

# Gingival Depigmentation: A Review

**Prakash Pai G<sup>1</sup>, M M Dayakar<sup>2</sup>, Deeksha<sup>3</sup>,  
Aishwarya<sup>4</sup>, Alisha Thankam George<sup>5</sup>**

<sup>1</sup>Professor, KVG Dental college & Hospital

<sup>2</sup>Professor & HOD, KVG Dental college & Hospital

<sup>3,4,5</sup>Post graduate student, KVG Dental college & Hospital

## ABSTRACT

A beautiful smile surely enhances the individual's self-confidence. The harmony of smile is attributable to the shape, colour, and position of the teeth in conjunction with the gingival tissue. Gingival pigmentation occurs in all races of man, varies from one race to another & caused by a variety of external and endogenous sources. Excessive deposition of melanocytic pigmentation has a significant impact on aesthetics and also produces psychological distress. A periodontal plastic surgery procedure called gingival depigmentation eliminates or reduces hyperpigmentation. Although there are numerous depigmentation procedures available to treat this problem, but there is a lack of research to aid clinicians in selecting the best effective approach. As a result, the goal of this review is to assess the existing depigmentation therapies. Cryosurgery, followed by lasers, has been reported by many studies to be superior procedures, with better aesthetic results and a low recurrence rates. However, additional randomized controlled long term studies are needed to better understand the efficiency and effectiveness of present approaches.

**Keywords:** Cryosurgery, Depigmentation, Gingival pigmentation Hyperpigmentation, Laser ,Melanocytes.

## INTRODUCTION

"Aesthetics" is the science of beauty, defined as the specific detail of an animate or inanimate thing that appeals to the eye. Aesthetic or cosmetic dentistry tries to combine function and beauty with each patient's values and particular demands. With these advancements, the practitioner can now create a periodontal environment that complements and enhances the establishment of excellent dental aesthetics. Gingival health and appearance are critical components of a beautiful smile. A beautiful smile highly depends on the level of appearance of the teeth and gingiva. The shape, position and color of the teeth, and level and color of the gingival tissue play an important role in smile harmony.[1] The pink colour of healthy gingiva is a characteristic macroanatomical feature that varies depending on the degree of keratinization, gingiva thickness, vascularization, reduced hemoglobin, and the presence of melanocytic cells.[2] Gingival pigmentation appears as a diffuse deep purple discoloration or as irregularly shaped brown, light brown, or black patches, striae, or strands.[3] Melanin, carotene, reduced haemoglobin, and oxy-haemoglobin are the major pigments responsible for the normal colour of the gingiva, with melanin having a significant incidence rate.[4] Excessive deposition of melanin located in the basal and supra-basal cell layers of the epithelium will result in gingival hyperpigmentation (Dummett, 1979) [5].

Furthermore, environmental risk factors such as Tobacco smoking, both active and passive, lead to gingival hyperpigmentation.[6, 7, 8, 9] Ethnicity and age also affect the color of gingiva but has no sexual predilection.[10] Gingival pigmentation is caused by both exogenous or endogenous factors.[11] A wide range of procedures have been advocated for the removal of gingival pigmentation, i.e. depigmentation.

### **Gingival Depigmentation**

Gum Depigmentation can be defined as periodontal plastic surgery done by removing or alleviating gingival hyperpigmentation using various techniques. Depigmentation is not a clinical indication but rather a treatment option when aesthetics are the patient's concern and desire. [12] Different techniques have been used with similar results. Selection of a technique should be based on clinical experience and personal preference. [13]

Roshni and Nandakumari [14] in 2005 classified different gingival depigmentation methods as:

1. Methods aimed at removing the pigment layer
  - 1.1 Surgical methods of depigmentation
    - (1.1.1) Scalpel surgical technique:
      - i. Slicing, or partial thickness flap technique
      - ii. Bone Denudation
      - iii. Abrasion
      - iv. Scraping
      - v. Gingivectomy
    - (1.1.2) Cryosurgery
    - (1.1.3) Electrosurgery
    - (1.1.4) Radiosurgery
    - (1.1.5) Lasers
  - 1.2 Chemical method of depigmentation using caustic chemicals, e.g. 90% phenol.
2. Methods aimed at masking the pigmented gingiva with grafts from less pigmented areas.
  - 2.1 Free gingival grafts (FGG)
  - 2.2 Acellular dermal matrix allografts.

#### **Criteria for Selection of Technique**

The patient's skin tone, extent of gingival pigmentation, lip contour, upper lip curvature, cosmetic concerns, and treatment expectations influence treatment plan coordination and technique selection. [13, 15, 16]

However, the procedure applied should be simple, cost-effective, and comfortable for the clinician and patient with limited pain and minimal tissue loss. [17] Care should be taken to avoid damaging the soft tissue and adjacent teeth. Inappropriate technique or careless application can lead to receding gums, damage to the adhesion apparatus, underlying bone and enamel.

### **1.1.1 Scalpel surgical technique**

It was one of the early techniques described to reduce gingival pigmentation and still it remains the most common treatment modality. This procedure basically involves surgical removal of the gingival epithelium along with the underlying connective tissue layer and allowing secondary healing of the exposed connective tissue.

#### **(i) Slicing or partial thickness flap technique**

Under local anaesthetic infiltration, two incisions are made using this approach, slightly extending the pigmented band's boundaries from the gingival margin to the vestibular area. The surgical area is indicated by these vertical incisions. The epithelium and some connective tissue are carefully separated from one end of the vertical incision using a no. 11 or 15 BP blade held parallel to the gingival surface. It is important to avoid leaving any pigmented remains over the denuded area. Periodontal pack is required after satisfactory hemostasis. Healing is usually uneventful, and complete epithelial healing takes 7 to 14 days. Depigmentation allows for secondary intention healing of denuded connective tissue. As a result, new epithelium forms that lacks melanin pigmentation.[18]

#### **(ii) Bone denudation technique**

Under local anaesthesia, two vertical incisions are made, one from the gingival margin to the vestibular area and extending slightly beyond the limits. The papillae are then divided into labial and lingual halves using B.P. blades. The two vertical incisions are then connected by a horizontal incision made into the vestibule apical to the pigmented band. Using a periosteal elevator, the tissue and periosteum are carefully separated from the underlying alveolar bone and removed en mass, exposing the subjacent alveolar bone.[19]

#### **(iii) Abrasion**

Ginwalla et al. reported the first known case of this method in 1966. It is a reasonably easy, adaptable technique that takes very little time and effort. The technique involves giving sufficient local anaesthesia before using high speed rotary instruments (round, straight or tapered bur with copious saline irrigation) to de-epithelize pigmented portions of the gingiva. Extensive caution is essential to avoid overpitting of the gingival surface or excessive tissue loss due to rapid speed. The procedure's crudeness, as well as the lack of splatter and aerosol, limits its utilisation. Smaller diamond burs do not easily smooth the surface and have a tendency to generate small pits in the region to be repaired, so larger burs are advised.[13]

#### **(iv) Scraping technique**

After infiltration of the area with local anesthesia no.15 or 11 B.P. blade handle is used Carefully to scrape off the epithelium along with the underlying pigment layer. The raw surface is irrigated, cleaned and dressing is given for 1 week. [20]

#### **(v) Gingivectomy technique**

Dummett and Bolden in 1963 used gingivectomy to remove pigmented gums. Incisions were made to remove as much clinically pigmented tissue as possible and a surgical pack was placed. They concluded

that the respective gingival procedures, if performed purely for cosmetic reasons, would not provide any forever results. This procedure leads to prolonged wound healing by secondary intent, causing excessive pain and discomfort as the underlying bone is exposed. It also leads to non-permanent pigmentation loss. [21]

### 1.1.2 Cryosurgery

Cryosurgery is the most widely accepted method of reducing gingival pigmentation. It involves freezing the gingiva using different materials, i.e. cryogens such as liquid nitrogen at very low temperatures[22]. Allington in the year 1950 was the first to use liquid nitrogen. This is a non-scarring, sutureless and dressing less method, without bleeding and causing Minimal damage to surrounding tissues. The minimum temperature required for cell damage varies depending on the cell, and melanocytes are extremely susceptible to low temperatures ranging from -4 C to -7 C, when cell death can occur. Another colourless, nonflammable, non-chlorofluorocarbon gas that is 1,1,1,2-tetrafluoroethene, often utilised which is inexpensive, simple to use, store and transport. After one week, any remaining pigmentation is often removed with a second round of cryosurgery.[23] The drawbacks of this approach are post-operative edoema and difficulties in managing penetration depth.[24, 25]

### 1.1.3 Electrosurgery

In the electrosurgical procedure, heat produced by high-frequency electrical energy transmitted to the tissues causes tissue to either cut or coagulate.[26]. The use of this approach for gingival depigmentation is favoured by its ability to control bleeding, shape tissue, and produce minimal scar tissue. However, patients experience more pain and discomfort during the early healing period.with this technique[22]. In addition, it requires more clinical expertise than the scalpel approach.[22,24] Prolonged or repeated application can cause heat buildup and unwanted tissue destruction.[24] Contact of the electrosurgical tip with the teeth, periosteum or alveolar bone can damage them.[22]

### 1.1.4 Radiosurgery

This is a new treatment modality for gingival pigmentation using radiofrequency. The thermal energy generated by the radio frequency device electrically affects the molecular breakdown of melanocytes present on the basal and supra basal layers of the gingival epithelium. The latent heat of radiosurgery delays the growth and migration of melanocytes, making it a more effective method of depigmentation than conventional method. Radiosurgery induces clotting, thereby reducing bleeding, but requires at least two treatments. Papillary areas can be easily de-pigmented with radiosurgery. Many times, the sensitivity of the technique and more cost are the limitations of this new technique .[27]

### 1.1.5 Lasers

Laser therapy has optimal efficacy in the treatment of gingival hyperpigmentation.[28] The most common lasers used for gingival depigmentation are carbon dioxide (CO<sub>2</sub>,10,600 nm) laser, neodymium:Yttrium, Aluminum and Garnet (Nd:YAG laser, 1064 nm) and diode (980 nm)[29, 30]. Laser exhibits enhanced hemostatic activity, good visibility at the surgical site and fewer postoperative complications such as pain, bleeding, edema, infection, and impaired wound healing.[14, 28, 31, 32, 33]. It is an effective and safe, accessible treatment modality to the interdental papilla and with low recurrence rate. [28, 34, 35, 36] Although laser can achieve better aesthetic results [46], it requires

complex equipment, takes up a lot of space, and is an expensive method.[24, 34]. Inappropriate application may damage gingiva and underlying alveolar bone which, in turn, can cause gingival recession, gingival fenestrations, and delayed wound healing.[37] One of the recent study by Armogida, et al., 2022 concluded that Applications of Q-Switched Nd: The YAG laser in the treatment of gingival melanin hyperpigmentation can be a promising regimen that provides excellent cosmetic results with mild postoperative discomfort and no associated complications. [38]

## 1.2 Chemical method

This is a treatment used to destroy the overlying epithelium using chemical agents. A wide range of chemical agents are available such as phenol, salicylic acid, glycolic acid and trichloroacetic acid[39]. In a study by Hirschfield and Hirschfield in 1951, pigmented gums were burned by destroying tissues up to and slightly below the basal layer of mucous membranes with a mixture of 90% phenol and 95% alcohol.[40] However, re-pigmentation and relapse occurred in all cases shortly after application of either agent. Because phenol can cause cardiac arrhythmias, cardiovascular monitoring is required.[11] The inability to control the depth of penetration and the degree of destruction is the main drawback of this method. As a result, these methods are no longer used & unacceptable to clinicians and patients alike.

## 2.1 Free gingival grafts (FGG)

In this technique, a non-pigmented autologous gingival graft taken from the patient's palate is placed in the prepared recipient site. [40]. This technique covers the pigmented gingiva area rather than removing it. [13] First Described by Tamizi, Taheri (1996) for the treatment of severe physiological pigmentation, which should be replaced by non-pigmented pigment using gingival autograft..The results of this procedure showed no evidence of re-pigmentation even after 4.5 years. Out of the 10 treated patients Only 1 patient had re-pigmentation after 1 year. Two surgical sites, postoperative discomfort due to pain, sensitivity to the technique and ghost like appearance of the treatment area due to hypopigmentation are the disadvantages of this technique[41, 42].

## 2.2 Acellular Dermal Matrix Allograft

It can be used as a safe alternative to autologous gingival graft in the treatment of gingival hyperpigmentation.[43] ADMA has the advantage of eliminating a second surgery for the donor graft site, fewer postoperative complications, unlimited graft availability, and better cosmetic results compared to FGG. [11,44] This method has been used successfully in eliminate or reduce gingival pigmentationand proven to be more effective than epithelial erosion after 12 months.[45]

## Future Advancements

### Plasma therapy

Current research focuses on the use of plasma as a new treatment for gingival hyperpigmentation and a gummy smile.[46] Plasma is the fourth state of matter and consists of a partially ionized gas containing free electrons produced at low temperatures[46]. The mechanism of action is based on the release of free radicals and reactive species.[47], along with the production of Ozone.[48]

### **Vitamin C ( Ascorbic acid)**

Gingival melanin pigmentation may be treated with ascorbic acid/vitamin C.[49] Tyrosine activity, which is crucial for melanin biosynthesis, is suppressed, which prevents the production of melanin.[49] Additionally, ascorbic acid directly inhibits the synthesis of dopaquinone, a precursor in the synthesis of melanin, which in turn prevents the formation of melanin. According to a study by Sheel, et al., (2015) the local application of ascorbic acid after the depigmentation treatment caused a delay in the repigmentation of gingiva.[50] A oral mesotherapy study using locally injectable Vitamin C has been known to be efficient, minimally invasive, safe and esthetically satisfactory technique for gingival depigmentation.[51] Another novel Microneedling technique using dermapen along with the topical application of vitamin C paste has been shown to be minimally invasive, less expensive and esthetic approach for gingival hyperpigmentation.[52]

### **Platelet rich fibrin ( PRF)**

Rezmelia sari, et al., (2022), presented a case report on Topical Application of Platelet-Rich Fibrin Liquid as a Novel and Minimally Invasive Treatment to investigate post-gingival depigmentation outcomes such as wound healing, pain and post-surgical complaints after performing gingival depigmentation using surgical scalpel method. The results suggested that PRF liquid provided better post-gingival depigmentation healing than cellulose based periodontal dressings and concluded that utilization of PRF liquid is expected to be an alternative for minimally invasive open wounds management especially post-gingival depigmentation.[53]

Other advancements like application and intra-oral formulations of Kojic acid, Placenta extract are still under research.

### **Gingival Repigmentation**

Relapse or gingival repigmentation is a major concern in the treatment of hyperpigmented gingiva.[54] The clinical appearance of melanin pigment after a period of clinical depigmentation is referred to as repigmentation.[55]. The time of repigmentation indicated in the literature is debatable because it relies on methodology and follow-up period. Furthermore, smoking, sun exposure, and genetic skin colour determination all influence the duration of relapse. However, the majority of the existing literature indicates that cryosurgery and lasers have a reduced recurrence rate.

### **Conclusion**

The majority of patients who need depigmentation therapy have severe gingival display. The choice of a procedure is largely influenced by the gingival biotype, the clinician's experience, the patient's preferences, and the rate of recurrence. Despite the fact that a variety of approaches have been used, cryosurgery followed by lasers has been found to be the best method with improved aesthetic outcomes and a low recurrence rate. Depending on the procedure used and the follow-up period, relapse or repigmentation is a serious risk. Case reports make up the majority of the literature that is currently available. As a result, the authors advise conducting randomised controlled longitudinal studies to assess the efficiency and effectiveness of the available techniques.

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