

Comparative evaluation of effect of locally intraepidermal Vit. C injection, conventional surgical depigmentation and depigmentation by diode laser(980nm) in anterior esthetic zone

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Abstract

Objective: The main objective of our study is to compare effect of locally intraepidermal Vit. C injection, conventional surgical depigmentation and depigmentation by diode laser(980nm).

Materials: 30 participants included in study with inclusion criteria mild to severe pigmentation (according to Dumett score 2-4) and Double evaluation of the depigmenting effect was performed using two different color assessment indices (Takashi and Kumar indices). The pain and itching grades were reported using VAS scale.

Method: The participants are divided into 3 groups with 10 participants in each group and they are treated with locally injected intradermally Vit C., Scalpel technique and diode laser respectively.

Result: At baseline and 9 months there was no statistical difference between three groups in index At 3 month, statistical significant difference was reported in index 1 (pvalue $\frac{1}{4}$ 0.003) and index 2 (p value $\frac{1}{4}$ 0.002). Regarding pain score, statistical significant reduction in scores

Conclusion: Usage of vitamin C could provide a long term stability of the gingival color if used after the surgical procedure.

Keywords : Gingival hyperpigmentation ,intraepithelial injection , vit.C, surgical depigmentation , diode laser

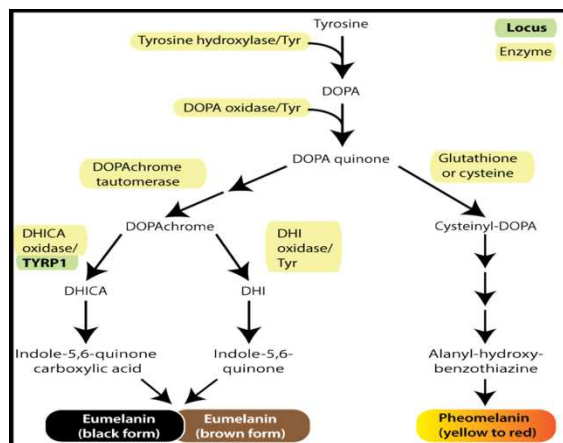
INTRODUCTION:

Gingival health and appearance are essential components of attractive smile of human being .Color of gingiva depends on size of blood vessels, epithelial thickness, quantity of keratinization and pigment within epithelial like melanin, carotene, reduced haemoglobin and oxyhemoglobin.¹

Oral pigmentation is a discoloration of the gingival/oral mucosa, associated with several exogenous and endogenous factors. Melanin pigmentation often occurs in the gingiva as a result of an abnormal deposition of melanin, due to which the gums may appear black.

Melanin pigmentation of the gingiva occurs in all the races. Melanin is non haemoglobin derived a brown pigment, is the most common natural pigment contributing to endogenous pigmentation of gingiva and the gingiva is also the most

predominant site of pigmentation on the mucosa. Melanin pigmentation is the result of melanin granules produced by melanoblasts intertwined between epithelial cells at the basal and suprabasal layer of gingival epithelium. Gingival pigmentation is presented as a diffuse deep purplish discoloration or as irregularly shaped brown and light brown or black patches, striae or strands



Fig,1 Synthesis of melanin pigmentation

Melanin pigmentation appears as early as 3 h after birth in the oral tissues and in some cases is the only sign of pigmentation on the body. It is generally agreed that pigmented areas are present only when melanin granules synthesized by melanocytes are transferred to the keratinocytes. This close relationship is known as the 'epidermal-melanin unit'.²

Different treatment modalities which have been reported include bur abrasion, scraping, partial thickness flap, cryotherapy, electrosurgery, gingivectomy, gingivectomy with free gingival autografting, chemical agents, such as 90% phenol and 95% alcohol lasers. And intradermal vit,C injection

Vitamin C is one of the approaches involved in skin depigmentation whether via topical or transdermal or intravenous approaches. Vitamin C is a water-soluble antioxidant. L-Ascorbic acid (vitamin C) also promotes collagen biosynthesis, provides photoprotection strengthening skin layers, reduces the melanin scavenging of free radical and enhancing of the immune system.³

Vitamin C, it was found to be involved in depigmentation due to several factors that not only depend on its direct effect on melanin and melanocytes but also due to the overall effect on the applied tissues. Once vitamin C is introduced to the target tissue, it binds efficiently to melanin due to the reactive oxygen species (ROS), calcium and copper content which causes intracellular deficiency of these items and the inability of the cells to produce melanin. Calcium deficiency causes failure of melanocytes to perform cellular adhesion to keratinocytes as calcium is essential to form cadherins.⁴ Adhesion to keratinocytes is an important stimulator to melanocytes in order to produce melanin, form dendrites and transfer the produced melanin to neighboring cells. Shortage of the intercellular copper limits the formation of tyrosinase, tyrosinase enzyme and peroxidase enzyme which in turn stops the melanin production.³

In conventional scalpel technique, the pigmented gingival epithelium along with a layer of the underlying connective tissue is surgically removed by splitting the

epithelium with blade. Care should be taken not to leave any pigmented remnants over the denuded area.. This process may be attributed to the fact that active melanocytes from the adjacent pigmented tissues migrate to the treated areas.

Laser ablation of gingival depigmentation has been recognized as one of the effective, pleasant and reliable techniques. It is usually sufficient to eliminate the pigmented areas and do not require any periodontal dressing. It also shows reduced pain and discomfort due to formation of protein coagulum. Laser light may also seal free nerve endings. The diode laser has been introduced in dentistry few years back. It is a solid-state semiconductor laser that typically uses a combination of elements to change electrical energy into light energy. It also can be delivered through a flexible quartz fiber optic hand piece. This energy level is absorbed by pigmentation in the soft tissues and makes the diode laser an excellent hemostatic agent It also allows good visibility at the surgical site.

Therefore, the aim of the present study was to compare the clinical efficiency of the non-surgical intraepidermal injection of vitamin C in comparison to the gold standard surgical technique (scalpel technique) and diode laser(980nm) for gingival depigmentation.

METHODOLOGY

Ethical aspects

All participants signed an informed detailed consent form before participation, where benefits, steps and side effects of the treatment protocol were fully explained.

The study design

The study was designed as non-randomized prospective clinical study. Following examination, the enrolled patients were divided equally to the study groups.

Screening procedures

The study was conducted in Divya Jyoti Dental college of science and research Modinagar in department of Periodontology and Oral implantology An initial evaluation,including medical and dental history, clinical examination, was conductedto determine patient eligibility for the study.

INCLUSION CRITERIA

- 1) above 18 y;
- 2) systemically free;
- 3) physiologic gingival hyperpigmentation related to esthetic region were selected.

EXCLUSION CRITERIA

1. Systemic diseases
2. Smoking
3. pregnant and lactating mothers

The included patients were divided into 3 groups:

- .Group 1-10 patients treated with intradermal vit.c injection
- Group 2- 10 patients treated with conventional scalpel surgical technique
- Group 3 -10 patients treated with diode laser(980nm)

Patient preparation

Each patient received complete oral prophylaxis and received personalized oral hygiene instructions. In addition, chlorhexidine mouthwash was recommended to be used before procedure. All patients were placed on a 2 weeks maintenance recall appointments. Oral hygiene measurements with modification of the patient habits were performed prior to treatment. Stoppage of spicy, acidic, coloring and hard food was recommended pre-operatively.

Non-surgical procedure

The operator performed all the injection procedures. The site was anesthetized using topical anesthetic agent (lignocaine gel or xylocaine gel). Infiltration anesthesia was recommended during the first injection visit. Intraepidermal injection of 1-1.5 ml (250 mg concentration) of ascorbic acid (Livocee 25% ampoule-Liv-Biocompany-India) was done. It was locally introduced in relation to the keratinized gingival tissues with extension to the whole target region successively using special syringes (insulin syringe-30 gauge). The needle was introduced parallel to the gingival tissues with the bevel facing upwards. Vitamin C was then delivered through the attached gingival tissues at the epithelium-connective tissue junction (equivalent to epidermal- dermal junction) till the tissues blanch. Maximum 0.1 ml of ascorbic acid was recommended for each point with 2-3 mm apart. The same dose was repeated once per week for maximum 4 visits till no further color improvement gained

Surgical depigmentation

The operator performed all the surgical procedures. For gingival ablation, epithelial layer and part of the connective tissue layer were removed using 15c blades till the pigment disappeared. Caution was taken at the canine region to avoid bone exposure. Thick gingival biotype is considered the most suitable condition for performing the surgical technique. Removal of adequate thickness of the gingival tissues is mandatory in order to reduce the recurrence rate. The marginal and interdental papillary tissues remain critical regions even in thick gingival biotypes. The biotype of these regions is not usually equivalent to the biotype of the remaining parts of the gingival tissues. In case of thin gingival biotype, papilla spare technique is recommended (being away from the gingival margin and interdental papilla with 1-2 mm). Thus, papillary depigmentation is not recommended in case of interproximal bone loss. Fortunately, these regions are not deeply pigmented which may be due to the thin epithelial layer and thus causing; minimal induction to the pigment cells. In case of thin gingival biotype and deeply located pigmentation, surgical depigmentation is not highly recommended. Periodontal dressing is recommended after treatment for 7-10 days. Healing occurs by secondary intention. Up till now, surgical depigmentation is considered one of the simplest periodontal surgical techniques as it requires minimal time, less effort and armamentarium.

Laser depigmentation

Sirona diode laser having wavelength 810 to 980 nm at 1.5 to 2 Watt power in a continuous wave mode with flexible fiber optic quartz delivery system was used. After the selected power settings were entered, the laser was activated. The procedure was performed in contact mode. The tip was held in light contact with the tissue and the procedure was performed with light sweeping brushstrokes. High volume suction was used. The laser tip was directed to the target tissue until blister formation occurred. Blistered gingiva was scraped off with wet, saline moistened gauze to remove the epithelium containing melanin pigmentation.

Post operative instructions

The postoperative instructions differed between 3 groups. In the surgical group, periodontal pack was currently placed following the surgical procedure in order to provide high protection to the surgical field till healing occurs. Patients were instructed to avoid mechanical oral hygiene during the first week after surgery so as to avoid the mechanical trauma to the treated sites. Patients were prescribed an analgesic (Ibuprofen 400 mg) to be used as needed. While following each injection visit, the patients were asked to abstain from mechanical oral hygiene procedures in relation to the target region for the day of procedure only. Tooth pastes (Colgate tooth paste) with anti-inflammatory mouth wash (Coolera mouthwash,) were recommended. Analgesics were recommended if pain or itching was detected in the first day.

Clinical parameters

Pre and post each procedure, the following clinical measurements were recorded

The clinical assessment of the degree of gingival pigmentation was performed using two different indices;

Dumett index

0-no clinical pigmentation (pink gingiva)

1-mild clinical pigmentation (mild light brown color)

2-moderate clinical pigmentation (medium brown or mixed pink and brown black color)

3-heavy clinical pigmentation (deep brown or bluish black color)

Takashi index

0: no pigmentation;

1: solitary unit (s) of pigmentation in papillary gingiva without extension between neighboring solitary units,

2: formation of continuous ribbon extending from neighboring solitary units

The color assessment was evaluated in the day light and by examining the regular digital photographs which were taken pre-operative, and post-operatively after 1 and 3 months. The immediate effect of treatments was detected after one week of the

completion of the procedure. The recurrence rate was measured after 9 months post-operatively. Pain and itching were reported by the patient after the surgical procedure and following each injection visit using visual analogue scale (VAS).

The visual analogue scale is divided into vertical and horizontal parts. The horizontal part (numerical) consists of 10 cm line with two end points represents "no pain" to "severe pain". While the vertical scale (verbal) measured by 5 points: no itching (zero), mild itching (1 point), moderate itching (2 points), severe itching (3 points), extremely severe (4 points)



Fig 2 The Red Color Represents The Critical Zone; The Green Color Represents Areas To Be Safely Injected While The Yellow Color Represents The Areas To Be Injected With Caution Due To Canine Eminence (Thin Gingival And Bone Biotype).



A

B



C

D



E

F



G

Fig 3 The Stages Of Vitamin C Depigmentation

A: Pre-Operative, B:Intra-Operative, C: After 1st Visit, D: After 2nd Visit,E: After 1 Month And F: After 3 Months Follow Up.G:After 9 Months Follow Up



A

B



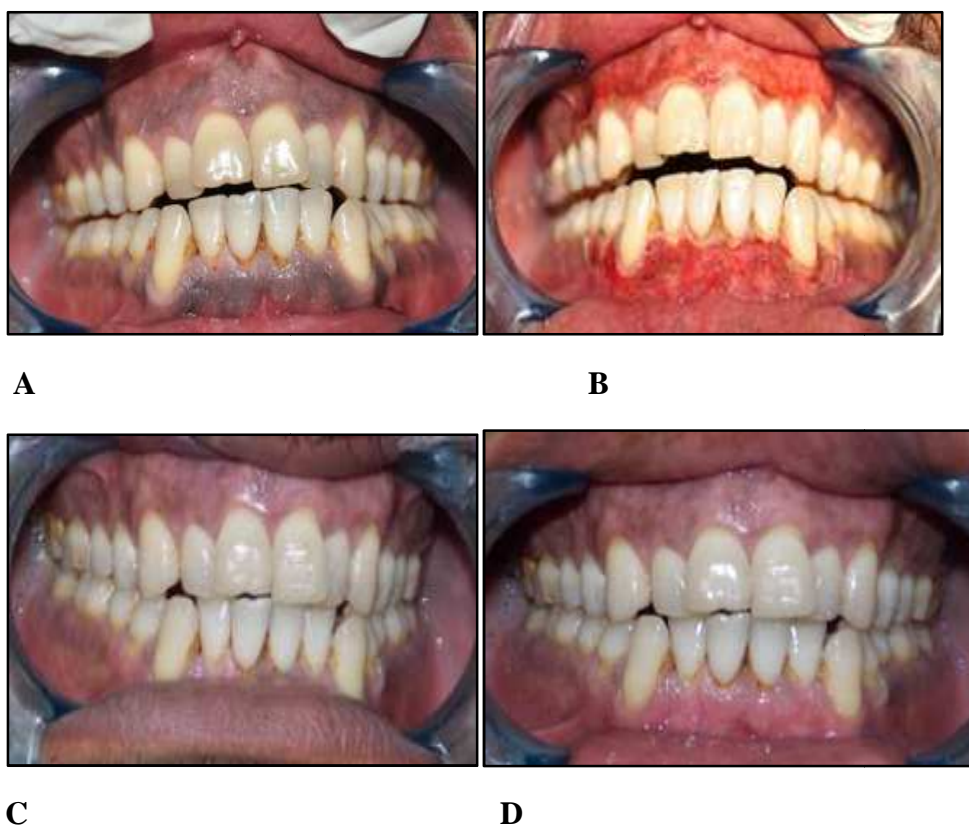
C

D



Fig 4 The Stages Of Depigmentation By Conventional Method

A: Pre-Operative, B: Intra-Operative, C: After coe pack placement, D: After coe pack removal, E: After 1 month, F: After 3 Month And G: After 9 Months Follow Up.





E

Fig 5 The Stages Of Depigmentation By Diode Laser

A: Pre-Operative, B: Intra-Operative, C: After 1 Month, D: After 3 Months and E: After 9 Months Follow Up.

RESULTS

At the base-line, there was no statistically significant difference (p value = 0.9) in pigmentation area according to index 1 value between three groups. After 3 month follow up, there was a statistically significant difference (p value = 0.003) in pigmentation area according to index 1 value between test and control groups while there was no significance (p value = 0.46) after 9 months follow up (**Fig.6**)

At the base-line, there was no statistically significant difference (p value = 0.14) in pigmentation area according to index 2 value between three groups. After 3 month follow up, there was statistically significant difference (pvalue = 0.002) in pigmentation area according to index 2 values between test and control groups while there was no significance (p value = 0.39) after 9 months follow up (**Fig.7**)

In the 1st day there was statistically significant decrease (p value = 0.004) in pain or itching score in the group III more than that in the group I and II. Pain score statistically and significantly decreased in the group I in the 2nd (p value = 0.0001), 3rd (p value = 0.0001) and after 1 week (p value = 0.0015) more than that in the group II (**Fig.8**).

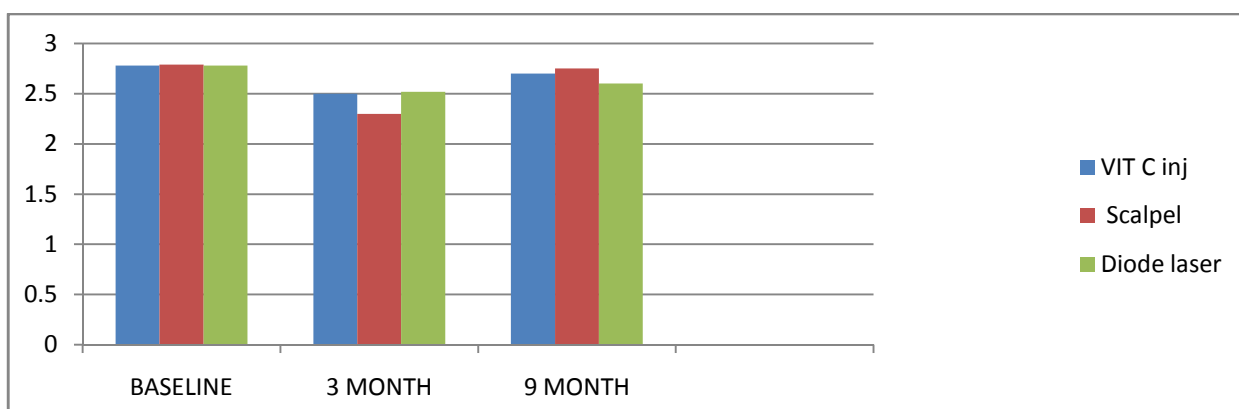


Fig 6 Showing The Mean Value Of Changes In Pigmentation In Three Groups According To Index 1

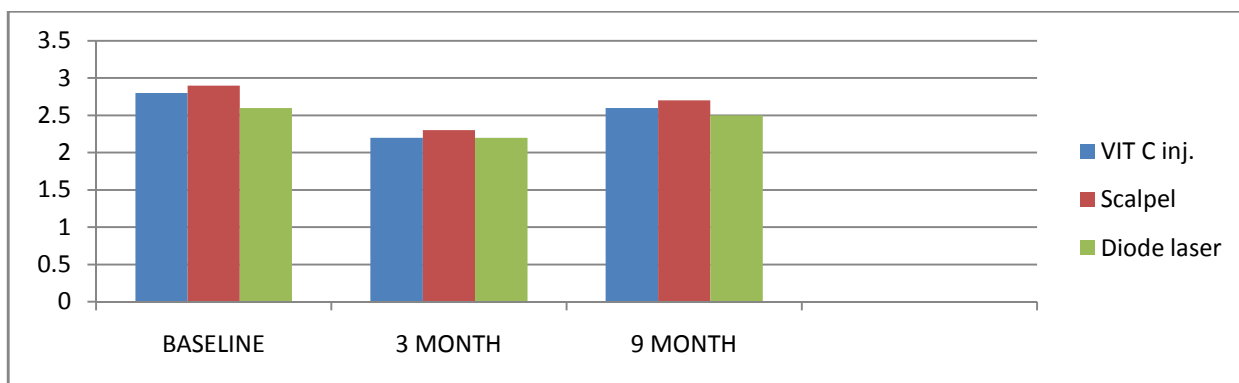


Fig 7 Showing The Mean Value Of Changes In Pigmentation In Three Groups According To Index 2

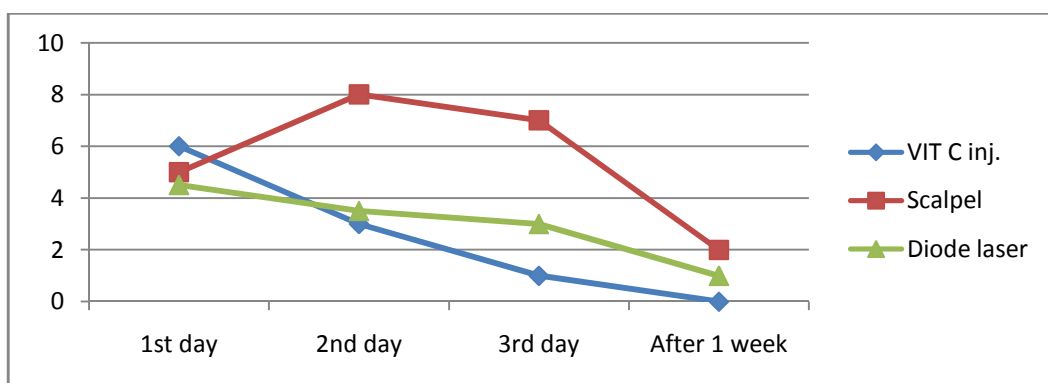


Fig 8 Showing The Mean Value Of Changes In Pain And Itching In Three Groups

DISCUSSION

It was found that melanin pigment is essential for protection of the nuclei of the dermal keratinocytes against ultraviolet radiation and other irritating factors (Plonka et al., 2009). While in the gingival tissues, there is minimal need to such protection. Due to high esthetic demands, the proposed technique should be simple, easy and based on careful analysis of pigmented gingival tissues. The surgical intervention is most commonly used to treat physiologic gingival hyperpigmentation. It depends on removal of the full thickness of the epithelial and the papillary connective tissue layer (Hedge et al., 2013 and Patil et al., 2015).

There are many advantages of lasers over surgical procedures. According to Wigdor et al (1995), these include:

1. Dry and bloodless surgery,
2. Instant sterilization of the surgical site,
3. Reduced bacteremia,
4. Reduced mechanical trauma,
5. Minimal postoperative swelling and scarring and
6. Minimal postoperative pain.

Pain and itching were regarded as painful stimuli. Itching may transit to pain due to increased discharge frequency of nociceptors (intensity theory) (Schmelz, 2010). Pain and itching are mainly caused by acidity and/or needle prick. Acidity is an essential property for ideal tissue penetration depth (Crisan et al., 2015). About 6% of the patients complained from mild itching. Ulceration seen in two patients of depigmentation done by vitamin C injection.

Both diode laser and scalpel technique provide satisfactory results regarding the efficiency of gingival pigmentation removal immediately after the procedure in terms of DOPI and Takashi index and gingiva became completely pink at 1 week, 2 weeks and 1 month appointments. Results of both treatment modalities were stable to some extent, with slight recurrence seen as solitary units of pigments mainly in the papillary area in both sites at 9 months. The difference in repigmentation was not significant but was slightly more in the diode laser group than in the scalpel group. This can be attributed to the shallow penetration depth of this type of laser and the consequent increased number of melanocytes remaining deep in the gingival tissue that may have become activated and started synthesizing melanin. A reason for the increase in the repigmentation in the papillary areas in both groups could be the difficulty in completely removing the melanin pigments from these sites and the increasing thickness of papillary tissue. This was in agreement with Esen et al.⁵ who found that the papillary area and gingival margins were the most repigmented sites after treatment with CO₂ laser.

At the end of the follow-up period, most patients in three groups were highly satisfied with the results. Although some cases presented with areas of repigmentation, this had a minimal effect that did not affect the level of patient satisfaction.

CONCLUSION

Usage of vitamin C could provide a long term stability of the gingival color if used after the surgical procedure. In the modern dental practice using laser technology, procedures can be accomplished with less invasive methods, a more relaxed appointment and less postoperative discomfort. The present study demonstrated that both the diode laser technique and the scalpel technique used for gingival depigmentation may achieve similar outcomes, as measured by Dummet oral pigmentation index, Hedin melanin index, postoperative pain perception, the required time for the treatment, and the amount of recurrence. Laser therapy requires a more advanced technology and is associated with higher financial costs than the use of the scalpel technique and Vitamin C injection, which is more economical. But Vitamin C injection technique requires more time (four appointment). Therefore, it can be concluded that the scalpel technique will remain the “gold standard” treatment technique for gingival depigmentation.

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