

An insight into gingival depigmentation techniques: The pros and cons

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ABSTRACT

Pigmentation of gingiva not just has an impact on esthetics but also creates psychological negativity. Although a wide array of depigmentation techniques are available to manage this condition, there is a scarcity of literature that guides clinicians to choose the most appropriate technique. Hence, the aim of this review is to evaluate the available depigmentation therapeutic modalities with an emphasis on their merits and demerits. The databases of MEDLINE and Cochrane databases of systematic reviews were searched to collect relevant scientific literature. Cryosurgery followed by lasers has been reported to be the superior techniques with better esthetic results and low rate of recurrence. However, further randomized controlled longitudinal studies are warranted to elaborate the efficiency and effectiveness of available techniques.

Keywords: Depigmentation, gingival pigmentation, periodontal surgery, repigmentation

Introduction

Gingival tissue constitutes the macroelement of dentofacial esthetics along with face, lip, and teeth.^[1] Gingiva participates in the harmony of smile with its pigmentation playing a crucial role. Pigmentation of gingiva is considered to be unaesthetic by patients, and it may have a psychological impact on them. This impact is aggravated in patients with “gummy smile” or excessive gingival display while smiling (high smile line).^[2]

Gingival hyperpigmentation can be defined as a darker gingival color beyond what is normally expected.^[3] Pigmentation is contributed by-products of the physiological process such as melanin, melanoid, carotene, oxyhemoglobin, reduced hemoglobin, bilirubin and iron^[4] and/or pathological diseases, and conditions.^[5] Melanin pigmentation results from melanin granules which are produced by melanoblasts.^[6] Furthermore, environmental risk factors such as tobacco smoking contribute to the gingival hyperpigmentation in both active and passive form.^[7-10] Ethnicity and age also influence the color of gingiva and has no sexual predilection.^[11] Various pathological causes of gingival pigmentation are listed in Table 1. A wide range of procedures have been advocated for the removal of gingival pigmentation, i.e., depigmentation.

Gingival Depigmentation

Gingival depigmentation can be defined as a periodontal plastic surgical procedure whereby the gingival hyperpigmentation is

removed or reduced by various techniques.^[2] Depigmentation is not a clinical indication but a treatment of choice where esthetics is a concern and is desired by the patients.^[12,13]

A variety of depigmentation techniques have been described in the literature which can be classified into the following groups:

1. Chemical methods: Using agents such as alcohols,^[14,15] phenols,^[14,15] and ascorbic acid.^[16,17]
2. Surgical methods
 - a. Conventional techniques
 - Gingival abrasion^[18,19]
 - Split thickness epithelial excision/scalpel surgical technique/surgical stripping^[3,20,21]
 - Free gingival grafting^[2,22]
 - Acellular dermal matrix allograft (ADMA).^[23,24]
 - b. Electrosurgery^[25-27]
 - c. Lasers^[28-30]
 - d. Cryosurgery^[11,12,31,32]
 - e. Radiosurgery.^[33-35]

Table 2 summarizes the studies comparing the different depigmentation techniques.

Criteria for Selection of Technique

Patient’s skin color, extent of gingival pigmentation, lip line, upper lip curvature, esthetic concern and expectation from the treatment, influence the orchestration of treatment plan, and selection of technique.^[2,12,20]

Table 1: Represents the list of various pathological cause of gingival pigmentation

Endocrine diseases	Addison's disease Acromegaly Albright's syndrome Addison's disease Nelson's syndrome
Drug-induced	Quinine Chloroquine Zidovudine Bleomycin Minocycline Ketaconazole Cyclophosphamide Chlorpromazine
Heavy metals	Lead Arsenic Bismuth Mercury Silver
Malignant neoplasms	Kaposi's Sarcoma Melanoma
Mucosal conditions	Lichen planus Oral melanoacanthoma Hemochromatosis Blue nevus Nevocellular nevus Hemangiomas HIV oral melanosis Inflammatory mucosal lesions
Tobacco associated	Smoker's melanosis
Idiopathic melanin pigmentation	Peutz-Jegher's syndrome Carney syndrome Leopard syndrome Complex of myxomas
Others	Amalgam tattoo Gingival tattoo Graphite tattoo

However, the procedure adopted should be simple, cost-effective, and comfortable to the clinician as well as patient with less pain and minimal tissue loss.^[36] Caution must be employed to avoid injury to soft tissues and adjacent teeth. Inappropriate technique or inadvertent application can result in a gingival recession, damage to attachment apparatus, underlying bone, as well as enamel.

Chemical Gingival Peeling

It is a treatment method used to destroy the overlying gingival epithelium using a chemical peeling agent. A variety of chemical agents are available such as phenols, salicylic acid, glycolic acid, and trichloroacetic acid.^[36] The most commonly used are phenols and alcohols.^[14] In a study by Hirschfield and Hirschfield in 1951, pigmented gingiva was burnt out by destroying tissue down to and slightly below the basal layer of mucous membranes using a mixture of 90% phenol and 95% alcohol.^[15] However, repigmentation and relapse occurred in all cases shortly after the application of either agent.^[15] As

phenols may induce cardiac arrhythmias, cardiac monitoring is necessary.^[23] The inability to control the depth of penetration and amount of destruction are the main drawbacks of this method. Thereby, these methods are no longer in use and are unacceptable to the clinicians as well as patients.

Ascorbic Acid

Ascorbic acid/Vitamin C has potential in the treatment of gingival melanin pigmentation.^[16] It inhibits the melanin formation by suppressing the tyrosine activity which is essential for melanin biosynthesis.^[16] Furthermore, ascorbic acid directly downregulates dopaquinone formation, a precursor in melanin synthesis, thus inhibiting the melanin formation. A study by Sheel *et al.* have reported the delay in repigmentation of gingiva with the local application of ascorbic acid following the depigmentation procedure.^[17]

Gingival Abrasion

The first case using this technique was documented by Ginwalla *et al.* in 1966.^[18] It involves the denuding of pigmented gingival epithelium by superficial abrasion using grit football shaped or doughnut-shaped coarse diamond burs in a low-speed handpiece.^[14,19] Extra care should be taken to control the speed and pressure of handpiece, so as not to cause unwanted abrasions or pitting of the tissue.^[23] It is a relatively a non-invasive and cost-effective technique and does not require any specific instruments.^[14] However, it is associated with various drawbacks such as technique sensitivity, increased treatment duration, post-treatment pain, placement of periodontal dressing, and high recurrence rate.^[14,19] Exposure of underlying alveolar bone can occur with high speed and/or increased pressure.

Scalpel Surgical Technique

It is also called as split thickness epithelial excision^[14] and surgical stripping.^[3] Conventional scalpel method involves the surgical excision of gingival epithelium using a scalpel and allowing the denuded connective tissue to heal by secondary intention.^[20,21] It is simple, most economical and convenient to perform with minimum time and efforts.^[4,23,37] Healing with this technique is faster in comparison to other surgical techniques.^[23,4] Although lower cost and lower rate of recurrence favor the surgical stripping of gingiva,^[3] it is associated with pain, post-operative discomfort, intra- and post-operative bleeding and requires placement of periodontal dressing.^[21,25,37-39] Thinner gingival biotype and narrow papillary areas contraindicate the use of this technique.^[40]

Free gingival grafting (FGG)

In this technique, an unpigmented free gingival autograft harvested from the patient's palate is placed on the prepared recipient site.^[22] This technique masks the pigmented

Table 2: Presents the various studies that compared the different depigmentation techniques

Study	Treatment comparison	Follow-up period	Results
Patel <i>et al.</i> ^[6]	Scalpel technique bur method electrosurgery laser	3 months	Post-operative healing and patient comfort were better with lasers in comparison to other techniques
Basha <i>et al.</i> ^[58]	Scalpel technique laser	6 months	Patient preference and post-operative comfort were higher with laser treatment
Ahmed <i>et al.</i> ^[51]	Cryosurgery	30 months	No evidence of repigmentation and adverse effects of the treated areas
Murthy <i>et al.</i> ^[46]	Bur abrasion laser scalpel technique	3 months	Lack of repigmentation and uneventful healings were seen with laser treatment than other methods
Narayankar <i>et al.</i> ^[31]	Cryosurgery scalpel technique	6 months	Recurrence rate for pigmentation is higher after scalpel treatment
Sedeh <i>et al.</i> ^[59]	Cryosurgery	18 months	No recurrence of pigmentation
Gupta <i>et al.</i> ^[42]	Electrosurgery scalpel technique	24 months	Increased pain levels and delayed healing were associated with electrosurgery whereas repigmentation was more frequent with scalpel treated sites
Chandna and Kedige ^[44]	Electrosurgery laser	1 week	Laser produces lesser pain and discomfort in comparison to electrosurgery
Patil <i>et al.</i> ^[60]	Cryosurgery scalpel technique	1 month	Longer repigmentation period and lesser post-operative discomfort were associated with cryosurgery than scalpel method
Mahesh <i>et al.</i> ^[33]	Radiofrequency scalpel technique	3 months	Sites operated with scalpel method showed higher pigmentation than the sites treated with the radioablation
Verma <i>et al.</i> ^[37]	Scalpel surgery	6 months	Scalpel surgery causes unpleasant bleeding and necessitates the covering of the surgical site with periodontal dressing
Kumar <i>et al.</i> ^[19]	Cryosurgery gingival abrasion	2 years	High rate of recurrence is seen with gingival abrasion than cryosurgery
Arikan and Gürkan ^[50]	Cryosurgery	30 months	No side effects were observed with improved esthetics
Elavarasu <i>et al.</i> ^[13]	Laser electrocautery	3 months	Recurrence rate was lesser with lasers when compared with electrocautery
Sheel <i>et al.</i> ^[17]	Vitamin C	9 months	Ascorbic acid application resulted in a slow rate of recurrence

gingival area rather than eliminating it.^[2] Two surgical sites, post-operative discomfort due to pain, technique sensitivity, and ghost-like appearance of the treated site due to hypopigmentation are the drawbacks of this technique.^[14,39]

ADMA

It can be used as a safe substitute for free gingival autograft in the treatment of gingival hyperpigmentation.^[24] ADMA has benefits of elimination of second surgical procedure for donor site, decreased post-operative complications, availability of unlimited amount of graft material, and satisfactory esthetic results than the FGG.^[23,24] However, it is technique sensitive, expensive and requires clinical expertise.^[23]

Electrosurgery

In electrosurgical technique, heat generated by transmission of high-frequency electrical energy to the tissues leads to either cutting or coagulation of tissue.^[26] Bleeding control, tissue contouring and less scar tissue formation favor the use of this technique for gingival depigmentation.^[41] However, pain and patient discomfort during the initial healing period is more with this technique.^[6,42] Furthermore, it requires more clinical

expertise than the scalpel surgical method.^[25,27] Prolonged or repeated application can induce heat accumulation and undesired tissue destruction.^[25] Contact of the electrosurgical tip with the teeth, periosteum, or alveolar bone can cause their damage.^[27]

Lasers

Laser therapy has optimal efficacy in the treatment of gingival hyperpigmentation.^[28] Most commonly used lasers for gingival depigmentation are carbon dioxide (CO₂, 10,600 nm) lasers, neodymium: Yttrium, aluminum, and garnet (Nd: YAG, 1,064 nm) and diode (980 nm) lasers.^[29,30] Lasers exhibit enhanced hemostatic activity, good visibility at the surgical site and fewer post-operative complications such as pain, bleeding, edema, infection, and impaired wound healing.^[28,43-47] It is an effective and safe treatment modality with ease of access to interdental papilla and low rate of recurrence.^[28,38,46,48] Although better esthetic results can be achieved by lasers,^[46] it requires sophisticated equipment, occupies large space and is expensive method.^[25] Inappropriate application may damage gingiva and underlying alveolar bone which, in turn, can cause gingival recession, gingival fenestrations, and delayed wound healing.^[14,19]

Cryosurgery

Cryosurgery is most widely accepted method of gingival depigmentation.^[11,19,31,32] It involves freezing of gingiva with the application of different materials, i.e. cryogen such as liquid nitrogen at very low temperatures.^[27] The effect of ultralow temperature of cryogen on gingival tissue causes the epithelium to undergo cryonecrosis, which helps to eliminate gingival pigmentation.^[49] It is an inexpensive method with long-term superior esthetic results, rapid healing, and low recurrence rate.^[19,50] Lack of bleeding, pain and scar formation, application without regional anesthesia, sutures or drugs, ease of application of cryogen at papillary areas and need of no complicated instruments, and prioritizes the cryosurgery over other depigmentation methods.^[19,31,32,47,51,52] Post-operative swelling and difficulty in controlling the penetration depth constitute the disadvantages of this technique.^[25,53]

Radiosurgery

It is a novel therapeutic modality for the gingival depigmentation that utilizes radiofrequency.^[33] Electrically generated thermal energy from the radiofrequency apparatus influences the molecular disintegration of melanin cells present on the basal and suprabasal layers of gingival epithelium.^[33] The latent heat of radiosurgery retards the development and migration of melanocytes, which makes it a more efficient method of depigmentation than the conventional methods.^[33] Radiosurgery produces coagulation, thereby reduces the bleeding but it requires at least two sessions of treatment.^[34,35] Papillary areas can be easily depigmented with radiosurgery.^[14] Multiple sittings, technique sensitivity, and more expense are the limitations of this novel technique.^[14,35]

Future Advancements

Plasma therapy

At present, ongoing research is focusing on utilizing plasma as a novel treatment technique for gingival hyperpigmentation and gummy smile.^[54] Plasma refers to the fourth state of matter consisting of partially ionized gases with free electrons, generated at a low temperature.^[54] The mechanism of action is based on the release of free radicals and reactive species.^[55] It also produces ozone.^[56]

Gingival repigmentation

A critical concern in the management of hyperpigmented gingiva is a relapse or gingival repigmentation.^[3] Repigmentation refers to the clinical appearance of melanin pigment following a period of clinical depigmentation.^[57] As it depends on methodology and follow-up period, the duration of repigmentation mentioned in literature remains controversial from one technique to other. Furthermore, factors such as smoking, sun exposure, and genetic determination of skin

color, influence the duration of relapse. However, the majority of the available literature has shown lower recurrence rate for cryosurgery and lasers.

Conclusion

Demand for depigmentation therapy is mostly seen in patients with the excessive gingival display. Gingival biotype, clinician's expertise, patient preferences, and recurrence rate, greatly determine the selection of a technique. Although a wide range of techniques have been employed, cryosurgery followed by lasers has been reported to be superior techniques with better esthetic results and low rate of recurrence. Relapse or repigmentation is a critical concern and depends on the technique employed and follow-up period. Majority of the available literature is comprised case reports. Hence, authors recommend the conduct of randomized controlled longitudinal studies to identify the efficiency and effectiveness of available techniques.

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