Aesthetic gingival depigmentation with ceramic soft tissue trimming bur and diode laser: a randomized controlled trial

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Abstract

Background: Pigmentation of the gingiva creates a detrimental impact sometimes in a pleasing smile.

Objective: This trial aimed to compare outcomes using diode laser or novel soft tissue ceramic trimming bur for gingival depigmentation.

Methods: Patient's pain, Dummet's Oral Pigmentation Index (DOPI), Wound healing, surgical time and the cosmetic results achieved were evaluated at baseline, 7th day, 14th day and 1 month.

Results: DOPI readings for diode laser technique (DLT) and ceramic bur technique (CBT) were similar at baseline, 7th day, and 1st month. Moderate bleeding was seen in 0% of the patients with DLT while 50% in CBT patients which was statistically significant. A good wound healing score was observed on the 7th day, 14th day and an excellent wound healing with both the groups at 1 month. On the surgical day and 1st day pain was higher in the CBT group although not statistically significant.A statistically increased surgical time of 28.64 ± 6.34 mins for the CBT group was observed.

Conclusion: DLT and CBT were both efficient for depigmentation and presented similar esthetic results. Both procedures did not result in any post-operative complications and the gingiva healed uneventfully. Ceramic burs can be used as an alternative to diode lasers.

Keywords: Hyperpigmentation; laser therapy; esthetics; pain; postoperative care.

Introduction

Facial aesthetics plays a very critical role among patients. The smile decides a very crucial element in the overall acceptance of facial esthetics. The gingival curtain actively dictates the harmony of a smile. In such circumstances sometimes hyperpigmented gingiva that deviates from the presumed normally pleasing and acceptable salmon pink colour may be visualized as unacceptable by the patient. A normal healthy gingiva usually ranges from pale pink to deep red in color and may vary from light to dark brown or black according to the amount and distribution of melanin in the tissue (Jones J, McFall Jr WT, 1977; Monteiro LS *et al*, 2015).

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Gingival melanin pigmentation may also be caused by several endogenous and exogenous factors. (Feller L *et al*; 2014). This hyperpigmentation is viewed by patients as unaesthetic and they desire the removal of pigmented gingival areas (Malhotra S *et al*; 2014).

Several techniques have been employed to treat gingival hyperpigmentation including surgical removal by scalpel (Roshna T, Nandakumar K, 2005), abrasive burs (Negi R *et al*, 2019), electrosurgery (Elavarasu S *et al*, 2015), cryosurgery (Tal H *et al*, 1987), chemical agents, free gingival grafts (Kumar S *et al*; 2012) and lasers (Lee KM *et al*; 2011). Some of the techniques have certain limitations such as painful healing by secondary intention ,the use of local anesthesia, hemorrhage, great skill and care while excising the epithelium to avoid exposure of the bone or create gingival recession after scalpel depigmentation, uncontrolled tissue removal

with caustic agents/cryosurgery, damage to underlying alveolar bone and subsequent gingival fenestration, inefficient depigmentation at the gingival margins and interdental papillary region with lasers (Ahmed SK *et al*, 2012).

Lasers have found various applications in the field of periodontics which also includes gingival depigmentation. The affinity of 810 nm diode laser for hemoglobin and melanin makes the gingival soft tissues an ideal target for cutting and coagulation and also depigmentation.They can be used both in pulsed or continuous mode. Laser therapy has the advantage of reduced discomfort/pain during the procedure and healing period. Reduced treatment times with no bleeding at the surgical sites and delayed repigmentation are added advantages. However lasers pose certain limitations such as need for precision at the gingival margin and interdental papilla, increased financial implications and altered wound healing due to inappropriate exposure (Klim JD *et al*, 2000)

Surgical bur abrasion technique is an uncomplicated approach that does not require complex equipment. Ceramic trimming burs were initially tried for gingivoplasty and currently it has been tried for gingival depigmentation as well. The burs are made of mixed ceramic (Zircon dioxide partly stabilized by Yttrium and Aluminium). The mode of action involves gentle cut/abrasion with minimal bleeding, no risk of necrosis and also prompts good hemostasis due to heat generated (Goldar K *et al*, 2020).

However there is few documented evidence of the effectiveness and comparative analysis of ceramic burs for gingival depigmentation in the scientific literature. In case of proven efficacy the surgical bur can to be used as an alternative to laser/scalpel gingivectomy. Hence the present study was aimed at comparing the effectiveness of ceramic soft tissue trimming bur with diode laser for gingival depigmentation over a period of 1 month.

Study design and population

This study was designed as a double-masked, randomized controlled trial with a split-mouth design comparing ceramic bur technique (CBT) and diode laser technique (DLT) for the esthetic treatment of gingival melanin hyperpigmentation. The study was approved by the Ethics Committee of the Krishnadevaraya College of dental sciences, Bangalore. A detailed description of the planned treatment was given to the patients and an informed and written consent was obtained. The study was carried out from December, 2019 to December, 2020.

The patients were selected from the Department of Periodontics, Krishnadevaraya College of Dental Sciences and Bangalore. A total of 14 patients aged between 18-40 years were selected. The study inclusion criteria were (1) patients with bilateral gingival hyperpigmentation having a primary concern for aesthetics, in the anterior portion of the gingiva; (2) Moderate to severe levels of gingival hyperpigmentation (Tal H *et al*, 2003) (3) full-mouth plaque score and full-mouth bleeding score <20 %; (4) absence of systemic diseases or acute pain, swelling, under medications which could affect the periodontium, pigmentation and tissue healing. Patients who (1) were pregnant or lactating and (2) were smokers, were excluded from the study.

Study protocol

The subjects underwent periodontal examination followed by Phase I therapy comprising of supra - subgingival scaling and oral hygiene instructions. Other required procedures such as extraction and provisional restorations were completed and patients were placed in supportive periodontal treatment.

The maxillary and mandibular arch were divided into two segments: Segment I- right first premolar to right central incisors. Segment II- left first premolar to left central incisors. The two contralateral segments presenting melanin gingival hyperpigmentation were randomly assigned to either one of the two treatment modalities - CBT (test group) and DLT (control group) by a computer generated table.

Surgical procedure (Figs. 1 - 8)

The procedure was done under local anesthesia Lignox® (2% lignocaine with 1:200,000 adrenaline). After adequate anesthesia the depigmentation procedure was performed.

Figure 1. Pre-operative view of bilateral hyperpigmented area.

Figure 2. Ceramic Trimming bur depigmentation in the right maxillary segment.

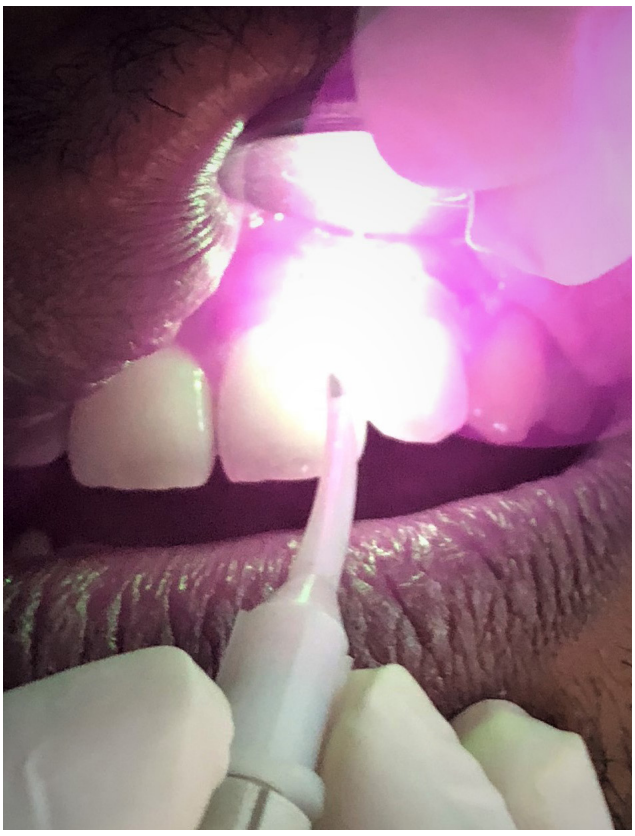

Figure 3. Diode laser depigmentation in the left maxillary segment.

Figure 4. Ceramic Trimming bur depigmentation immediate post operative.

Figure 5. Diode laser depigmentation immediate post operative.

Figure 6. 7th day post operative view of both segments.

Figure 7. 14th day post operative view of both segments.

Figure 8. 1 month post operative view of both segments.

Depigmentation with Ceramic soft tissue trimmer (DFS Precicut®)

The ceramic trimmer was used on the pigmented gingiva using high speed rotary instrument. The instrument was operated at a high speed handpiece of 3,00,000-4,50,000 rpm, gently in intermittent mode according to the manufacturer's guidelines. Water coolant was avoided to facilitate thermal coagulation. A feather touch pressure was applied in a light to and fro motion avoiding contact with the bur in a single site for extended period of time to avoid unwarranted excision of gingival tissues. Gingival debris were cleared at regular intervals with moist gauze piece. After the depigmentation, the surgical segment was irrigated with saline and a periodontal dressing (Coe - Pak, GC America) was placed. Post-operative oral hygiene instructions were given to the patients which included the use of a CHX mouthwash (Clohex ADS mouthwash – 0.2%, India) and use of an ultra-soft bristle toothbrush (Colgate – Palmolive; India) limited. Patients were advised not to consume any hot beverages that could interfere with the healing outcomes (Goldar K *et al*;2020).

Depigmentation with 810nm diode laser

For sites treated with laser, local infiltration with anesthetic solution was only administered when discomfort was experienced by the patient. The laser beam (ARC, Fox 810nm Diode Laser, Germany) was pointed at an external bevel of 45 degrees and at energy settings of 0.5-1.5 watts continuous wave (CW) with small brush like strokes. A 400 μm strippable fibre was used with a power setting of 1.5 watts initially in pulsed wave mode (PW) set at 0.20 ms of pulse duration and 0.10 ms of pulse interval for the de-epithelialization procedure. After deepithelialization, power setting was increased to 2W to obtain rapid ablation for drawing out the deeply seated pigments beneath the basement membrane and execute hemostasis. The charred debris was gently wiped with moist gauze soaked in saline. Laser safety protocol was diligently followed. The same post-operative oral hygiene instructions were given to the patients (Murthy B *et al*, 2012).

Both - procedures were carried out in one single appointment, by the same operator. As a part of post-surgical care all patients were prescribed Paracetamol 650 mg (Crocin® 650 mg, Encore Healthcare Pvt. Ltd, India). Patients were also encouraged to perform chemical plaque control with a solution of chlorhexidine mouthwash (Clohex ADS mouthwash 0.2%, India) twice a day for 1 month. Following depigmentation, patients were recalled on 7th day, 14th day and 1st month.

Methods of assessment

The efficacy of depigmentation, hemostasis effect, post-operative pain perception and discomfort, wound healing capacity were considered as the primary outcomes while patient preference of the techniques, time taken for the surgical procedure and the level of patient satisfaction after the therapy were evaluated as secondary outcomes. The following clinical parameters were examined and followed up over 7th day, 14th day and 1 month.

1. Dummet Oral Pigmentation Index (DOPI) (Dummet and Gupta, 1964)

The index is used to score gingival pigmentation and intensity of gingival hyperpigmentation. Scoring criteria are as follows:

0. Pink – no pigmentation
1. Light Brown – mild pigmentation
2. Mixed Pink and Brown or Medium Brown
3. Deep Brown – Blackish Brown

2. Bleeding and Gingival colour (Ladvige et al; 2009)

Bleeding: A - None, B - Slight, C - Moderate, D - Severe

Color: A - Improvement, B - Slight improvement, C - No change, D - Deterioration

Pain : A - None, Slight, C - Moderate, D - Severe

Difficulty of Procedure : A - Very easy, B- Easy, C- Difficulty, D - Impossible

Wound Healing : A - Complete epithelialization, B - Incomplete epithelialization, C - Ulcer, D - Tissue defect of necrosis

3. Wound healing assessment (Landry et al; 1988)

1. Very Poor: Tissue color - ≥ 50% gingiva red, Response to palpation - Bleeding, Granulation tissue - Present, Suppuration - Present
2. Poor: Tissue color - ≥ 50% gingiva red, Response to palpation- Bleeding, Granulation tissue - Present, Suppuration - None
3. Good: Tissue color - ≥ 25% but <50% gingiva red, Response to palpation- No Bleeding, Granulation tissue - None, Suppuration - None
4. Very Good: Tissue color < 25% gingiva red, Response to palpation- No Bleeding, Granulation tissue - None, Suppuration - None
5. Excellent: Tissue color -All tissue is pink and healthy, Response to palpation- No Bleeding, Granulation tissue - None, Suppuration - None

4. Visual analogue scale (VAS) for pain and patient satisfaction (Huskisson EC, 1974) - Scale ranging from 0 to 10, with 0 denoting no pain , 5 - moderate pain and 10 - worst possible pain.

5. Surgical time taken

Statistical analysis

All statistical procedures were performed using Statistical Package for Social Sciences (SPSS) 20.0. All quantitative variables was expressed in mean and standard Deviation. Qualitative variables will be expressed in percentages. Shapiro-Wilk test was used for testing the normality assumption of the quantitative data. Independent t test was used for association between variables. Probability value ($p < 0.05$) was considered statistically significant.

Results

14 patients - enrolled for the study and none was lost to follow up. No patients reported any side effects of eventful outcomes. 64% of males and 35% of females with mean age of 18-23 years participated. Both - groups showed favorable healing with no complications.

Dummet Oral Pigmentation index (DOPI) readings for DLT and CBT were not significantly different at baseline, 7th day, and 1st month. Intra-operatively moderate bleeding was seen in 0% of the patients with DLT while 50% in CBT patients which was statistically significant. Post-operatively 86% of the patients showed no bleeding with DLT while 50% showed no bleeding in CBT, which was statistically not significant (Table 1). On the 7th day a good wound healing score of 3.7 (DLT) and 3.64 (CBT) was observed on the bur treated sites when compared to diode laser treated sites. Similarly on the 14th day 4.35 (DLT) & 4.5 (CBT) was observed and showed an excellent wound healing with both the groups at the end of 1 month (Table 1).

The VAS (pain) score for the DLT group was scored at around 1.21 ± 1.42 that reduced to 0.57 ± 1.22 on the 1st day. For the CBT group, pain was 2.14 ± 1.70 during the surgery and 1.07 ± 1.54 on the 1st day. In both groups no pain was experienced at 7th day. On the surgical day and 1st day pain was higher in the CBT group although not statistically significant as summarised in Table 1. A surgical time of 28.64 ± 6.34 mins for the CBT group and 14.65 ± 2.98 for the DLT group ($p < 0.001$) was observed which was a statistically highly significant.

Discussion

Hyperpigmentation is clinically visible during speech and smile sometimes it may rise as an esthetic problem to certain groups of individuals.To resolve this issue various depigmentation techniques have been tried. Clinical expertise, surgical precision and increased cost sometimes are the limitations of depigmentation procedures. The use of ceramic burs for depigmentation is one such procedure.

The use of a ceramic - bur - based depigmentation works on the principle of simple surgical abrasion with the help of ceramic burs and does not require any sophisticated procedures except for a ceramic trimming bur which ensures a precise and definite abrasion without increase in thermal energy, minimal bleeding and virtually no risk of necrosis makes this an attractive alternative.

Table 1. Outcomes of Depigmentation with DLT and CBT groups.

		DLT	CBT	p-value
Bleeding Index - Intra operative (n/%)	A (None)	13 (93)	2 (14.3)	0.001**
	B (Slight)	1 (7)	5 (35.7)	
	C (Mod)	0	7 (50)	
Bleeding Index-Post Operative (1 month) (n/%)	A (None)	12 (86)	7 (50)	0.11
	B (Slight)	2 (14)	6 (42.8)	
	C (Mod)	0	1 (7.2)	
Wound healing (Mean ± SD)	7th Day	3.7 ± 0.36	3.64 ± 0.49	0.24
	14th Day	1.28 ± 0.46	1.07 ±0.26	0.15
	1 Month	5.0	5.0	
VAS Score (Mean ± SD)	Intra Operative	1.21 ± 1.42	2.14 ± 1.70	0.13
	1st Day	0.57 ± 1.22	1.07 ±1.54	0.35
	7th Day	0	0	
Surgical Time taken (Mins)		14.50 ± 2.98	28.64 ± 6.34	<0.001**

The current clinical trial notes a mean healing index of (3.64) on the bur treated sites when compared to diode laser treated sites (3.71) on the 7th day. Similarly on the 14th day 4.35 (DLT) and 4.5 (CBT) was observed and an excellent wound healing with both - groups at the end of 1 month. At 1 month all sites treated with diode laser and bur showed complete healing which is similar to that achieved by Goldar K *et al*;2020. The ceramic bur and diode laser showed similar healing patterns in the current trial unlike better healing with bur showed by Negi R *et al*;2019.

Intraoperative bleeding was also more in the CBT group as compared to DLT group. This can be related to the hot tip effect of lasers which facilitates blood coagulation and hemostasis. The results of the current trial is similar to Negi R *et al*; 2019 where laser treated area showed lesser bleeding than bur treated area.

Considering patients perception of pain, this trial revealed no difference between both treatments which is similar to Riberio *et al*; 2013 but contrary to the observation of Negi R *et al*; 2019 where pain was lowered in the laser group. However it is noteworthy that the CBT group showed higher pain perception than the DLT group although not significant in the current study.

Out of a total of 14 patients 9 patients preferred the Laser technique whereas 5 patients found the ceramic soft tissue bur to be more efficient and less painful. A reduced chair time was noted in the DLT group, this aspect can prove to be beneficial in clinical practice both to patient and operator.

A thin gingival phenotype may not be suitable for the use of a ceramic bur. Also a difference in the application of bur inter operatively and intra operatively maybe seen, also control of the bur could be imprecise. More studies are required with long time follow up with other treatment procedures to state that a ceramic trimmer can be used as the best alternative to all other treatment modalities for gingival depigmentation.

Conclusions

As observed in this study, no statistical significance was seen in the comparison of both techniques in terms of efficiency. The results of this study indicated that both DLT and CBT were efficient for depigmentation with similar esthetic results. Both procedures did not result in any post-operative complications and the gingiva healed uneventfully. Thus proving that the ceramic bur can be used as an alternative to a diode laser.

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