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RESEARCH ARTICLE

EVALUATION OF REPIGMENTATION FOLLOWING GINGIVAL DEPIGMENTATION USING LASER TECHNIQUE: A CASE SERIES

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Abstract

The harmony of the smile is not only determined by the shape, position and the color of the teeth but also by the level and color of the gingival tissues. Gingival hyperpigmentation is a major concern for a significant number of patients, as a relevant aesthetic or cosmetic need. Oral melanin pigmentation is considered to be multifactorial and could be related to physiological or even pathological reasons and can be the consequence of a variety of local or systemic factors. The aim of this study is to evaluate the repigmentation followed by gingival depigmentation carried out with a diode laser for 2 to 4 years of follow up. Five patients who were esthetically conscious of their dark gums were selected for this study. After reevaluation mild to moderate pigmentation was noted in all the cases.

Introduction:-

The gingiva is the part of the oral mucosa that covers the alveolar processes of the jaws and the cervical portions of the teeth. Gingival health and appearance are the essential components of an attractive smile. A smile is not only a method of communication but is also a medium of socialization, interaction and attraction.[1]The harmony of the smile is not only determined by the shape, position and the color of the teeth but also by the level and color of the gingival tissues.[2] The colour of the gingiva plays a key role in the aesthetics of the patient.[3] Gingival colour is generally described as "coral pink". The factors that affect the gingival color include its vascularity, thickness, keratinization and gingival pigmentation. Melanin, carotene, reduced haemoglobin and oxy-haemoglobin are the prime pigments contributing to the normal colour of the gingiva, out of which melanin shows the maximum incidence rate.[4]

Melanin, a brown pigment, is the most common natural pigment contributing to endogenous pigmentation of gingiva. It is a non–hemoglobinderived pigment formed by cells called melonocytes which are dentritic cells of neuroectodermal origin in the basal and spinous layers.[5]Melanin pigmentation is the result of melanin granules produced by melanoblasts intertwined between epithelial cells at the basal layer of gingival epithelium.[5]The degree of melanin pigmentation varies from one individual to another, which is mainly due to the melanoblastic activity.[6] Gingival pigmentation may appear as early as 3 hours after birth.[7]Gingival pigmentation is presented as a diffuse

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deep purplish discoloration or as irregularly shaped brown and light brown or black patches, striae or strands.[8]Oral pigmentation is a discoloration of the gingival/oral mucosa, associated with several exogenous and endogenous factors. Etiological factors are varied which include drugs, heavy metals, genetics, endocrine disturbances, syndromes such as Albright's syndrome, PeutzJegher's syndrome, and also in inflammation. Adverse habits such as smoking can also stimulate melanin pigmentation and the intensity of pigmentation is related to the duration of smoking and the number of cigarettes consumed. The pigmentation is mostly localized at the anterior labial gingiva, affecting females more than males.[9]Gingival melanin pigmentation occurs in all races.[10]There has been controversy about the relationship between age and oral pigmentation. Steigmann and Shulamit (1965) stated that all kinds of oral pigmentation appear in young children.[11] Prinz (1932), on the other hand, claimed that physiologic pigmentation did not appear in children and was clinically visible only after puberty.[12]

Gingival depigmentation is a periodontal plastic surgical procedure where by the gingival hyperpigmentation is removed or reduced.[13]The first and foremost indication for depigmentation is patient demand for improved esthetics. Gingival hyperpigmentation was classified according to melanin index by Hanioka et al into three classes; class 0 indicates no pigmentation, class 1 represents solitary units of pigmentation in papillae only, and class 2 displays a continuous ribbon of gingival pigmentation .[14]In this case series we have used oral pigmentation index which was introduced by Dummett and Gupta in 1971 [Figure 1].[15]Elimination of these melanotic areas can be done by scraping, free gingival autografting, cryosurgery, electrosurgery, and various types of lasers.[16]Gingival re-pigmentation refers to the reappearance of melanin pigmentation following a period of time after depigmentation.[17]It is a common concern in the treatment of gingival hyperpigmentation and starts with migration of melanocytes from the adjacent free gingiva. The extent and time interval of recurrence varies depending upon the treatment modalities performed, in addition to the length of follow-up.[18] The mechanism of repigmentation is not well-known; although according to the migration theory, active melanocytes from the adjacent pigmented tissues migrate to the treated areas.[19]

The present case series was aimed to evaluate the reappearance of gingival pigmentation following diode laser gingival depigmentation technique in 2 to 4 years followup.

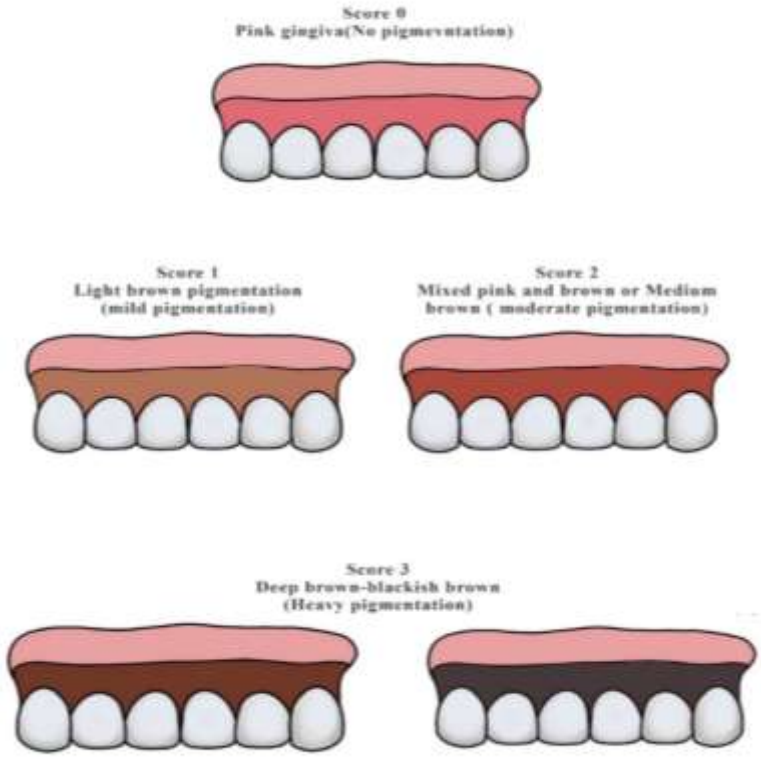

Figure 1:- Oral Pigmentation Index (Dummett and Gupta in 1971).

Case Reports

Case 1

A 22-year-old Female patient visited to the Department of Periodontics, Sree Mookambika Institute of dental sciences, Kulasekharam with chief complaints of heavily pigmented gums. History revealed that it was present since childhood suggestive of physiological melanin pigmentation [Figure 2 A]. Patient was systemically healthy without any habits. Patient's oral hygiene was satisfactory. The DOPI score was 3. Patient was explained about the treatment options and the possibility of repigmentation after certain period. Phase I therapy was done. Upper arch in relation to 13 to 23 was planned for laser therapy.Local infiltration of lignocaine was administered. At the maxillary anterior region from canine to canine (anterior esthetic segment), gingival depigmentation done using diode laser (860 nm, 1.0 watt). There was absolutely no bleeding during the procedure. Postoperative instructions were given to the patient, amoxicillin 500 mg given thrice daily for three days along with Zerodol P was given twice daily for 3 days. Patient was recalled after 1-week for re-evaluation. Wound healing was satisfactory. After 1-week, the pack was removed, and the surgical area was examined. On 1-week postoperative follow-up, the healing was uneventful without any postsurgical complications. The gingiva appeared pink, healthy, and firm giving a normal appearance [Figure 2B].

The patient was followed up for review after 4 years [Figure 2C] to evaluate the recurrence status of pigmentation. DOPI score after re-evaluation was2. Repigmentation was seen as diffuse brownish pigmentation in the marginal gingiva, interdental papilla and attached gingiva.

Figure 2:- (A) Pre operative image (B) 1 week post operative (C) 4 years post operative follow-up.

Case 2

A young male patient aged 23-year visited the Department of Periodontics, Sree Mookambika Institute of dental sciences with the chief complaint of blackish discolouration of gums [Figure 3A]. The DOPI score was 3. The procedures were performed with the same method as described in the previous case. The wound healed well after 2 weeks [Figure 3B]. The patient was followed up for review after 3 years to evaluate the recurrence status of pigmentation [Figure 3C]. DOPI score after reevaluation was 2. Repigmentation was seen as a diffuse light brown pigmentation along the marginal gingiva, interdental papilla and attached gingiva.

Figure 3:- (A) Pre operative image (B) 2 weeks post operative (C) 3 years post operative followup.

Case 3

A 23-year-old male had a chief complaint of black gums [Figure 4A]. The procedures were performed with the same method as in the previous case. The DOPI score was 3. The wound healed well after 4 weeks. No pain or bleeding

complications were found. Pigmentation was absent in the newly formed epithelium, with the gingiva appearing pale pink in color after a period of 1 month [Figure 4B].The patient was followed up for review after 4 years to evaluate the recurrence status of pigmentation [Figure 4C]. DOPI score after reevaluation was1. Repigmentation was noted as patches of light brownish pigmentation along the marginal gingiva and interdental papilla.

Figure 4:- (A) Pre operative image (B) 4 weeks post operative (C) 4 years post operative follow up.

Case 4

A young 24-year-old female patient visited the Department of Periodontics, Sree Mookambika Institute of dental sciences with the chief complaint of blackish discoloration of gums and with a request for esthetic treatment of black gums. [Figure 5A]. The procedures were performed with the same method as in the previous case. The DOPI score was 2. The wound healed well after 4 weeks. No pain or bleeding complications were found. [Figure 5B]. The patient was followed up for review after 3 years to evaluate the recurrence status of pigmentation [Figure 5C]. DOPI score after reevaluation was 1. Repigmentation was noted as light brownish pigmentation in the attached gingiva.

Figure 5:- (A) Pre operative image (B) 4 weeks post operative (C) 3 years post operative followup.

Case 5

A 22-year-old female had a chief complaint of discolouration of gums [Figure 6A]. The patient gives a medical history of asthma and under medications for past 8 years. DOPI score was 2. At the maxillary anterior region from canine to canine, gingival depigmentation done using diode laser (860 nm, 1.0 watt). The wound healed well after 4 weeks. No pain or bleeding complications were found. The gingiva became pink and healthy within 4 weeks [Figure 6B]. The patient was followed up for review after 2 years to evaluate the recurrence status of pigmentation [Figure 6C]. DOPI score after reevaluation was 2.Repigmentation was noted as diffuse light brownish pigmentation along the marginal gingiva, interdental papilla and attached gingiva in relation to 11-13 and patches of light brownish pigmentation was seen along the marginal gingiva and interdental papilla in relation to 21-23.

Figure 6:- (A) Pre operative image (B) 4 weeks post operative (C) 2 years post operative follow up.

Discussion:-

Gingival health and appearance are essential components for an attractive smile and removal of unsightly pigmented gingiva is the need for a pleasant and confident smile.[20]Oral pigmentation occurs in all races of man, and the gingiva is the most frequently pigmented intraoral site (Dummett and Gupta 1964).[5]This pigmentation may be seen across all races and at any age, and it is without a gender predilection. Melanin pigmentation of the gingiva is completely benign and does not present a medical problem. Complaints of "black gums" are common and a demand for depigmentation is usually made for esthetic reasons.[21]Different procedures have been proposed for gingival depigmentation. Roshni & Nandakumar in 2005 classified different gingival depigmentation methods asScalpel surgical technique, Bur abrasion method, Electro-surgery, Cryosurgery, Lasers like diode, carbondioxide (CO_2),

Nd: YAG,Er: YAG, and also used different methods to mask the pigmented gingiva with grafts such as free gingival grafts, acellular dermal matrix allograft. [22]

The word LASER is an acronym for Light Amplification by Stimulated Emission of Radiation. Lasers were first introduced in 1960 by Maiman and were brought into general practice by Dr William and Terry Myers.[23]Today, the laser has largely found its place among the therapeutic arsenal used in depigmentation. Several lasers have been used according to their wavelength: carbon dioxide (CO2), semiconductor diode, Neodymium-Doped Yttrium Aluminum-Garnet (Nd: YAG), and Erbium-Doped Yttrium Aluminum-Garnet (Er: YAG). They are considered to be a less invasive de epithelialization alternative to traditional surgical procedures that present several risks such as pain, edema, and infection.[24]

Although, CO_2 lasers are very commonly used for depigmentation procedure, they can damage tooth structure and the delivery system is very cumbersome. Since CO_2 lasers are used in noncontact mode, they can also cause loss of tactile sense.[23]Also, diode is an excellent soft tissue laser and is indicated for cutting and coagulating gingival tissue.[25,26]Thus, we decided to use diode lasers. Wavelengths of diode laser are highly absorbed by pigmented tissue. This case series presents recurrence of gingival pigmentation after depigmentation was carried out using a diode (860 nm) laser, but the pigmentation was comparatively moderate. In diode laser radiation energy is transformed into ablation energy, resulting in cellular rupture and vaporization with minimal heating of the surrounding tissue [27]. The diode laser is a solid-state semiconductor laser that is emitted in continuous-wave and gated-pulsed modes [24]. Thanks to its different components, it converts electrical energy into light energy, which in turn is converted into heat.[28,29] Dental laser energy has an affinity for hemoglobin and melanin. It is characterized by wavelengths of 800-980 nm which target especially soft tissues. It is therefore ideal for gum depigmentation.[24,28,30] Higher power (>2.5 W) would manifest as discomfort and pain during the post-operative period and, moreover, could delay the healing time. Therefore, as a rule, a low-power setting (≤2.5) was used during the procedure.[31]For a proper depigmentation, the basal and suprabasal layers of the gingival epithelium, where the melanocytes are located, must be removed [32][Figure 7].

According to Atsawasuwan and Greethong (1999)[33] laser beam produces bloodless field for surgery, causes minimum damage to the periosteum and underlying bone, and the treated gingiva and mucosa do not need any dressing.This has the advantages of easy handling, short treatment time, hemostasis, decontamination and sterilization effects.But this approach needs expensive and sophisticated equipment, which makes the treatment very expensive[33].Laser beam even destroys the epithelial cells including those at the basal layer, and hence reduces repigmentation[34].

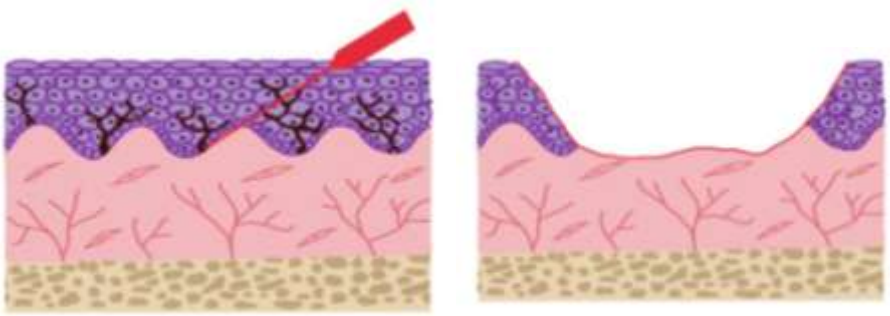

Fig 7:- Removal of epithelium using Diode Laser.

Khakar et al found that pain was less in patients treated with laser compared to patients treated with surgery and electrosurgery, probably due to the ability of the laser to seal blood vessels and nerve endings. [35]

In this case series repigmentation was seen as a diffuse brownish pigmentation at the end of 4 years in case 1,diffuse light brown pigmentation was observed at the end of 4 years in case 2, patches of light brownish pigmentation were seen in case 3, linear light brownish pigmentation were seen in case 4 and diffuse light brownish pigmentation and patches of light brownish pigmentation were seen in case 5 which could be a result of the ongoing process of repigmentation.

The decreased intensity of pigmentation may be due to the lesser production of pigments. The intensity may increase with time and may reach to pre-treatment level as it depends on the racial background of the patient. The results are consistent with the finding of Bergamaschi et al who demonstrated that permanent results cannot be offered when gingival depigmentation procedures are performed for cosmetic reasons.[36]

The reappearance of melanin pigment after a period of clinical depigmentation is called as repigmentation. The mechanism of re-pigmentation is explained by migration theory, according to this theory active melanocytes from the adjacent pigmented tissues migrate to treated areas, causing re-pigmentation.[37] Re-pigmentation may also be attributed to the melanocytes which are left during surgery as stated by Ginwalla et al.[38] These may become activated and start synthesizing melanin. He reported re-pigmentation in 50% of their cases between 24 and 55 days.[38]

Dummett and Bolden operated pigmented gingiva by gingivectomy procedure in 9 cases. Re-pigmentation occurred in 67% of the areas, as early as 33 days after surgical removal.[39]Perlmutter and Tal have also reported gingival repigmentation that occurred 7 years after the gingival depigmentation in one patient. [6]

Re-pigmentation was not occurred in any of the four patients treated by Atsawasuwan et al within one year after the gingival depigmentation using Nd: YAG laser.[33] Nakamura et al described depigmentation with CO_2 laser in 10 patients. No repigmentation was seen in the 1st year, but four patients showed repigmentation by 24 months.[40]The recurrence of pigmentation can be due to the nature of the melanocytes. These cells arise from the neural crest ectoderm and enter the epithelium as melanocytes from about the 8th gestational week and, by the 14th week, these cells may have reached densities of 2000/mm^2 in some regions.

Melanocytes have a reproductive self-maintaining system of cells. When locally depleted, they repopulate and Keratinocyte-derived Growth Factors, Fibroblast Growth Factor-β act as a mitogen. These cells lack desmosomes and possess long dendritic processes that extend between keratinocytes. Melanin is synthesized in the melanocytes in small structures called melanosomes. These melanosomes are injected into the keratinocytes by the dendritic processes. All individuals, whether lightly or darkly pigmented, have the same number of melanocytes in any given region of the mucosa. Butit has been observed that cells with melanin are present in connective tissue in the case of individuals who have a very high melanin pigment. These cells are actually macrophages that have engulfed the melanin pigment. [39]

Tal et al observed no re-pigmentation occurring in any of the patients with Er: YAG laser after 6 months. The pattern of recurrence in all the cases with re-pigmentation was patchy in distribution and due to its mild intensity, the results can be considered to be satisfying for the patients.[41]

Recurrence can be prevented by the entire removal of melanin from the free gingiva and interdental papilla since repigmentation starts as a result of migrating melanocytes from free gingiva. Adequate tissue removal may not be possible at the marginal gingiva and interdental papilla region due to close proximity of the adjacent teeth.[43] Jagannathan R et al, concludes that laser is an effective and fast tool that causes less pain, discomfort, faster healing, and delayed repigmentation compared with scalpel or electrosurgery for gingival depigmentation.[44]

Bur abrasion has the highest rate of repigmentation by 8.89, followed by laser 1.16%, then electrosurgery 0.74%, then cryosurgery 0.32%, and then diode laser 0.19%, while repigmentation rate following scalpel technique may occur after 7 years.[45]The laser procedure was more acceptable to the patient as the procedure took less time and was more comfortable as the area did not require injecting local anesthesia and absence of post-operative pain and hemorrhage. Also, from the operator's point of view, the laser technique was easier and faster to perform than the epithelial excision technique. Ribeiro et al.[46] and Simsek Kaya et al.[47] found similar results: That the subjects experienced a higher extent of discomfort/pain on the side treated by the scalpel technique as compared with the diode laser-treated side during the first post-therapy week. Also, the use of a diode laser presented advantages in terms of less discomfort/pain during the post-therapy period and a reduction of treatment chair time.

The limitation of the study is mainly the fact that a histopathological assessment is also needed to understand the process of repigmentation.

Conclusion:-

The growing esthetic concern requires the removal of unsightly pigmented gingival areas to create a confident and pleasant smile, which altogether may alter the personality of an individual. This could be attained easily by using diode laser. Thus, we conclude that mild to moderate pigmentation was noted in all the cases after re-evaluation for above 2 to 4 years.

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