De - epithelialisation of Gingival Hyperpigmentation - An informed view

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ABSTRACT

The colour of gingiva plays an integral role in evaluating health and disease. Pigmentation of the gingiva is caused by mealnocytes and the degree of pigmentation is determined by the relative activity of the melanocytes. Hyperpigmented gingiva in individuals with gummy smile or a high smile line may be of an esthetic concern. Various techniques ranging from use of a scalpel, bur abrasion, cryotherapy and lasers have been tried for depigmentation procedures. This communication reviews the present available techniques for depigmentation and a case treated with a combination of techniques.

Introduction

The colour of gingiva, which ranges from pale pink and coral pink to deep red and violet plays an integral role in evaluating health and disease. It depends on the vascular supply, thickness and degree of keratinization of the epithelium and the presence of melanocytes.

Dark pigmentation of the gums often occurs as a result of an abnormal deposition of melanin. Several physiologic and/or pathologic factors can cause gingival hyperpigmentation. (Table 1) Physiological over deposition of melanin is by far the most common cause. The present communication intends to review the various causes of gingival hyperpigmentation, available treatment modalities and present case scenarios where some of the periodontal plastic surgical techniques can be employed.

Physiologic Oral Pigmentation

Melanin is normally produced by melanocytes

Table 1: Etiology of gingival hyperpigmentation.[1]

Endogenous Factors (Diseases that increase melanin pigmentation)	**Exogenous Factors**
1. Addison's disease 2. Peutz-Jeghers syndrome 3. Albright syndrome (polyostotic fibrous dysplasia) and von RecklingHausen disease (neurofibromatosis) 4. Bile pigments can stain skin and mucous membranes 5. The deposition of iron in hemochromatosis can stain oral mucous membranes	1. Atmospheric irritants (coal and metal dust) 2. Coloring agents in food \ or lozenges 3. Tobacco 4. Amalgam tattoo 5. Metallic pigmentation: heavy metals (bismuth, arsenic, mercury, lead and silver) 6. Antimalarial drugs

Melanin is a non-hemoglobin derived endogenous brown pigment produced by dendritic melanocytes situated in the basal and spinous layer of the oral epithelium. There are two groups of melanin that are synthesised in melanosomes from tyrosine: one is insoluble black and the brown eumelanins, and the other alkali soluble yellow and reddish brown phaeomelanins. Tyrosinase present in melanosomes hydroxylates tyrosine to dihydroxyphenylalanine (DOPA), which in turn is converted to melanin.

Epidemiology and clinical presentation

Gingival pigmentation is seen in all races with different prevalence in each race and population. Presence of genetic trait in some populations may be the determinant and this is termed physiologic or racial gingival pigmentation.[2-4] Chances of developing pigmented gingiva are extremely high among the dark skinned.[4] Colour differences within individuals result from the relative activity of the melanocytes in producing melanin and not by the number of melanocytes. Gingival pigmentation is noticed across all age groups and no gender predilection has been noted.

The highest rate of gingival pigmentation has been observed in the area of incisors and decreases considerably in the posterior regions.[4] It is seen more commonly on the labial surface than on the palatal and lingual surfaces.[5] The shade of pigment can be classified as very dark brown to black, brown, light brown-yellow.[6]

Need for depigmentation

Melanin hyperpigmentation usually, does not present as a medical problem, but patients may complain that their black gums are not esthetic. This problem is aggravated among patients with a "gummy smile" or excessive gingival display while smiling or during speech.[7]

Gingival depigmentation is a periodontal plastic surgical procedure where the darkly pigmented gingival epithelium is removed or the pigmentation reduced by various techniques.[1] All the available strategies involving mechanical, surgical, chemical, electrosurgical, and cryosurgical techniques are employed to depigment the gingiva with varied results.(Table 2) The patient's own demand for depigmentation to improve esthetics remains the most common indication for the procedure.

Table 2: Methods of Gingival Depigmentation1

Methods Aimed at Removing the Pigment Layer	Methods aimed at masking the pigmented gingival with grafts from less-pigmented areas
1. Abrasion technique : using a large, round diamond bur 2. Surgical methods of depigmentation 1. Scalpel surgical technique (gingivectomy) 2. Cryosurgery 3. Electrosurgery 3. Chemical methods of depigmentation 4. Lasers 1. Carbon dioxide (CO2) lasers 2. Diode lasers 3. Nd:YAG lasers 4. Er:YAG lasers 5. Er;Cr:YSGG lasers.	1. Free gingival graft (FGG) 2. Subepithelial connective tissue grafts 3. Acellular dermal matrix allografts

In the past, bone denudation procedure was tried for depigmentation. Its invasive nature and the resultant bone loss failed to popularise the technique.

An attempt was also made by displacing the flap (push back technique) with the presumption that melanocytes may transiently lose their ability to produce and transfer the melanin pigment to the keratinocytes.[8] But repigmentation occurred at a faster rate and the method was discontinued.

Abrasion technique using a bur

The bur abrasion technique involves de - epithelisation of heavily pigmented gingival areas using high speed rotary instruments under local anesthesia. A large round bur or straight bur can be used with copious saline irrigation. Minimal pressure must be applied with feather light brushing strokes, without holding bur in one place. Any bur can be used for the purpose, taking enough care not to cause pitting of the gingival surface or to remove too much of tissue. The technique is relatively simple, versatile and requires minimum time and effort. It does not require sophisticated and expensive armamentarium. If repigmentation occurs, the procedure can be repeated in the same area without limitation or causing any permanent damage. However, pain, bleeding and difficulty in controlling the depth of de-epithelialisation are some of the complications associated with the bur abrasion technique. High speed hand piece and surgical diamond bur can also be used to eliminate pigmentation with marginally better results.[9,10]

Surgical methods

1. *Gingivectomy:* Dummet and Bolden[11] described the selective gingivectomy technique where only the clinically pigmented tissue is excised. However, more pain and prolonged discomfort was reported due to the exposure of underlying bone and a faster rate of repigmentation was observed. Thus, these gingival resective procedures if performed for the sole purpose of cosmetics do not seem to yield permanent results.
2. *Scalpel technique:* Use of scalpel is one of the first few and still popular techniques employed for the surgical removal of pigmented gingiva. This technique is economical and carries the advantage of having a faster rate of healing when compared to the other techniques. It is a simple and versatile method that requires minimum time and effort. However, scalpel surgery causes unpleasant bleeding during and after the operation and necessitates the use of periodontal dressing to cover the surgical site for a duration of 7 to 10 days.
3. *Cryosurgery:* It involves the use of local freezing for the controlled destruction or removal of living tissues by denaturation of proteins leading to cell death.[12] The various cryogens that have been used are salt - ice (-20^{0}C), $C0_2$ slush (-20^{0}C), fluorocarbons (Freons) (- 30^{0}C), nitrous oxide (-75^{0}C), $C0_2$ snow (-79^{0}C), liquid nitrogen [-20^{0}C (swab), -196^{0}C (spray)]. Cryogens are delivered through the dipstick method, spray technique or by using cryoprobes.

   The dipstick method utilizes a small cotton bud/ swab dipped in liquid nitrogen, which is applied to the pigmented area and maintained in contact for around 20 - 30 seconds[13], until a narrow halo of white ice forms around the bud. With this method, one cannot obtain temperatures lower than -20°C and cannot reach below a depth of 2-3 mm. It is suitable method for treating superficial benign lesions.

   Spray technique is the most popular method using open end cryoprobes i.e. spray tip cone or cylinder. In this method, the cryogen is sprayed directly on to the lesion. The spray tip is held 1 cm away from the lesion and a steady spray of liquid nitrogen is directed at the centre of the lesion.

   In the cryoprobe technique, liquid nitrogen is circulated so as to cool the tip of the cryoprobe, which is to be applied on to the lesion.

   The cryosurgery does not require the use of local anesthesia. It is relatively a painless procedure with minimal chances of infection, and has shown to produce excellent results lasting for several years. This procedure does not require a periodontal dressing.

   The main disadvantage is that it could leave behind residual pigments. It will be not possible to observe immediate tissue changes after application of the cryogen. Some

of the areas remain unexposed to the cold temperature. The depth and extent of destruction of the underlying tissue is difficult to control as this is affected by several factors such as temperature attained at the tip of the cryoprobe, cryodose, pressure applied, number of cycles and the type of tissue treated.

4. *Electrosurgery:* It is a surgical technique performed using controlled, high - frequency electrical (radio) currents in the range of 1.5 to 7.5 million cycles per second, or MHz. Electrical energy is thought to lead to molecular disintegration of melanin cells, present in basal and suprabasal cell layers of operated and surrounding sites. It retards migration of melanin cells from the locally situated cells.

   The loop electrodes are most commonly used. One of the basic rules is to always keep the tip moving. Prolonged or repeated application of current to the tissue induces heat accumulation and undesired tissue destruction, whereas interrupted application at intervals adequate for tissue cooling (5 - 10 seconds) reduces/ eliminates heat build-up. Contact with the periosteum or alveolar bone should be avoided. Superior efficacy of electrosurgery over epithelial excision or bur abrasion-scraping techniques has been reported.[14]

Chemical methods

Use of chemicals for depigmentation has been in practice since 1950s.

1. Mixture of phenol (90%) and alcohol (95%) are used to burn out pigmented gingiva. The regeneration of gingiva takes long time, and repigmentation is seen in significant proportion of cases.
2. 5% paraformaldehyde and
3. Potassium hydroxides are few of the chemicals tried.

These chemical substances cause tissue necrosis and the pain that proceeds their use has rendered the method not acceptable.

Lasers

Laser ablation of gingival depigmentation has been recognized as one of the most effective, pleasant, and reliable techniques. Different lasers have been used for gingival depigmentation, including carbon dioxide (CO_2; 10,600 nm), diode (820 nm), neodymium-doped:yttrium, aluminum, and garnet (Nd:YAG; 1,064 nm), erbium-doped (Er-YAG; 2,940 nm), and erbium- and chromium-doped:yttrium, scandium, gallium, garnet (Er,Cr:YSGG; 2,780 nm) lasers.

Lesser intra- and postoperative pain reduction, and rapid wound healing are important advantages of laser use. Pain reduction after using lasers may be due to the protein coagulum formed on the wound surface that seals off sensory nerve endings and it also acts as a biologic dressing. The rapid wound healing after using lasers may be related to the photobiomodulation (PBM). PBM accelerates lymphatic and blood flow resulting in reduction in toxins and contributes to a larger expression of collagen and elastic fibers during the early phases of the wound-healing process.[1] This helps to reduce pain, enhance repair, and induce regeneration promoting faster healing and a return to the normal.

Methods of masking pigmented gingiva

Free gingival grafts (FGG), subepithelial connective tissue (SCT) grafts and acellular dermal matrix allografts have been used for this purpose. FGG and SCT graft application are invasive procedures and are extensive in nature. They also involve a second surgical site that adds to additional discomfort and poor tissue color matching at the recipient site. Therefore these masking techniques are not the considered procedures for depigmentation.

Case report

A 20 years old male patient reported to the university periodontology clinic with the complaints of darkly pigmented gums and irregularly placed teeth. On examination, the patient revealed a Class II smile line (High smile line - between 0 and 2 mm of marginal gingiva visible or between 0 and 2 mm apical to the cemento-enamel junction visible for the reduced but healthy periodontium), hyperpigmented gums in both the arches extending from the region of first premolar to first premolar and malposed upper and lower anterior teeth (Figure 1) .

It was decided to carry out depigmentation procedure on request. An informed written consent was obtained. It was planned to carry out depigmentaion procedure using different technique for the four different quadrant under local anesthesia. Procedure on maxillary arch region was carried out at the first sitting and that for mandibular arch 10 days later. Periodontal packs were placed post-procedure after both sittings and oral analgesics (Tablet aceclofenac 100mg for 3 days) were prescribed. Tissue response by healing was documented as complete (complete epithelialisation), delayed (raw area covered with thin epithelial layer in most areas), or incomplete (islands of uncovered areas) based on percent and extent of surface reepithelialisation.

In the maxillary arch, gingival scraping using the scalpel technique was used for the left quadrant. The scalpel technique involved gradual slicing and scraping of the gingival epithelium until the pigmentation was completely eliminated (Figure 2).

Bur abrasion technique using high speed rotary instruments under liberal saline irrigation was employed for the right quadrant. Emphasis was on applying minimal pressure and making feather light brush strokes to avoid pitting and excessive removal of the tissue leading to the underlying bone exposure. (Figure 3)

Figure 1. Hyperpigmented Upper and lower gums

Figure 2a. Gingival Scraping using the scalpel technique

Figure 2b. Scraping of gingiva until pigmentation is completely eliminated

In the areas on the mandibular arch, gingival scraping with scalpel was carried out for the left quadrant as was done earlier for maxillary arch region (Figure 4).

For the right quadrant, electrocautery using diamond and a loop electrode for light brushing strokes over moist gingival tissue

surface was utilised for de - epithelialisation. The tip of the electrode was kept in constant motion to avoid building up of heat (Figure 5).

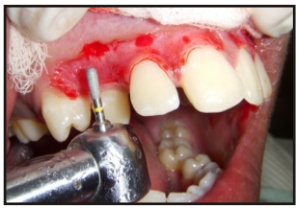

Figure 3a. Bur abrasion technique

Figure 3b. Bur abrasion technique with minimal pressure to avoid excessive removal of tissue

Figure 4a. Gingival scraping in mandibular arch using the scalpel technique

Figure 4b. Scraping of gingiva until pigmentation is completely eliminated

At the follow-up visits, the patient admitted on enquiry, higher degree of discomfort and comparatively more bleeding in the areas treated with the scalpel technique than in the areas where bur abrasion or electrocautery was used. But the patient did not complain of any on his own. The area treated with electrocautery showed a delayed tissue response for healing than at quadrants where scalpel or bur abrasion was used. None of the quadrants showed incomplete healing at 10 day follow-up (Figure 6).

All the three different techniques followed for depigmentation in this case provided similar comparable outcomes at 3 months follow-up. There was no evidence of repigmentation. (Figure 7).

Figure 5a. Electrocautery using diamond and loop electrode

Figure 5b. De-epithelized Gingiva

Figure 6. De-pigmented Maxillary arch

Figure 7. De-pigmented mandibular & Maxillary arch

However, one should keep in mind while counselling that repigmentation can occur. Although the exact mechanism of repigmentation is unclear, active melanocyctes from normal skin and hair matrix are believed to proliferate and migrate into the depigmented areas.[15]

Esthetics has been a very challenging field to the periodontists. Colour of the gingival plays a major role in the overall maintenance of esthetics. As of now, the clinicians experience and expertise along with the patients desire dictate the decision of an appropriate technique or a combination of available techniques to address the problem of hyperpigmented gingiva.

Key Messages (Provide appropriate messages of about 35-50 words to be printed in centre box): Various methods of depigmentation are available with equal efficiency. Depigmentation is not a clinical indication but a treatment of choice where esthetics is a concern and is desired by the patient.

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