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Comparative Evaluation of Healing, Recurrence of Pigmentation and Pain Perception Following Depigmentation with Scalpel and Ceramic Soft Tissue Trimming Bur: A Split Mouth Randomized Controlled Trial

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Abstract:
Background*: Gingival melanin pigmentation occurs in many individual in variable amount caused by melanin granules. Excessive gingival pigmentation may be a major esthetic concern for many patients. Methods of deepithelialization of the pigmented areas of gingiva using various methods are well documented. Scalpel is most common method used for gingival depigmentation. Ceramic soft tissue trimming bur is recently introduced method for the same. As there are less studies in present comparing this two modalities for gingival depigmentation, this study is conducted to evaluate clinical and patient perception of both this techniques.*
Materials and Methods*: Overall, 9 patients (with 30 sites), having complaint of unesthetic gingival pigmentation, were included in the study. Gingival depigmentation was done with scalpel and ceramic soft tissue bur techniques with split-mouth study design. Dummet Oral Pigmentation Index (DOPI) and Gingival Pigmentation Index (GPI) were used to measure pigmentation. Visual Analog Scale (VAS) taken immediate postoperatively to evaluate pain perception. Hydrogen peroxide (H_2O_2) 3% was applied to evaluate epithelialization after 1 week. Patients were recalled for Follow-up at 1 week, 1 month and 3 months postoperatively to evaluate healing and recurrence. Inter-group comparison was done using paired t-test and intra-group comparison was done with unpaired t-test.*
Results*: Statistically significant difference was seen from baseline to 3-months follow-up in both the groups. No significant difference between both the techniques was observed. (p value <0.05= significant) Comparatively, less bleeding occurred in bur treated sites with less VAS score postoperatively.*
Conclusion: *This study concluded that results of scalpel and soft tissue trimming bur are comparable in terms of esthetic outcomes. So, ceramic soft tissue trimming bur can be used as an alternative to scalpel.*
Key Word*: Repigmentation, Scalpel, Ceramic soft tissue trimming bur, Depigmentation, Gingival hyperpigmentation*

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I. Introduction

A smile serves as a social and communication tool. There are various factors that determine harmony of the smile like shape, position and color of the teeth or lips and the gingival tissues, which means that the appearance and health of the gingiva are crucial elements of an ideal smile[1]. Melanin exhibits the highest incidence rate among the primary pigments that contribute to the normal color of the gingiva, along with carotene, reduced haemoglobin, and oxy-haemoglobin. Gingival hyperpigmentation is caused by an excess of melanin deposited in the basal and supra-basal cell layers of the epithelium[2]. Brownish-black gingival melanin pigmentation does not pose a health risk. However, with the uprising esthetic concerns among the patients to create an esthetically pleasant and confident appealing smile, patients desire treatment of hyperpigmented gingiva[3]. The term "repigmentation" describes the clinical reappearance of melanin pigmentation after a period of clinical depigmentation. Melanocytes from normal skin proliferate and migrate into the areas of skin that have lost pigmentation, which is the mechanism proposed to explain spontaneous repigmentation[4]. This study was conducted to evaluate the difference between two surgical procedures of gingival depigmentation such as (1)

Surgical scalpel and (2) Ceramic soft tissue trimming bur in healing, pain perception and recurrence of pigmentation.

II. Material And Methods

A total of 9 patients including 6 females and 3 males, aged between 18 to 32 years, having chief complaint of unesthetic gingival pigmentation, willing to participate in this study were enrolled. Ethical approval was obtained from Institutional Ethics Committee with project no. 192/02/2023. Clinical Trial Registration approval was received with no. CTRI/2023/09/058078.

Study Design: Split-mouth randomized controlled clinical trial

Study Location: This study was conducted in Department of Periodontia, Government Dental College and Hospital, Jamnagar, Gujarat.

Study Duration: March 2023 to February 2024

Sample size: 9 patients

Subjects & selection method: Total 43 patients referred to the department of periodontia were screened for gingival pigmentation, out of which 29 were excluded due to not meeting inclusion criteria, 5 patients were not willing to participate in the study. Total 9 patients were enrolled for the study. Purposive sampling method was used to select the subjects.

Inclusion criteria:

1. Patients with bilateral gingival hyperpigmentation in maxillary or mandibular anterior tooth region (DOPI: Score 2 and 3 and GPI: Score 2 and 3)
2. Systemically healthy individuals
3. Age: 18-50 years

Exclusion criteria:

1. Patients with any systemic diseases
2. Patients with acute pain or swelling in oral cavity
3. Pregnant or lactating women
4. Smokers

Procedure methodology

After enrollment, oral prophylaxis was done. 1 week after oral prophylaxis, patients were recalled for surgical procedure. Pre-operative photographs were recorded with standardized photography methods (Fig. 1).

FIGURE 1: Pre-operative Photograph with gingival pigmentation

Prior to the surgical procedure, the subjects provided written consent. Maxillary and/or mandibular arches were divided into right and left segment. Both the segments were treated with two different surgical approaches of gingival depigmentation:

(1) Test site: Ceramic soft tissue trimming bur

(2) Control Site: Surgical scalpel.

Total 30 segments were randomly divided into both the groups, 15 sites in each group. Randomization was done with coin flip method.

Baseline data were collected including:

(1) DOPI by Dummet and Gupta (1964) to score the intensity of gingival hyperpigmentation [5].

(2) GPI by Kumar S. (2012) was used to score extent of gingival hyperpigmentation [6].

SURGICAL PROCEDURE:

Surgical procedure and follow-up were done by the same surgeon in both the test and control sites. Local infiltration with 1:200,000 Lidocaine-Adrenaline was used to anesthetize the area.

TEST SITE: Depigmentation was done with Soft Tissue Trimming bur, STT250, Strauss & Co., Israel. (fig. *2*)

FIGURE 2: Gingival Depigmentation with Soft Tissue Trimming bur (Test Site)

Soft tissue trimming bur was used at high-speed rpm using airotar without water coolant to remove pigmented gingival epithelium. The rotary bur was moved in unilateral direction over the tissue. As a result of the bur's frictional heat producing instantaneous tissue coagulation and reduced bleeding, coolant (water) was not used. Intermittent irrigation with saline was done to prevent overheating. After the procedure surgical area was examined for any tissue remnants, if any, then removed and surgical area was covered with Coe-Pak™ (GC America).

CONTROL SITE: Depigmentation was done with surgical scalpel using no. 15 blade. (Fig.: 3)

FIGURE 3: Gingival Depigmentation with scalpel method (Control Site)

The blade was used in a scraping motion to remove pigmented gingival tissue. During the procedure, bleeding was controlled with the pressure of wet gauze.

After the procedure, surgical area was examined for remaining pigmented tissue and post-operative photographs were taken. (Fig.: 4)

FIGURE 4: Immediate post-operative Photograph

Surgical area was covered with Coe-Pak™ for 1 week. Post-operative verbal and written instructions were given. Tablet Diclofenac Sodium- 50 mg twice daily was prescribed for 5 days for pain control. Visual analogue scale (VAS) for pain was recorded for each segment after treatment.

Follow-up was taken after 1 week, 1 month and 3 months of the procedure. At 1 week, wound healing was evaluated visually. After drying the region to be assessed, cotton soaked in 3% H_2O_2 was applied to the healing wound. (Fig.: 5)

FIGURE 5: Assessment of wound healing with 3% H_2O_2 after 1 week

Wound healing assessment criteria was as follows[7]:

- Negative (−): No bubble formation (complete epithelialization)
- Positive (+): Bubble formation (incomplete epithelialization)

At 1 month and 3 months follow-up, DOPI and GPI were recorded to measure the outcome. (Fig. 7)

FIGURE 6: 3 months follow-up

Statistical analysis

Numerical data were presented as mean and standard deviation values. The collected data was entered in Microsoft excel spreadsheet. The entire data was statistically analysed using Statistical Package for Social Sciences (SPSS version 26.0, IBM Corporation, USA) for MS Windows. For inter-group comparison, paired-t test and for intra-group comparison unpaired-t test was used. The significance level was set at $P < 0.05$ for all tests.

III. Result

DOPI values for test and control sites were 2.4 ± 0.52 and 2.53 ± 0.52 at baseline, 0 ± 0 and 0 ± 0 at 7th day, 0 ± 0 and 0 ± 0 at 1st month and 0.2 ± 0.42 and 0.2 ± 0.41 at the 3rd month respectively. The scores were not statistically significant between both the groups at baseline, 7th day, 1st month and 3rd month using paired t-test. (p value >0.05) (Table 1)

	TEST GROUP		CONTROL GROUP		
	MEAN	SD	MEAN	SD	P VALUE
BASELINE	2.4	0.52	2.53	0.52	1
1 WEEK	0	0	0	0	1
1 MONTHS	0	0	0	0	1
3 MONTHS	0.2	0.42	0.2	0.41	1

TABLE 1: DOPI score between test and control group

GPI values for test and control sites were 2.53 ± 0.52 and 2.53 ± 0.52 at baseline, 0 ± 0 and 0 ± 0 at 7th day, 0 ± 0 and 0 ± 0 at 1st month and 0.27 ± 0.59 and 0.27 ± 0.59 at the 3rd month respectively. The scores were not statistically significant between both the groups at baseline, 7th day, 1st month and 3rd month using paired t-test. (p value >0.05) (Table 2).

	TEST GROUP		CONTROL GROUP		
	MEAN	SD	MEAN	SD	P VALUE
BASELINE	2.53	0.52	2.53	0.52	1
1 WEEK	0	0	0	0	1
1 MONTHS	0	0	0	0	1
3 MONTHS	0.27	0.59	0.27	0.59	1

TABLE 2: Gingival pigmentation Index score between test and control group

Intra-group comparison of both the groups showed statistically highly significant difference from baseline to 1 week, 1 month and 3 months. (p-value <0.0001) (Table 3).

	TEST		CONTROL	
	DOPI	GPI	DOPI	GPI
BASELINE TO 1 WEEK	<0.0001	<0.0001	<0.0001	<0.0001
BASELINE TO 1 MONTH	<0.0001	<0.0001	<0.0001	<0.0001
BASELINE TO 3 MONTHS	<0.0001	<0.0001	<0.0001	<0.0001

TABLE 4: Intra-group comparison in test and control group from baseline to 1 week, 1 month and 3 months

Bleeding was comparatively less in test sites than that of control sites. Complete epithelialization was seen with H_2O_2 test in all the sites after 1 week. Mean VAS score was 1.27 for test group and 1.67 for control group post-operatively with statistically significant difference (p value- 0.0086). At 3 months, repigmentation was observed in 3 test sites and 3 control sites. The patients did not report any complications following the surgery.

IV. Discussion

Various treatment procedures are used for gingival depigmentation. Patient's skin color, extent of gingival pigmentation, smile line, upper lip curvature, esthetic concerns and expectations from the treatment, influence the treatment plan and selection of the technique[8]. In present literature, few studies were done on ceramic soft tissue trimming bur. So, this randomized controlled trial was aimed to compare both the techniques of gingival depigmentation- Ceramic soft tissue trimming bur and surgical scalpel in relation to repigmentation rate, epithelialization, pain perception and clinical results at 3 months.

When it comes to gingival depigmentation, the scalpel method remains the most reliable. The scalpel procedure is widely used due to its affordability, simplicity and efficiency. The disadvantages of this approach are infections and bleeding during surgery. Various studies have compared surgical scalpel with Laser showing less intra-operative bleeding and less pain perception following treatment with Laser, as well as less chance for infection of the wound[9,10,11,12].

In another study, Faten et al. (2023) compared the clinical result of scalpel, ceramic trimming bur and diode laser technique for treatment of gingival depigmentation[12]. The ceramic trimming bur and diode laser groups showed significantly less bleeding tendency than the scalpel group. All groups showed similar wound healing and degree of epithelialization.

Treatment of removal of gingival pigmentation was compared between a modern technique of ceramic soft tissue trimming bur and diode laser by Phebie et al. (2022)[13]. Excellent results were obtained by both the techniques. No post-operative complications were reported and gingiva healed uneventfully. Therefore, ceramic burs can replace diode laser in management of gingival pigmentation.

Sharath et al. (2020) evaluated various methods used for treatment of gingival depigmentation such as bur method, scalpel, laser method and Ceramic gingival trimming bur[1]. All the techniques provided excellent esthetic results and uneventful wound healing. Post-operatively, there was no history of pain or infection.

Other uses of soft tissue trimming bur are in cases of operculectomy, crown lengthening procedures and for esthetic gingival contouring of uneven margins or in cases of altered passive eruption. Mohamed et al. (2023) conducted a study using soft tissue trimming bur and scalpel in excision of gingival hyperplasia[14]. He concluded that gingivectomy and gingivoplasty procedures using soft tissue trimming bur is a promising and fast approach with significantly less post-operative pain, improved wound healing and less intraoperative bleeding due to immediate coagulation. A study done by Omidkhoda et al (2024) evaluating the efficacy of ceramic bur and scalpel in gingivectomy procedures for orthodontic patients showed that both the treatment

modalities are effective to treat gingival hyperplasia with the ceramic bur having an added advantage of less post-operative pain[15].

A study done by Bakutra G. et al (2017) compared the healing of gingival depigmentation with scalpel and diode laser and observed that lesser numbers of melanocytes were found on immunohistological examination in scalpel group compared to diode laser and thus, less repigmentation was noted in scalpel group at 1 year follow-up[16].

Limitation of this study are histologic evaluation was not done and short-term follow-up to evaluate repigmentation.

V. Conclusion

Based on the results of this study it can be concluded that ceramic soft tissue trimming bur can be used as an alternative to surgical scalpel for gingival depigmentation. It is economic compared with LASER & also has advantages like less bleeding during procedure, comfortable to patient, less chair side time required as well as it is easy to use. To generalize this finding, future research with a larger sample size, long-term follow-up and histologic evaluation will be required.

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