application, the pigmented area was isolated and air dried. After application of LA and wax stents (to protect teeth), the cryogen was sprayed using a spray tip. This was connected to a TFE bottle by means of a control valve and dispensing pipe on the pigmented area. A freezing zone of 4 -5 mm of diameter was continuously maintained for 30-40 sec for 1-2 min. 

Post operative instructions included maintenance of good oral hygiene and avoid trauma around the depigmented site. Subjects were prescribed with Paracetamol 500mg to be taken SOS.

III. STATISTICAL ANALYSIS

The data was first entered into Microsoft excel and then statistical analysis was done using SPSS (statistical package for social sciences) version 24.0. Paired t-test is used for comparison of mean values within each group at different time intervals when the data follows normal distribution. One-way ANOVA (Analysis of Variance) test for comparison of difference between mean values of more than 2 groups when the data follows normal distribution. Post hoc Bonferroni test was used for multiple comparisons after the application of the ANOVA test for comparison within the groups. The p-value was taken significant when less than 0.05 (p<0.05) and Confidence interval of 95% was taken.

IV. RESULTS

The clinical parameters were recorded at different time intervals and were subjected to statistical tests. On intragroup comparison GI, PI scores showed significant changes from baseline to 6 months but changes were insignificant from 3 to 6 months. On Intergroup comparison there was insignificant differences reported at different time periods.

The mean VAS score after 1 week for scalpel with laser, scalpel with TFE and TFE with laser showed insignificant difference (0.823, 0.107 and 0.823 respectively) (Table 1).

On Intragroup comparison , all groups showed significant reduction in DOPI scores. However on intergroup comparison of scalpel with laser group, the changes in DOPI remained insignificant at all time intervals (p value1.00), scalpel and TFE group there was significant difference observed between baseline to 3 months and baseline to 6 months (p value 0.0001), whereas the changes between 3 to 6 months remained insignificant (p value1.00) (Table2). When DOPI scores of TFE and laser groups were compared the mean changes were significant between baseline to 3 months and baseline to 6 months (0.0001) and insignificant between 3 to 6 months (p value 1.00) (Table 2).

V. DISCUSSION

Gingival health and appearance are essential components of a charming smile. Although clinical gingival pigmentation does not indicate a medical problem, “black gums” may be esthetically displeasing, particularly in patients with a high smile line. The etiology of oral pigmentation as stated earlier can be attributed to physiological or pathological, occurring in all human races and countries. Sources of pigments that contribute to the normal gingival colour are variable, the most common source being melanin. Melanosomes produced by melanocytes uniquely synthesize and store melanin pigments. Melanocytes located in the epithelial basal cell layer convert tyrosine to melanin by using the enzyme, tyrosinase, which is then stored in basal cells in the form
Demand for cosmetic therapy is commonly made by people with moderate gingival melanin pigmentation. Various methods such as chemicals, gingivectomy, gingivectomy with free gingival autograft, acellular dermal matrix allografts, electrosurgery, cryosurgery, abrasion with diamond bur and various types of lasers have been used in the treatment of gingival melanin depigmentation with varied degrees of success. The present study evaluated the efficacy of three techniques (scalpel, laser and cryotherapy) used commonly for gingival depigmentation.

Study was carried out in 30 subjects (including dropouts). No adverse reactions were reported in all the groups during the study period. Randomization of the sites were done on assumption that study was done under standard conditions providing true results and it would provide strongest possible basis for inference about treatment effects.

**PI and GI scores** on intragroup comparison showed significant changes from baseline to 3 months and 3 to 6 months in scalpel, laser and TFE groups. The study results were in contrast with Rao PVN et al study, plaque scores decreased at first month and three months posttreatment. Present study results were in accordance with Ipek H et al for plaque scores but contrasting for GI scores. Intragroup comparison from baseline to 6 months plaque and gingival scores showed significant increase in plaque scores and is in contrast with Rao PVN et al and for only plaque scores with Basha et al. The present study results are because of scores recorded at baseline after 2 weeks postscheduling. During the study period some increase in plaque formation would have happened physiologically and could also be attributed to difficulty encountered by patients immediately after surgery. Apart from giving OHI no professional scaling was done. On Inter group comparison there was no significant difference reported between all the groups at different time intervals this is accordance with studies results of Basha et al, Ipek H et al and Rao PVN et al.

**DOPI:** The intragroup comparison of mean DOPI scores of scalpel, laser and TFE groups showed statistically significant reduction from baseline to 3 months. These results are similar to study of Singh V et al, Kumar S et al, Grover HS et. al, Bhardwaj et al, Rao PVN et al, Boyapati R et al, Narayankar SD et al and Chhina S et al. The present study results indicate initially all the three techniques were effective in reducing gingival pigmentation over 3 months.

Intragroup comparison of DOPI scores between 3-6 months showed statistically insignificant changes in scalpel and laser group (p=0.80, 0.170 respectively) that can be interpreted as No/minimal repigmentation observed, whereas TFE group showed statistically significant changes between 3-6 months (p value= 0.011) i.e. repigmentation occurred in patients treated with cryogen (TFE®). The present study results are in contrast to Singh V et al and Rao PVN et al. Results showed that TFE was not effective in controlling repigmentation. Recurrence of pigmentation is described as spontaneous and has been attributed to the activity and migration of melanocytic cells from surrounding areas.

Intragroup comparison between baseline to 6 months there was significant reduction of DOPI scores reported in all three groups similar to Singh V et al, Kumar S et al, Ribeiro FV et al, Rao PVN, Bhardwaj et al, Basha et al and Narayankar SD et al.

On Inter group comparison of scalpel and laser no difference was observed at all time intervals this is in accordance with Thangavelu A et al, Grover HS et. al, Ribeiro FV et al, Bhardwaj et al, Basha et al, Suragimath G, et al, Boyapati R et al, Lama Ashour BD et al and Chandra GB et. al.

So far to best of knowledge of the authors no studies comparing scalpel, laser and TFE group is available. In the present study, comparing scalpel and laser no significant difference at various time intervals was observed. Scalpel technique being one of the earliest and most common techniques of depigmentation and serves as a gold standard and is considered economical easy to perform, epithelium with a layer of connective tissue is stripped off, disadvantages are unpleasant bleeding during surgery, need for periodontal dressings and healing occurs by secondary intention. Therefore patients treated using scalpel technique shows more discomfort and delayed healing compared to diode lasers in gingival depigmentation. On comparing scalpel with TFE there was significant change observed in DOPI between baseline to 3 months and 6 months (p value 0.0001) and no statistical changes between 3 – 6 months (p value 1.00). The present study results are in contrast with Ahmed SK
et al., Kumar S et al., and Narayankar SD et al. The present study results show that there was repigmentation in TFE group compared to scalpel group, attributed to, repigmentation is described as spontaneous, occurring due to activity and migration of melanocytic cells from surrounding tissues. Usually ultralow temperature (-81°C for 10 sec) created by cryosurgery technique results in complete epithelial destruction and elimination of gingival epithelium along with melanocytes.

Intergroup comparison of laser and TFE showed significant changes between baseline to 3 months and 6 months (p value 0.0001), however nonsignificant changes were reported between 3- 6 months (p value=1.00). The present study results are in contrast to Singh Vet al and Jokar L et al.

The present study results show that laser was superior to TFE group can be attributed choice of delivery method depend on the size, tissue type, and depth of the pigmented area, location of the area in oral cavity, penetration of cryogen. Additional patient factors mentioned earlier also contributes to repigmentation.

VAS scores on intragroup comparison at 1 week for the scalpel, laser and TFE groups was statistically insignificant at one week (p =0.104) which shows that no technique was superior to the other in reducing pain perception. All patients experienced almost same pain or no pain immaterial to the technique of depigmentation. These results are in accordance with Grover HS et al but in contrast with Bhardwaj A et al. On Inter group comparison it was seen that there were no statistically significant differences reported in the scalpel, laser and TFE group at one week study results are comparable with K Gurumoorthy et al, Grover HS et al. Contrast with Ribeiro FV et al and Bhardwaj A et al, Narayankar SD et al., Chhina S et al. In the present study no difference in VAS scores was found when different techniques were compared for estimating pain perceptions among subjects of study groups, since VAS could there are different pain thresholds in individuals, post-operative pain being a complex phenomenon influenced by psychological, environmental and physical factors and individual surgeon skills. Application of Coepak™ in scalpel group which serves as a physical barrier, laser setting and formation of the protein coagulum on wound surface, serving as a biological dressing and seals the ends of sensory fibers in laser group, and protection of adjacent oral hard and soft tissues during the use of cryogen apart from that the formation of necrosed layer which again serves as a physical barrier, these all factors may be together responsible for less pain perception in all study groups.

The limitations of the study was longer post-operative period would have been better for assessing repigmentation. A large sample size would have generalized the result in a population. The penetrability of the cryogen could not be assessed. No histological and histochemical assessment was done to evaluate the activity of melanocytes.

VI. CONCLUSION

The groups showed increase in plaque and gingival index at 3 months and it remained same till 6 months. VAS scores were similar in all three groups at the end of 7 days postoperatively. Reduction in DOPI from baseline was observed in all groups, scalpel and laser were found equally effective in gingival depigmentation and preventing repigmentation. TFE group showed initial reduction but early repigmentation.

WITH SCALPEL fig 1-3

AT BASELINE  AT 3 MONTHS  AT 6 MONTHS

WITH LASER  fig 4-6
Table 1: Comparison of three study groups with respect to VAS at 1 week

<table>
<thead>
<tr>
<th>Groups</th>
<th>VAS at 1 week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Scalpel</td>
<td>0.75</td>
</tr>
<tr>
<td>Laser</td>
<td>0.38</td>
</tr>
<tr>
<td>TFE</td>
<td>0.00</td>
</tr>
</tbody>
</table>

F-value 2.520
P-value 0.104*

Mean 0.107
Scalpel v/s TFE

Table 2: Intergroup and intragroup changes in DOPI scores at different time intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Change from Baseline to 3 months</th>
<th>Change from 3 to 6 months</th>
<th>Change from baseline to 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>Scalpel</td>
<td>2.80</td>
<td>0.21</td>
<td>0.37</td>
</tr>
<tr>
<td>Laser</td>
<td>2.68</td>
<td>0.37</td>
<td>0.25</td>
</tr>
<tr>
<td>TFE</td>
<td>0.65</td>
<td>0.25</td>
<td>0.28</td>
</tr>
</tbody>
</table>

F-value 139.095
P-value (among 3 groups) 0.0001*
Change in Scalpel (p value) 0.0001*
Change in Laser (p value) 0.0001*
Change in TFE (p value) 0.0001*

Scalpel v/s TFE 0.0001*
Scalpel v/s Laser 1.00*
Laser v/s TFE 0.0001*

*p-value significant at <0.05, # non-significant

REFERENCES:


