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Comparative Evaluation of Gingival Depigmentation by Diode Laser and Cryosurgery Using Tetrafluoroethane, A 12 month follows up study

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ABSTRACT

Introduction- Gingival hyperpigmentation is a common esthetical concern in patients with excessive gingival display. Pigmentation of the gingiva is a negative factor in an otherwise acceptable "smile window. Diode laser and Cryosurgery has been recognized recently as the effective, pleasant and reliable technique.

Aim- The objective of the study was to evaluate and compare the effect of Gingival Depigmentation by Diode Laser and Cryosurgery Using Tetrafluoroethane.

Material and Methods- The study included 20 patients who presented with a chief complaint of unesthetic anterior gingiva due melanin hyperpigmentation. They were randomly divided into group A and group B of 10 patients each. Patients in group A were treated using a diode laser. The laser beam was set at 0.70 W power, 200 J energy, in continuous mode. Patients in group B were treated using tetrafluoroethane cryosurgery. Patients were followed up for 0,1, 3, 6 and 12 months.

Results- Both the groups showed significant reduction in Gingival pigmentation index score at 0, 1,3,6 and 12 months interval after treatment.

Conclusion- The depigmentation achieved using diode laser and cryosurgery techniques was found equivalent and satisfactory.

Keywords: Gingiva, Diode laser, Cryosurgery, Hyperpigmentation

INTRODUCTION

One of the important factor in the maxillary anterior gingiva is the color of the gingiva. Factors which determine the color of gingiva are, increase or decrease in blood vessels, thickness of the epithelium, extent of keratinization, and endogenous and exogenous pigmentation.[1] Gingival hyperpigmentation may be internal or external in origin.[2] Gingiva is the most common site for hyperpigmentation. Melanin pigmentation is the most common reason for hyperpigmentation of gingiva. [2,3] Gingival melanin pigmentation is not a pathological problem. Patients with a gummy smile or excessive gingival hyperpigmentation usually

complain of a black gum and they want cosmetic therapy for same.[3] Melanosomes synthesized by melanocytes, synthesizes store and melanin pigment.[4] Melanin hyperpigmentation usually does not present a systemic problem, but some individuals may complain of unesthetic black-brown gingiva. Melanin hyperpigmentation may be considered as a psychologic problem as well. [1,5] Many procedures have been used in the treatment gingival pigmentation. Although some procedures like chemical methods are no longer in use. [1,6] Other methods like gingival abrasion [1,7] and scalpel technique [1,8] have been applied with variable

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results for gingival depigmentation procedures. Cryosurgery [1,8,9] and laser [1,3,10] have been recognized as effective and reliable techniques for gingival depigmentation procedures. Patients' satisfaction is good with these techniques. Cryosurgery is method of tissue destruction by freezing and is most important and useful therapeutic technique in the medical and dental practice. [11,12] Various cryogens have been used in the cryosurgery. Tetrafluoroethane (TFE) is a nonchlorofluorocarbon, newer, colorless usually used as a coolant in refrigerating systems and electronic circuits.[12] Kumar et al, in 2013 concluded by case series that ultralow temperature of TFE causes controlled cryonecrosis of gingival epithelium and effectively eliminates gingival pigmentation without any significant side effects and esthetically pleasing results.[13] TFE which is most commonly used in cryosurgery has a melting point of -101° C and a boiling point of -20° C. It is commercially available in the form of pressurized spray.[1] Laser is used for gingival depigmentation procedure which includes CO2 (10,600nm),[5] neodymium doped yttrium aluminum garnet laser (1,064 nm),[5] erbium doped yttrium aluminium garnet laser(2,780nm),[5] and diode laser (820 nm).[14] Diode laser is delivered through fiber optic hand piece.[14] Diode laser has wavelength ranging from 819 to 940 nm.[14] The power output, which is generally 2 to 10 W, can be delivered either in pulsed or continuous mode.[1] Several studies have reported positive outcome after using the diode laser for depigmentation procedures.[8,14] The following study was undertaken to evaluate and compare the effectiveness of diode laser and cryosurgical technique using TFE for gingival depigmentation procedure.

MATERIALS AND METHODS:

A randomized clinical study was carried out in the department of periodontology and implantology in GDC Aurangabad. A total number of 20 patients were included in the study with age group between 20 to 40 year. The patients who complaints of unesthetic maxillary anterior gingiva and who had healthy periodontium were included in the study. Only patients with physiologic melanin hyperpigmentation were included in the study. The patients were randomized into group A (Laser n=10) and group B (Cryosurgery n = 10). Exclusion criteria for the study were pregnancy, breast feeding

mothers, malignancy, uncontrolled diabetes mellitus, melanin pigmentation associated with systemic diseases, adverse reaction to cryosurgery and laser. Patients having habit of smoking and tobacco chewing were excluded from the study. Relative contraindications were cold intolerance and cold urticaria. Patients who signed written informed consent prior to his or her participation in the study were included in study and all patients were completely explained about merits and demerits of the study.

Before the gingival depigmentation procedure, complete scaling was done in all patients in 2 to 3 appointments, followed by oral hygiene instructions. To assess the gingival pigmentation, a new index system, Gingival pigmentation index (GPI) which was given by Bradley and Grace, were included in the study. GPI were assessed before depigmentation procedure and subsequently on 1, 3, 6 and at the end of 12 month. Patient satisfaction was assessed using a simple questionnaire.

Group A: Diode Laser

Special laser-protective glasses were used before applying lasers. Highly reflective instruments or instruments with mirrored surfaces were avoided during the procedure. The laser was used at 0.70 to 1 W power, 200 J, in continuous mode. Topical or local anaesthetic was used if needed. Local infiltration was given on the site of interest. Laser ablation was started from the mucogingival junction working toward the free gingival margin, including the papillae. The motion of the laser ablation was circular with overlapping circles. The procedure was completed within 30 to 45 minutes.

Group B: TFE Cryosurgery

Topical anesthesia with 10% xylocaine spray was used, to minimize the discomfort caused by cooling. The TFE delivering device consisted of a TFE cylinder, with a spray-controlling nozzle at the tip. The rolled cotton was used for application of TFE. TFE were sprayed on rolled cotton swab and immediately applied over the pigmented area. Freezing zone was maintained for 30-40 seconds. The procedure was completed within 15-20 minutes.

Postoperative instruction such as avoiding smoking and hot and spicy food for at least 24 hrs were given to the patients. Analgesics were prescribed to the

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patients and instructed to take after experiencing pain only.

All patients were recalled after 1 week, 1, 3, 6 and 12 months for postoperative observation. Pigmentation was assessed by direct clinical examination. Statistical analysis was done using x2 test (intergroup comparison).

RESULTS:

The present study was conducted in 20 patients. In that 13 were females and 7 were males. 14 cases had moderate pigmentation while 6 cases had severe pigmentation.

Group A: Diode laser

Immediately after the laser ablation procedure the area was covered with whitish slough in all the patients. There was slight bleeding and irritation immediately after treatment in 3 cases of diode laser depigmentation procedure. While remaining cases showed no signs of bleeding and irritation. Immediately after treatment no signs of swelling were observed. Slight pain was noted in few cases of depigmentation by diode laser during treatment. Thereafter no pain was noted in the patients in remaining follow up period. There was a significant decrease in cases with mild pain after 1 week, 1 month as well as 3 months compared to pain during treatment and immediately after treatment. Only 3 out of 10 cases showed spotted pigmentation after 1 month follow up. These cases were again treated by diode laser.

The GPI score before depigmentation procedure for all cases was 3. At the end of 6 months, a score of 0 was given for eight cases, because there was complete absence of pigmentation. The presence of spots of pigmentation in two cases resulted in a score 1. These cases were treated again by diode laser. At the end of 12 month, there was complete absence of pigmentation and score 0 was given to all cases.

Group B: Cryosurgery by TFE

Immediately after, 30 seconds of application of TFE there was a whitish slough appearance. Then 30minutes after the procedure treated area appeared red. On day 1 tissue necrosis became evident, which was sloughed off from the underlying tissue in all the patients. There was no bleeding during and immediately after the cryosurgery procedure. In cryosurgery procedure there was no pain during and immediately after the procedure. Mild discomfort was observed in few cases after the procedure. After 1month, spotted pigmentation reappeared in 3 cases, which were treated by TFE again. The GPI score before depigmentation procedure for all cases was 3. At the end of 6 months, there was complete absence of pigmentation in 7 cases, so a score of 0 was given to those cases. Because there were spots of pigmentation in 3 cases a score of 1 was given. These cases were treated again by cryosurgery. At the end of 12 month, there was complete absence of pigmentation in all cases so score 0 was given to those cases.

At 12 months, comparative evaluation (statistical analysis using x2 test, exact) of both groups revealed similar results. Patient satisfaction was assessed using a simple questionnaire. Statistical assessment of patient response to each question was done (x2 test, exact). However, all patient reported being esthetically satisfied by both procedures of gingival depigmentation.

DISCUSSION:

Cryosurgery and diode laser have been found to be effective techniques for gingival depigmentation procedures. Diode laser having wavelength in the range of 800-980 nm is quickly absorbed by hemoglobin, melanin and other pigments. It penetrates into the tissue by one of the methods of absorption, propagation, radiation, and reflection. The penetration is done by laser energy and changes energy into heat which eventually causes physical changes.[15] Cryosurgery and diode laser causes lesser amount of postoperative pain than other techniques of depigmentation.[15,16] The lesser amount of postoperative pain for the laser is due to the coagulation of protein on the wound surface and ability to seal the sensory nerve endings.[16,17] Ribeiro et al[18] and Lagdive et al[19] also reported that the sites treated with laser had slight or no pain. In the studies of Berk et al,[20] and Murthy et al,[21] who used diode laser for the treatment of gingival physiologic hyperpigmentation, 1 week after operation, gingiva healed and its color were pink. Healing after laser therapy is found to be faster than healing after TFE procedure. Photo biomodulation effects of laser helps in stimulating the fibroblasts, angiogenesis, and accelerating the lymphatic flow,

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which enhances repair and regeneration. The bactericidal effect of the laser related to the generation of reactive oxygen species may also add to the faster healing in a relatively sterile environment.[22] Because of the presence of active melanocytes in the basal cell layer of the epithelium, Pigmentation may reappear in some cases.[23] Due to failure in complete removal of active melanocytic cells from the epithelial basal layer, re-pigmentation may occur and it may also reoccur as a result of melanocyte migration from surrounding gingival areas. [16,17] In the present study, no statistically significant difference existed in the melanin scores between the 2 techniques, both laser and cryosurgery showed a better efficiency in terms of pigmentation removal, and there were no signs of pigmentation recurrence for both modalities at the end of 12 months.

CONCLUSION:

During the 12-month follow-up, the depigmentation achieved using diode laser and cryosurgery techniques was found equivalent and satisfactory. Recurrence of pigmentation was not observed in any cases of depigmentation by diode and cryosurgery after 12 months follow up. Both the technique of gingival depigmentation are safe and effective treatment modalities that provides optimal aesthetics with minimal discomfort in patients with gingival hyperpigmentation.

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Diode laser- group



Cryosurgery- group B



Baseline



Immediate post-op



12- month follow up

Fage 965

Cryosurgery unit



Gingival Pigmentation Index					
Score	Criteria				
0	Absence of pigmentation, pink colour of gingiva				
1	Spots of brown to black pigmentation				
2	Brown to black pigmentation, more than spots but not diffuse				
3	Diffuse brown to black pigmentation involving papillary, marginal, and attached gingiva				

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Questionnaire Name of the patient Age/Sex

- A. Postoperative pain
 - 1. None
 - 2. Mild
 - 3. Moderate
 - 4. Severe
- B. Discomfort
 - 1. None
 - 2. Yes
 - 3. No
- C. Final aesthetic Outcomes
 - 1. Dissatisfied
 - 2. Partially satisfied
 - 3. Completely satisfied

GPI Scores for Laser Treatment at Different Time Intervals

Patie nts	Preoperativ e	l mont h	3 mont h	6 month	12 month
1	3	0	0	0	0
2	3	0	0	0	0
3	3	0	0	0	0
4	3	1	0	0	0
5	3	0	0	0	0
6	3	0	0	1	0
7	3	1	0	1	0
8	3	0	0	0	0
9	3	1	0	0	0
10	3	0	0	0	0

mont h Patie nts mont h Preoper ative mont h month Т U Ι Ι Ι y I

GPI Scores for Cryosurgery Treatment at Different Time Intervals

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