Journal of Indian Dental Association Madras (JIDAM), 2025; Volume No: 12 , Issue No: 1

Review Article | ISSN (O): 2582-0559

AESTHETIC ENHANCEMENTS: EXPLORING GINGIVAL DEPIGMENTATION TECHNIQUES

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Abstract

The harmony of the smile is attributable to the shape, color, and position of the teeth in conjunction with the gingival tissue. The pigmentation of gingiva has a major impact on esthetics and also creates psychological negativity. Gingival hyperpigmentation is a multifactorial benign condition that causes esthetic concern to the person. Melanin is a nonhemoglobin-derived pigment formed by melanocytes, dendritic cells of neuroectodermal origin in the basal and spinous layers. Melanin is a brown-colored pigment, and it is the result of endogenous pigmentation. The deposition of melanin pigment darkens the color of the gingiva, Although there are numerous depigmentation procedures available to treat this problem, there is a lack of research to aid clinicians in selecting the most effective approach. As a result, the goal of this review is to assess the existing depigmentation therapies.

INTRODUCTION

Gingival hyperpigmentation can be defined as a darker gingival color beyond what is normally expected. Pigmentation is contributed by-products of the physiological process such as melanin, melanoid, carotene, oxyhemoglobin, reduced hemoglobin, bilirubin and iron and/or pathological diseases, and conditions[1]. The normal physiologic colour of gingiva is coral pink or salmon pink with variations in the amount of gingival melanin pigmentation. Gingival pigmentation particularly on the labial surface of anterior teeth has plays an integral component of general aesthetics of an individual[2]. Gingival pigmentation is caused by both exogenous or endogenous factors[3]. Physiologic gingival pigmentation (PGP) is the most common type, resulting in excessive melanin deposition leading to hyperpigmentation[4]. Irrespective of its origin, many local and/ or systemic factors including genetics, tobacco use, antimalarial agents and tricyclic antidepressants may cause gingival pigmentation[5]. Gingival hyperpigmentation affects females more than males, and it is usually present in the anterior labial mucosa[6]. Gingival hyperpigmentation can also be associated with some syndromes such as Laugier–Hunziker syndrome, neurofibromatosis, Peutz–Jeghers syndrome, and Hemochromatosis[7]

CLASSIFICATION OF GINGIVAL PIGMENTATION

According to the extent of involvement:

Localized pigmentations

Amalgam tattoo, graphite or other tattoos, nevus, malignant melanoma, Kaposi's sarcoma, melanoacanthoma, epithelioid ligomatosis, melanotic macules, verruciform xanthoma.

Multiple or Generalized Pigmentations

1. Genetics: Idiopathic melanin pigmentation (racial or physiologic pigmentation), Peutz-Jegher's syndrome, Laugier-Hunziker syndrome, complex of myxomas, spotty pigmentation, endocrine overactivity, Carney syndrome, Leopard syndrome, and lentiginosis profuse

2. Drugs: Smoking, betel, anti-malarials, antimicrobials, minocycline, amiodarone, clorpromazine, ACTH, zidovudine, ketoconazole, methyldopa, busulphan, menthol, contraceptive pills, and heavy metals exposure (gold, bismuth, mercury, silver, lead, copper)

(Received 15th November 2024; Accepted 20th January 2025; Published 28th March 2025)

3. Endocrine: Addison's disease, Albright's syndrome, Acanthosis nigricans, pregnancy, hyperthyroidism

4. Post inflammatory: Periodontal disease, postsurgical gingival repigmentation

5. Others: Generalized neurofibromatosis, incontinentipigmenti , Gaucher's disease, Whipple's

disease, Wilson's disease, HIV disease, thalassemia, pigmented gingival cyst, Haemochromatosis, and nutritional deficiencies[8,9].

PROCESS OF PIGMENTATION

According to the current nomenclature, melanocytes are dendritic cells, found in the basal and spinous layers of the gingival epithelium. They synthesize melanin in organelles called melanosomes. Melanophages or melanophores are cells that phagocytose melanin granules**[10]**. The process of pigmentation consists of three phases[11]

1. Activation of melanocyte

2. Synthesis of melanin

3. Expression of melanin

Synthesis of melanin: Starting with the amino-acid tyrosine, the enzyme tyrosinase, is a essential requirement and the successive steps in the production of melanin are as follows:

Dopaquinone is produced as the immediate product, when tyrosine is oxidized by tyrosinase. In the absence of cysteine, dopaquinone undergoes the intramolecular addition of the amino group giving leucodopachrome.The redox exchange between leukodopachrome and dopaquinone gives dopachrome. Dopachrome gradually decomposes to give mostly 5,6-dihydroxyindole (DHI), and to a lesser extent DHI-2-Carboxylic acid (DHICA). This latter process is catalyzed by tyrosinase-related protein-2, now known as dopachrometautomerase. Finally, these DHI are oxidized to eumelanin. tyrosinase-related protein-1 is believed to catalyze the oxidation of DHICA to eumelanin. On the other hand, in the presence of cysteine,

dopaquinone rapidly reacts with cysteine to give 5-Scysteinyldopa and to a lesser extent

2-scysteinyldopa.Cysteinyldopas are then oxidized to give benzothiazine intermediates and finally to produce pheomelanin[12].

GINGIVAL DEPIGMENTATION

Gingival depigmentation can be defined as a periodontal plastic surgical procedure whereby the gingival hyperpigmentation is removed or reduced by various techniques.Depigmentation is not a clinical indication but a treatment of choice where esthetics is a concern and is desired by the patients[13].

Melanin pigmentation can be treated by various methods that include chemical methods using phenol, alcohol, ascorbic acid, and surgical methods of depigmentation such as chemical peeling, ascorbic acid application, gingival abrasion technique, split-thickness epithelial excision, combination technique (gingival abrasion and split-thickness epithelial excision, free gingival grafting, and recent methodologies in gingival depigmentation lasers, cryosurgery,and radiosurgery[14].

CRITERIA FOR SELECTION OF TECHNIQUE

The patient's skin tone, the extent of gingival pigmentation, lip contour, upper lip curvature, cosmetic concerns, and treatment expectations influence treatment plan coordination and technique selection[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. 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[17].

Chemical 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. The most commonly used are phenols and alcohols. 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. However, repigmentation and relapse occurred in all cases shortly after the application of either agent. As phenols may induce cardiac arrhythmias, cardiac monitoring is necessary. 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 clinicians as well as patients[18,19].

Scalpel surgical technique:

Slicing or partial split-thickness flap:

In this technique, under local anesthetic infiltration, two incisions are given extending from the gingival margin to the vestibular area, a little beyond the limits of the pigmentedband. These vertical incisions demarcate the surgical area. A no.11 or 15 BP blade is held parallel to the gingival surface, the epithelium and a portion of the connective tissue is gently dissected out from one end of the vertical incision. Scalpel surgical technique is a consideration of the equipment constrains in developing countries. It is simple, easy to perform, cost effective , and above all with minimum discomfort and esthetically acceptable to patients. This technique is contraindicated in thin gingival areas, as removal of pigmented gingival epithelium may lead to gingival recession[15].

Abrasion Technique

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 copius 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[15].

Bone Denudation Technique:

Under LA two vertical incisions are placed, each extending from the gingival margin to the vestibular area, a little beyond the limits. Then the papillae are split into labial and lingual halves with B.P. blades. A horizontal incision is then made into the vestibule, apical to the pigmented band, connecting the two vertical incisions. With a periosteal elevator, the tissue along with the periosteum is gently separated from the underlying alveolar bone and is removed mass entirely exposing the subjacent alveolar bone[20].

Scraping technique

Afterinfiltrationoftheareawithlocalanesthesia no.15 or 11B.P.bladehandleis usedCarefully toscrapeofftheepitheliumalongwiththeunderlying pigmentlayer.The raw surface is irrigated, cleaned and dressingis given for 1 week[21]

Gingivectomy technique

Dummett and Boldenin 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.[22].

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 [23]. Allington in the year 1950 was the first to use liquid nitrogen. This is a non-scarring, suture less 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 colorless,

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[24].The drawbacks of this approach are post-operative edoema and difficulties in managing penetration depth[25].

Electrosurgery:

In the electrosurgical procedure, heat produced by high-frequency electrical energy transmitted to the tissues causes tissue to either cut or coagulate[26]. It is found that this method controls hemorrhage, permits adequate contouring of tissues, causes less discomfort to patient, less scar formation, and less chair time. Electro-surgery requires more expertise than scalpel surgery. Prolonged or repeated application of current to tissues induces heat accumulation and undesired tissue destruction. Contact with periosteum or alveolar bone and vital teeth should be avoided[27].

Radiosurgery:

Radiosurgery describes the most advanced form of electrosurgery. It is the removal of soft tissue with the aid of radio frequency energy[28]. This electromagnetic energy operates between the frequencies of 3.0 MHz (MHz) to 4.0 MHz, with 4.0 MHz being the optimal frequency.The main advantage of radiosurgery is its ability to produce coagulation in the operative area which would often have extensive bleeding. Also, some studies reported less thermal damage and faster healing with the 4.0 MHz radio wave technology over the scalpel and lasers. Radiosurgery produces a fine micro-smooth incision with no overt lateral heat being sent to the surrounding tissues. On the other hand, the main disadvantage of this method is that it is expensive and requires at least two sittings for completion within 2 weeks of treatment[29,30]

LASER:

It is an acronym for light amplification by stimulated emission of radiation. Lasers used for depigmentation include [31]

1. CO2

2. Diode

3. Er:YAG

4. Er,Cr:YSGG

5. Nd:YAG

Melanocytes, located in mostly basal and suprabasal layers of gingival epithelium, should be eliminated for a proper depigmentation. Superior to other techniques, application of a laser results in homogeneous ablation of epithelial and rete pegs as well. Diode laser with 810 nm wavelength is used in soft tissues for coagulation and cutting. Diode laser irradiation also has a bactericidal effect resulting in hemostasis. Having a high affinity to penetrate into hemoglobin and melanin pigments makes it the preferred laser for depigmentation of gingiva. Diode lasers can be used both in pulsed or continuous mode. Application of the laser in pulsed mode prevents overheating of surrounding tissues that may cause necrosis and jeopardize healing. Taking into consideration the previously published studies diode laser was used in continuous mode in this study knowing the fact that it may penetrate deeper and affect connective tissue as well. That's why the evaluations were also made at weeks 4 and 12. The use of lasers has several advantages such as no need to place a periodontal dressing, short healing period, no or very slight pain, no hemorrhage. The only disadvantage may be the high cost of the lasers. Inappropriate application may damage gingiva and underlying alveolar bone which, in turn, can cause gingival recession, gingival fenestrations, and delayed wound healing[32-34].

Free gingival autograft:

Free gingival autograft is used to create a widened zone of attached gingiva and in root coverage procedures and can also be used as a method to mask the area of pigmented gingiva[35]. First Described by Tamizi, and 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 4.5years.Out of the 10 treated patients Only 1 patient had re-pigmentation after1year.Two surgical sites,postoperative discomfort due to pain, sensitivity to the technique and ghost-like

appearance of the treatment are due to hypopigmentation are the disadvantages of this technique[35,36].

Acellular Dermal Matrix Allograft

Itcanbeusedasasafealternativetoautologousgingivalgraftinthetreatmentofgingivalhyperpigmentation[37]. 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. This method has been used successfully in eliminate or reduce gingival pigmentation and proven to be more effective than epithelial erosion after12 months[38].

Gingival Repigmentation

Relapse or gingival repigmentation is a major concern in the treatment of hyperpigmented gingiva[39]. The clinical appearance of melanin pigment after a period of clinical depigmentation is referred to as repigmentation. 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[39].

Conclusion

Demand for depigmentation therapy is mostly seen in patients with black gums or with high smile line. Gingival biotype, clinician's expertise, patient preferences, and recurrence rate, greatly determine the selection of a technique scalpels is one of the simplest and popular techniques to be used. This treatment involves surgical removal of superficial layers of gingival epithelium along with a thin layer of the underlying connective tissue, Relapse or repigmentation is a critical concern and depends on the technique employed and follow-up period.

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