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Depigmentation Needed or Not-A Thought

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Abstract:- Hyper pigmented gingiva may become an aesthetic concern for many people when associated with gummysmile, and require aesthetic correction. Here comes the role of depigmentation. Depigmentation is nothing but a periodontal plastic surgical procedure in which gingival hyperpigmentation is removed or eliminated by different techniques. The commonly employed techniques include scalpel technique, bur abrasion, cryosurgery, electrosurgery, chemical method, laser with different wave lengths. Each technique has its own advantages and disadvantages.

Keywords:- *Gingival Depigmentation, Repigmentation, scalpeland LASER technique of depigmentation.*

I. INTRODUCTION

A variety of pigments, including melanin and carotene, oxyhaemoglobin, reduced haemoglobin, bilirubin, and iron influence the colour of the gingiva.[1]. Out of which melanin is the most commonone. Melanin is synthesized by the cells called melanocytes, theyfound scattered throughout basal and supra basal layers[2]. The melanin is transformed into the keratinocytes via melanosomes. The relative coloration of the gingiva depends onthe quantity of melanin produced by melanocytes and absorbed by keratinocytes. The number of melanocytes in fair and dark skin is constant, but their activity varies.The most common pigmented intraoral tissue is attached gingiva.The intensity and distribution of oral pigmentation differs between races, between individuals of the same race, and between areas of the same mouth.Gingival hyper pigmentation is defined as a darker gingival colour than is generally expected. It will depend upon the degree of melanocytes activity, genetic constitution, hormones and UV radiation.

When associated with a gummy smile and black gums, hyperpigmented gingiva can become an aesthetic problem for many people, necessitating aesthetic treatment. Here comes the role of depigmentation. Depigmentation is a periodontal plastic surgical procedure that removes or reduces gingival hyper pigmentation using various techniques[3]. The commonly employed techniques include scalpel technique, bur abrasion, crayosurgery, electro surgery, chemical method, laser with different wave lengths. Various factors to be considered while choosing an appropriate procedure which include patient as well as the operator factors.

This article provides brief review about depigmentation and detailed description on its technical aspects, aesthetic considerations healing aspects, and recurrence rate.

II. PHYSIOLOGY BEHIND PIGMENTATION

Melanocytes are the cells that synthesize melanin.; they are specialized dendritic cells with unicellular naturepresent in the basal cell layer.Primitive melanocytes derived from the neural crest of the ectoderm.They divide and maintain themselves as a self-reproducing cell in the epithelium..Structurally they are round with pale staining cytoplasm which lacks desmosomes and tonofilaments but possess long dendritic process called melanosomes, there are the melanin producing organelles.[4]

Melanosomes are classified into four stages based on their degree of maturation.[5].it include,

- Stage 1-vesicles with a membrane delineation containing tyrosinase and proteinaceous matrix
- Stage 2-oval organelles with a wide variety of membrane filaments distinctive periodicity
- Stage 3-There is less periodicity and melanin deposition.
- Stage 4-A dense, uniform particle with no discernible internal structure.

Process of synthesis of melanin is called as melanogenesis as a result of which there are two type of melanin are produced.

- Pheomelanin
- Eumelanin

Tyrosinase catalyses the first step in the biosynthesis pathway for both eumelanin and pheomelanin.

Tyrosine ⟹ DOPA ⟹ Dopaquinone

Dopaquinone can react with cysteine. –Pheomelanin

Dopaquinone ⟹ cysteine ⟹ Benzothiazine intermediate Pheomelanin

The melanin synthesis can be controlled by three major determinants, genes radiations, hormones.

III. CLASSIFICATIONS

Pigmented lesions of the oral cavity are multifactorial in etiology. In day to day practice a dentist encounters a number of pigmented conditions in the oral cavity .so it is important to differentiate between these pigmentations. They are broadly classified as exogenous and endogenous. However various classifications are put forward by various authors that makes to elaborate as well as simplify the diagnosis. The existing classification of pigmented lesions include Dummet et al 1967[6], Brocherioce1985[7], Meleti2008[8], Kauzman et al 2004[9].The above-mentioned classification systems are mainly focusing on racial pigmentation. In 2014 Peeran et al[10](Table 1)made a

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classification for gingival pigmentation in terms of aesthetics in the various treatment techniques used.It takes in to account the aestheticaspects ,i.e.Melanin pigmentation in the anterior aesthetic smile area and the severity and extent of gingival pigmentation.consideration the etiology of other pigmented lesions of the gingiva, the classification is as follows.

Class	Classification Criteria
I	Coral pink/salmon pink coloured gingiva
II	Localized/Isolated spots/areas of gingival melanin pigmentation which does not involve all the three parts of gingiva, that is, attached, free, and papillary gingiva Mild to moderate pigmentation Severe/intense pigmentation
III	Localized/Isolated unit/s of melanin pigmentation which involve all the three parts of gingiva, that is, attached, free, and papillary gingiva Mild to moderate pigmentation Severe/intense pigmentation
IV	Generalized diffuse pigmentation which involve all the three parts of gingiva that is, attached, free and papillary gingiva. Mild to moderate pigmentation Severe/intense
V	pigmentation
VI	Tobacco associated pigmentation like smoker's melanosis and chewing tobacco
VII	Gingival pigmentation due to exogenous pigments eg:-Amalgam tattoos, Cultural gingival tattooing, Drinks, Food colors, Habitual betelnut/khat chewing, Lead-Burtonian line, Mercury, Silver, Arsenic, Bismuth, Graphite, Other foreign bodies, Topical medications, Idiopathic
VIII	Gingival pigmentation due to endogenous pigments like Bilirubin, Blood breakdown products, Ecchymosis, Petechiae, Hemochromatosis, Hemosiderin.
IX	Drug-induced gingival pigmentation like ACTH, Antimalarial drugs, Chemotherapeutic agent busulfanb and doxorubicin, Minocycline, Oral contraceptives, Phenothiazines.
X	Gingival pigmentation associated with systemic diseases and syndromes like Addison's disease, Albright's syndrome, Basilar melanosis with incontinence, Beta thalassemia; Healed mucocutaneous lesions-Lichen planus, Pemphigus, Pemphigoid; Hereditary hemorrhagic telangiectasia; HIV-associated melanosis, Neurofibromatosis, Peutz-Jeghers and other familial hamartoma syndromes, Pyogenic granuloma/Granulomatous epulis Pigmented benign and malignant lesions involving the gingival like Angiosarcoma, Hemangioma, Kaposi's sarcoma, Malignant melanoma, Melanocytic nevus, Pigmented macule

Table 1: gingival depigmentation classification (Peeran et al 2014)

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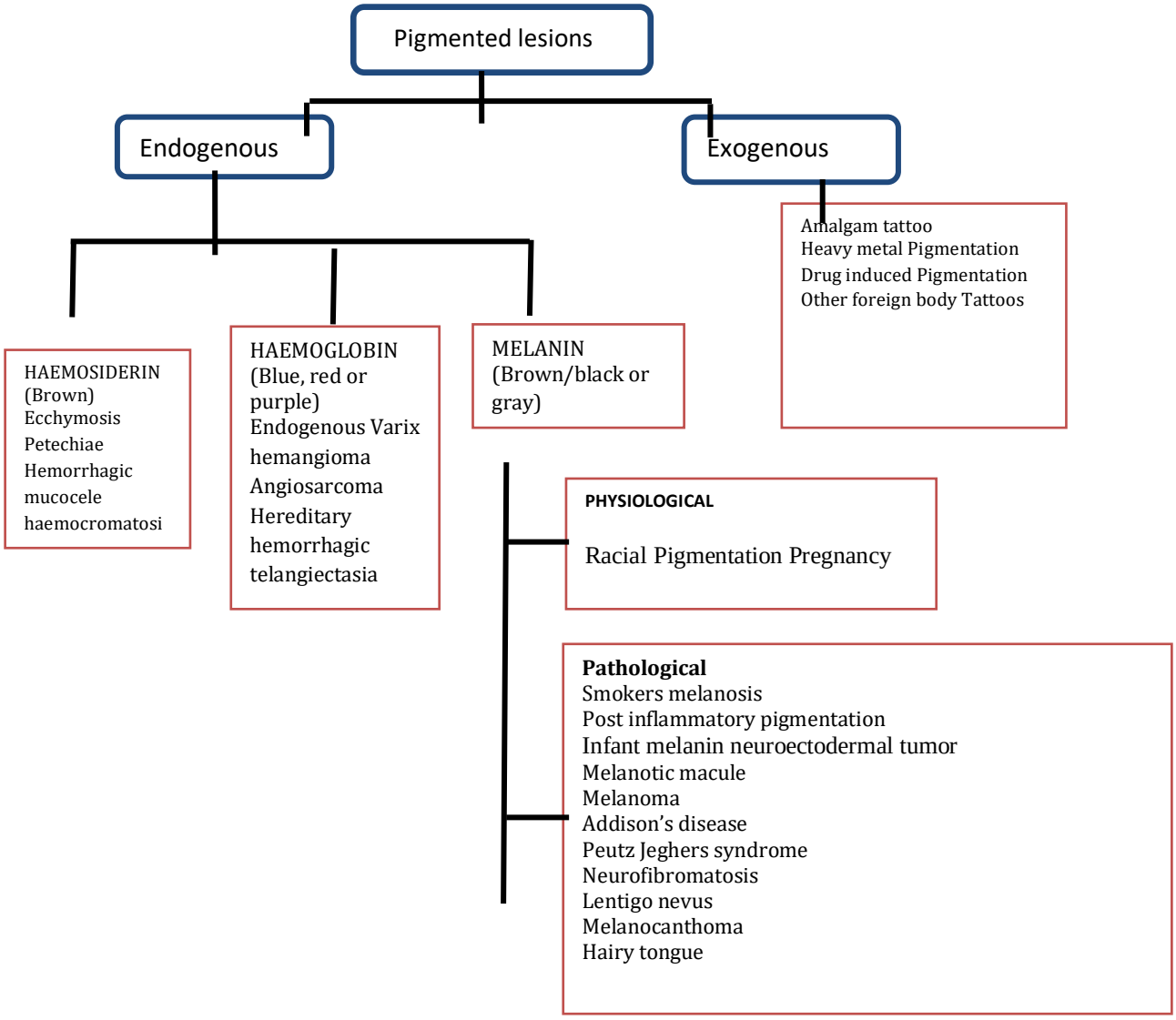

Fig. 1: classification of various pigmented lesion by (Patil s et al-2015)

IV. IS DEPIGMENTATION REQUIRED?

Gingival depigmentation is not a clinically indicated procedure until aesthetic is a concern and is desired by the patien[12,13]. Before performing a depigmentation procedure through any technique certain factors to be considered, according to which dentist should precede further. First and foremost, why he/she need depigmentation to be done, if it is an aesthetic concern the following things to be considered in account.

- Patient skin colour
- Thickness of keratinized gingiva /biotype
- Extend od pigmentation
- Smile line of the patient &upper lip curvature
- Exact cause of the pigmentation& severity
- Patient satisfaction &pain threshold of the patient after procedure
- Healing and recurrent rate after each procedure

Indian population have various colour shades from dark to fair.Ponnaiyan et al (2013)[14]In a study of south Indians, the most of the pigmentation was confined in the attached gingiva and interdental papilla, which had a positive link with skin colour. In fair individuals the gingival and skin colour may vary, in such cases depigmentation become choice of treatment for aesthetic concern.

Most considered index while planning for gingival depigmentation are:-DOPI oral pigmentation index(by Dummet 1971)[15,16],melanin pigmentation index (by Takashi et al 2005)[17]and smile line index (by Liebart&Deruelle 2004)[18].

In 2016 Nimisha nandanan et al done an observational study to find out the possible relationship between gingival pigmentation and gingival biotype and skin pigmentation &they found a positive correlation[19]. Different procedure has been proposed for gingival depigmentation; However, the procedure should be simple, cost-effective, and comfortable for both the clinician and the patient, with minimal pain, discomfort, and tissue damage. Inappropriate

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techniques may result in gingival recession, attachment apparatus damage, and underlying bone damage.

Azzeh M.[20] classified the various techniques used for gingival hyperpigmentation.
Methods for removing the pigmented layer include:

- Abrasion technique using long, round diamond bur
- Surgical methods of depigmentation
  - Scalpel surgical technique
  - Cryosurgery
  - Electrosurgery
- Chemical methods of depigmentation using 90% phenol and 95% ethanol
- Lasers
  - CO2 lasers
  - Diode lasers
  - Neodymium doped ; Al :Yttrium Garnet (Nd: YAG) laser
  - Erbium –doped ;Yttrium :Al Garnet (Er: YAG) laser
  - Er, Cr: YSGG laser
- Techniques for masking pigmented gingiva with grafts from less pigmented areas are being developed.:
  - Free Gingival Graft
  - Sub-epithelial connective tissue graft
  - Acellular Dermal Matrix (ADM) allograft

For performing any cosmetic/aesthetic surgical procedure appropriate patient selection criteria play a major role of success. As in case of gingival depigmentation. Considering the patient factors including the healing,intra and post operative comfort as well as the recurrence rate. And clinician's factors, The scalpel surgical technique and the LASER are the most widely used techniques.

V. SCALPEL SURGICAL TECHNIQUE

Also know as surgical stripping or split thickness epithelial excision.The scalpel technique for depigmentation is simple and easy to perform, non-invasive, and most importantly, cost effective, so it is still the most popular treatment modality.Prior to opting this technique, the biotype and the papillary area of the gingiva has to be evaluated.After obtaining adequate local anaesthesia, a layer of pigmented epithelium is surgically removed, either by scraping or slicing with a B.P blade no 15 or 11. It is important not to leave any visible pigments over the denuded area, that may cause repigmentation. After adequate hemostasis a periodontal pack is placed allow it to heal by secondary intention.The healing process after surgical depigmentation is as follows::

- Immediately: clot formation and acute inflammation of the underlying tissues occur.
- GT replaces the clot
- PDL (Periodontal Ligament) capillaries migrate into GT
- Capillaries connect with gingival vessels within 2 weeks.
- As healing occurs, vascularity increases initially and then gradually decreases.
- Surface epithelialization takes 5 to 14 days.
- Complete epithelial repair occurs in 3 - 4 weeks..

Almas et al. (2002)[21] treated a 28-year-old male Caucasian on both maxillary and mandibular arches with the scalpel method, which was first pioneered by Dummett and Bolden in 1963[22], and the patient was monitored for a longitudinal period for any recurrence of pigmentation in the 6 month follow-up period, and there was no relapse of pigmentation within this duration of follow-up, and there was no relapse. Perlmutter and Tal (1986)[23] used scalpel gingivectomy to remove pigmented keratinized gingiva in two JewishYemenite adult males. After surgery, the exposed connective tissue was covered with a periodontal pack for 7–10 days. The tissues were subsequently checked for evidence of repigmentation on a regular basis. Healing was eventful in both the patients; nevertheless, the pigmentation returned 32 months later, in first case complete repigmentation occurred after 7 years.

Scalpel depigmentation techniques are inexpensive[24], they must be performed under effective local anaesthesia, and to achieve adequate hemostasis pressure must be applied, which increases patient discomfortintra-operatively[25];After the procedure use a periodontal pack as a surgical dressing. Healing of the denuded surgical area, where the connective tissue is now devoid of epithelium, happens by secondary intention and hence has a period of morbidity associated with it; a convalescence period of 7–14 days is indicated, during which the patient may be unable to eat normally. Due to melanocyte movement from the surrounding area, there is also an increased risk of relapse.

VI. LASER TECHNIQUE

Laser ablation has recently been proposed as the most effective and dependable method for depigmenting hyperpigmented gingiva..Maiman invented lasers in 1960, and they have been widely used in the medical field since then..The fact that lasers are a less invasive, less painful alternative to conventional and traditional depigmentation techniques.In dentistry, lasers with different wavelengths, such as "blue" and "green" diode lasers (440, 532 nm), near infrared diode lasers (810, 940, 980 nm), and mid-infrared Nd:YAG (1064 nm), have a broad affinity for pigmented chromophores, including melanin.Mid-infrared erbium YAG lasers (2940 nm), erbium chromium YSGG lasers (2780 nm), and far-infrared CO2 lasers (10,600 nm) all have high water absorption and thus are useful for depigmentation. Shorter visible and near-infrared wavelengths will penetrate the cell surface layer, destroying the basal membrane and melanin deposits. Longer wavelengths, on the other hand, may act as a "laser peel," vaporising the surface layer by layer until the melanin layer is removed. Both procedures should be carried out with caution in order to achieve depigmentation while avoiding more serious risks of damage, such as thermal conduction through the underlying bone and/or dental root and pulp.One reason for this is melanin's broad absorption spectrum as a molecule, as well as the high protein and water content (up to 93 percent) of the melanosomes into which it is packaged[27,28]. Because the laser light's energy is absorbed, it is not necessary to de-epithelize the entire pigmented area; instead, be cautious and allow the light to degranulate the melanosomes (via protein absorption) and/or denature the melanin. Due to denatured

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or degranulated melanin, the post-surgical area appears light brownish after laser-assisted depigmentation. Continuous wave emissions, such as those seen with visible, near-IR diode, and CO2 wavelengths, should be used with caution to avoid overheating; the laser emission mode may affect the thermal relaxation capacity of the treatment area. In addition, the tissue penetration.Overall, it is critical to understand how to use the least amount of power necessary to achieve a desired result.

Trelles et al. (1993)[29] used an argon laser (514 nm) at 1.5 watts (W) of power in pulsed mode of 300 milliseconds, 50 percent duty cycle, and a spot size of 0.5 mm using a fibre tip, in contact mode, and under local anaesthesia in 36 patients in one of the earliest reports of the use of lasers for depigmentation.

The majority of patients (except two) did not require any post-operative analgesic, and all 34 had good depigmentation results. However, no follow-up period or pigmentation relapse using the Nd:YAG laser was mentioned.Ribeiro et al. (2012)[30] conducted a randomised clinical trial to compare the efficacy of scalpel depigmentation versus the Nd:YAG laser. Each modality was assigned to one side of the anterior maxillary arch at random. They used the Visual Analog Scale (VAS) to assess patient pain responses, and they graded the reappearance of pigmentation from poor to excellent on a predetermined arbitrary scale of 5 grades. They found that the scalpel method took longer and resulted in more pain after surgery than the Nd:YAG laser technique. Patients' aesthetic satisfaction with scalpels and Nd:YAG lasers was comparable after 6 months.

In the year 2020[31] Chandra and colleagues The DOPI was used in a split-mouth randomised clinical trial to compare and assess scalpel technique and diode laser (810 nm)-assisted depigmentation for bleeding, post-operative pain, and pigmentation recurrence after 6 months. While the scalpel-treated side healed faster, patients experienced more bleeding during and immediately after the procedure. However, both pain (after one day and one week) and pigmentation recurrence (after six months) were comparable between the two groups, with the diode laser group having slightly lower percentages of pain and pigmentation recurrence, though this was not statistically significant.

Because they use optic fibre energy delivery, Nd:YAG and diode lasers (both visible and near infrared) can depigment in contact mode. While this gives the operator tactile feedback, the procedure should be carried out with light, broad, sweeping brush strokes of the fibre tip in an apico-cervical direction (from the attached gingiva downward to the marginal gingiva). It is critical not to focus on any one area for too long, as this can result in an exposure time that exceeds the thermal relaxation time of the tissue, resulting in deeper collateral damage and delayed healing. It's also important not to nick the thin marginal gingiva, as this can result in unpredictable healing with rolled gingival margins and even minor gingival recession.

The erbium laser family (Er:YAG and Er,Cr:YSGG), CO2 lasers, and newer generation super pulsed diode lasers (that use a glass rod instead of a fibre tip) enable non-contact operation. This technique is very comfortable for the patient because it eliminates the scraping sensation of the fibre tip during the procedure.Working in non-contact mode necessitates extreme precision and accuracy. Erbium lasers are used for depigmentation, and the energy is delivered in a free running pulsed mode through sapphire or zirconia tips, with the pulses visible as opaque spots on the gingiva. These spots must have at least 20–30%[32] overlap, preferably around 50% overlap. If the space between two succeeding spots is not treated, pigmentation will appear in these areas after healing.As one moves forward, flakes of desiccated and ablated epithelial tissue fly up as if brushed, giving rise to the term "brush technique" for this erbium laser depigmentation method. Remove the desiccated epithelial layer with moist gauze or the convex outer bend of a curved explorer after covering an area of gingiva, and then return to the areas that still show pigmentation. There would be some amount of bleeding as the procedure progressed. Erbium lasers are very gentle, with Er:YAG lasers penetrating only 2–4 m and Er,Cr:YSGG lasers penetrating around 15 m.[33],As a result, the area must be worked on in layers until the pigmentation is removed. In this case, water is the primary laser energy absorber, followed by epithelial and melanosome proteins, but no absorption in haemoglobin would translate clinically as poor hemostasis.

Tal et al. (2003)[34]used a 500 mJEr: YAG laser at a frequency of 10 pulses/second and a spot size of 3 mm from a distance of 7 mm from the tissue on 10 patients who needed depigmentation with only a 2.5 percent lidocaine topical application..Melzack's McGill pain questionnaire was administered to the patients.At 1, 2, 3, and 6 months, they were evaluated for the recurrence of any pigmentation. Only three patients required analgesics after surgery, and the vast majority said it was a pleasant experience. Even after 6 months, there was no recurrence of pigmentation in any of the patients. Working with CO2 lasers lacks the relative control that erbium lasers provide, and the articulating arms used to deliver energy in CO2 lasers are bulky and cumbersome. To focus a spot size of, say, 0.8 mm from a distance of 1–2 cm away, a learning curve is required. Because the wavelength of the CO2 laser (10,600 nm) is highly absorbed by the water content of soft tissues. It is effective and especially well suited for the treatment of gingival hyperpigmentation.. Because of its high absorption, it has a low penetration (around 50 m) thus no risk to the underlying periosteum and bone. It can also remove a thin layer of epithelium by causing blisters and then completely detaching the epithelium. Hegde et al. refer to this as the "epithelial peel technique" (2013)[35]. The CO2 laser ablates melanocytes by selectively removing epithelial cells from the basal layer of the treated area..

Gholami et al. (2018)[36] evaluated and compared the efficacy of scalpel surgical stripping versus the Er,Cr:YSGG laser at 4.5 W and 2.5 W in a split-mouth approach in a randomised clinical trial. Pain was assessed using the VAS, both healing and bleeding were assessed using an arbitrary scale. After one year, Hedin's classification was used for

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assessing the reappearance of pigmentation. Most patients reported less pain with both Er,Cr:YSGG laser settings, and patient satisfaction with both laser settings and scalpel was comparable. Patients treated with both laser settings had more complete epithelial healing at 7 days than the scalpel group, and relapse rates after 1 year were comparable.

Nammouret al. (2020)[37] compared the relapse rate after depigmentation (over 5 years) between three different laser wavelengths in a randomised clinical trial on smokers and nonsmokers(Er:YAG, CO2, and diode laser 980 nm).They assessed the return of gingival pigmentation using the Hedin's Classification and discovered that the relapse rate was faster in the smokers group, while the diode laser group had the most enduring results in both smokers (average, 29 months) and non-smokers (average, 39 months), and the Er:YAG laser group had the earliest return of pigmentation (average, 7 months) in both smokers and non-smokers (average, 9 months). Although laser wound healing is slower than scalpel wound healing, post-operative advantages include a sterile inflammatory response, hemostasis, minimal wound contraction, painless healing without swelling, and the patient's freedom to resume normal food habits.[38]

VII. REASONS FOR REPIGMENTATION

The reappearance of melanin pigmentation after a period of depigmentation is referred to as repigmentation[39]. According to Land's migration theory[40], Melanocyte shift occurs when active melanocytes from adjacent pigmented tissues migrate to treated areas, resulting in relapse. With laser depigmentation, there is no melanocyte shift after the procedure. This is most likely due to the removal of the epithelium all the way to the basement membrane by the laser.[15]. Aside from any of this, leftover melanocytes during surgery and hormonal changes, as well as excessive sunlight exposure, genetic and ethnic factors, are thought to be the causes of repigmentation. [39].

VIII. CONCLUSION

Depigmentation therapy is most likely to benefit patients who have excessive gingival display. Gingival biotype, clinician expertise, patient preferences, and recurrence rate all play a role in technique selection.Despite the use of different techniques, cryosurgery followed by lasers has been reported to be superior techniques with better aesthetic results and a low recurrence rate. Then also the commonly employed technique is surgical scalpel and LASER.Relapse or repigmentation is a serious concern that is influenced by the technique used as well as the duration of the follow-up period.

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