

Review Article

Gingival Esthetics by Depigmentation.

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Abstract

In dentistry, esthetics has a special place. Although gingival melanin pigmentation does not present a medical problem, clinicians are often faced with a challenge of achieving gingival esthetics. Melanin pigmentation of the gingiva occurs in all races. Melanin, a brown pigment, is the most common cause of endogenous pigmentation of gingiva and is the most predominant pigmentation of mucosa. Gingival hyper-pigmentation is seen as a genetic trait in some populations and is more appropriately termed physiologic or racial gingival pigmentation. This problem is aggravated in patients with a “gummy smile” or excessive gingival display while smiling. Gingival depigmentation is a periodontal plastic surgical procedure whereby the gingival hyper-pigmentation is removed or reduced by various techniques. The first and foremost indication for depigmentation is patient demand for improved esthetics. Various depigmentation techniques have been employed, with similar results. Selection of a technique should be based on clinical experience and the individual's preferences. Removal of gingival melanin pigmentation should be performed cautiously and the adjacent teeth should be protected, since inappropriate application may cause gingival recession, damage to underlying periosteum

and bone, delayed wound healing, as well as loss of enamel.

Key Words: Melanin, depigmentation, esthetics, scalpel.

INTRODUCTION

Until recently dentists' and public's concept of dental esthetics was necessarily limited to alteration of the teeth themselves. Dentists concerned themselves with changing the position, the shape and color of the teeth – basically restoring missing unit or enhancing those already present. But now-a-days the growing concern of the individuals towards their appearance has led to incorporation of different periodontal treatment modalities in cosmetic dentistry based upon patients treatment needs. This has also led to change in domain of periodontics from being strictly a health service to one where smile enhancement has been brought to the forefront of treatment planning. The individual's ability to exhibit a pleasing smile directly depends upon the quality of the dental and gingival elements that it contains, their conformity to the rules of structural beauty, the relations existing between the teeth and lips during smile and its harmonious integration in the facial composition. Melanin hyper-pigmented gingiva is an esthetic problem in many individuals, particularly if the hyper-

pigmentation is on the facial aspect of gingiva and visible during speech and mastication especially in patients with gummy smiles. Today's growing esthetic concerns among the patients require the removal of unsightly pigmented gingival areas to create an esthetically-pleasant-smile.

A large number of parameters like the patient's skin color, the extent of gingival pigmentation, lip line, upper lip curvature and the esthetic concerns of the patient and his/her expectations from the treatment, play an important role in orchestrating the treatment plan.

EVALUATION OF GINGIVAL PIGMENTATION

Gingival pigmentation can be classified according to melanin index categories.^[1]

Class 0: No pigmentation.

Class 1: Solitary unit(s) of pigmentation in papillary gingiva without extension between neighboring solitary units.

Class 2: Formation of continuous ribbon extending from neighboring solitary units.

SMILE LINE

Analyzed by Liebart's classification:^[2]

Class 1: VERY HIGH SMILE LINE – >2 mm of the marginal gingiva is visible or > 2 mm apical to the CEJ is visible.

Class 2: HIGH SMILE LINE – Between 0 - 2 mm of marginal gingiva is visible or between 0 and 2 mm apical to the CEJ is visible.

Class 3: AVERAGE SMILE LINE- Only gingival embrasures are visible.

Class 4: LOW SMILE LINE- Gingival embrasures and CEJ are not visible.

DEPIGMENTATION PROCEDURES

Roshni & Nandakumar in 2005 classified different gingival depigmentation methods as:^[3]

I. Methods aimed at removing the pigmented gingiva:

A. SURGICAL METHODS:

- a. Scalpel surgical technique,
- b. Bur abrasion method,

c. Electrosurgery,

d. Cryosurgery,

e. Lasers,

f. Radiosurgery.

B. CHEMICAL METHODS.

II. Methods aimed at masking the pigmented gingiva:

A. Free gingival graft.

B. Acellular dermal matrix allograft.

Method 1-SCALPEL SURGICAL TECHNIQUE

It was one of the first techniques described for gingival depigmentation and still enjoys the status of being the most popular treatment modality. This technique was first illustrated by Dummet and Bolden in 1963.^[4] This technique is contraindicated in thin gingival areas, as removal of pigmented gingival epithelium may lead to gingival recession

In this technique, after achieving adequate local anesthesia, the pigmented gingival epithelium along with a layer of the underlying connective tissue is surgically removed by splitting the epithelium with B.P blade no: 15 & 11. Due care is taken to not to leave any pigmented remnants over the denuded area. After adequate hemostasis, periodontal pack is needed. Healing is generally uneventful and complete epithelial healing is achieved in 7 to 14 days.

Scalpel surgical technique is highly recommended in 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 patient.

Method 2- BUR ABRASION METHOD

The first documented case using this technique was reported by Ginwalla et al in 1966.^[5] It is a relatively simple and versatile technique and requires minimum time and effort. Technique involves de-epithelisation of pigmented areas of the gingiva by using high speed rotary instruments after adequate local anesthesia. A large surgical (round & straight or tapered) bur with copious saline irrigation is used. Pressure

application should be minimal and feather light brushing strokes without holding the bur in one place are recommended. Extensive care is required to avoid over-pitting of the gingival surface or removal of excessive tissue due to high speed.

The crudeness of the procedure and not of spatter and aerosol prevent this procedure from being the periodontist's favorite.

Method 3 - ELECTROSURGERY

Electro-surgery is the use of high frequency (50 kHz) electrical energy in the radio transmission frequency band, which is applied directly to tissue to induce histological effects. The first documented case report using electro-surgery for de-pigmentation was by Ginwalla et al in 1966.^[5]

The radio waves created by the device travel from the electrode tip to the patient and are returned to the device via an indifferent plate antenna placed under the patient's body in the vicinity of the surgical site. As the current passes, the impedance to the passage of current through the tissue generates heat, which boils the tissue water, creating steam, resulting in either cutting or coagulation of tissue.

Three patterns of current flow are produced, which are:

1. Fully rectified, filtered, used mainly for incision (90% cut and 10% coagulate).
2. Fully rectified, used mainly for the excision of epidermal growths (50% cut and 50% coagulate).
3. Partially rectified, used mainly for hemostasis or coagulating vascular lesions (90% coagulate and 10% cut).

After achieving local anesthesia, the desired diamond loop electrode is fixed to the hand-piece. The hand-piece is held in a pen-like fashion and the tip of the electrode is swiftly moved over the pigmented tissue to be excised. Electrode is used in a light brushing stroke and the tip is kept in motion all the time. The contact time of the tip of the electrode with the tissue should be very brief. Keeping the tip in one place could lead to excessive heat build up (Lateral-heat accumulation) and destruction of the tissues. After each use, the tip of the electrode is wiped on the rough surface of the saline-soaked

gauze to remove all debris.

Electro-surgery requires more expertise than scalpel surgery. Prolonged or repeated application of current to tissue induces heat accumulation and undesired tissue destruction. Contact with periosteum or alveolar bone and vital teeth should be avoided.^[6]

This technique is uncomfortable to patients due to foul odor and the use of high-speed suction is mandatory. Contraindications to this technique include patients with a keloidal tendency, cardiac pacemakers, and history of recent active episode of herpes simplex infection.

Method 4- CRYOSURGERY

Oral cryosurgery is a controlled method but shows non-selective tissue destruction of superficial tissues. Most vital tissues freeze at approx -2°C & ultra low temperature (below -20°C) results in total death by freezing of cytoplasm leading to denaturation of proteins and cell death. First cryosurgical de-pigmentation was documented by Tal et al in 1987.^[7]

Mechanism of Action

Liquid nitrogen, at -196°C (-320.8°F), is the most effective cryogen for clinical use. Temperatures of -25°C to -50°C (-13°F to -58°F) can be achieved within 30 seconds if a sufficient amount of liquid nitrogen is applied by spray or probe. Irreversible damage in treated tissue occurs because of intracellular ice formation. The degree of damage depends on the rate of cooling and the minimum temperature achieved. Inflammation develops during the first 24 hours after treatment, further contributing to destruction of the lesion through immunologically mediated mechanisms. Slow thaw times and repeat freeze-thaw cycles produce more tissue injury than a single freeze and thaw cycle.

Cryosurgery Devices

1. Cotton-tip applicator:

Chin JY (1998) described cryosurgical treatment of melanin-pigmented gingiva using direct application of liquid nitrogen (-190°C) with a cotton swab to the pigmented

gingiva.^[8]

2. Liquid nitrogen spray: Employed to manage benign, pre-malignant, and malignant lesions.
3. Cryoprobe: Used in the treatment of smaller facial lesions. A cryoprobe attached to the liquid nitrogen spray gun also provides added versatility.

This technique does not require local anesthesia and can be performed after topical anesthesia. Water soluble gel is applied over area of gingiva to increase the thermal conductivity. Expansion cryoprobe cooled to -81°C is applied to the pigmented area for 10 seconds. Frozen site thaws spontaneously within 1 minute and mild erythema develops. Removal of pigments cannot be evaluated during procedure & thus requires a second sitting after about 5-7 days, during which the residual areas of pigmentation should be removed. Depth of penetration is difficult to control and prolonged freezing could cause excessive tissue destruction; precision is needed. Treated sites are covered by epithelium within 2 weeks following freezing and keratinization is completed after 3-4 weeks. The requirements of expensive specialized equipment prevent this technique from being used widely for gingival depigmentation.

Cryosurgery is followed by considerable swelling and it is also accompanied by increased soft tissue destruction. Ishida & Silva^[9] and Gage & Baust^[10] reported that in cryosurgery, all the parts of the freeze-thaw cycle can cause tissue injury and healing is eventful. Depth control is difficult and optimal duration of freezing is not known, but prolonged freezing increases tissue destruction.

Method 5- LASERS

Nd: YAG Laser has a particular affinity for melanin or dark pigments; it works more efficiently when energy is applied in the presence of a pigment.

Unlike the CO_2 and Er:YAG lasers, the Nd:YAG laser has low absorption in water, and the energy scatters or penetrates into the biological tissues. The photothermal effect of this laser is useful for soft tissue surgery. Melanin's absorption spectrum ranges from 351 to 1064 nm and the wavelength of the Nd:

YAG laser is 1064nm.

For the depigmentation procedures, the recommended parameters are: 6 watts, 60 milli-joules per pulse, and 100 pulses per sec.

No discomfort, pain, or bleeding complications are found intra-operatively or postoperatively. Ablated wounds heal almost completely within 4 days. The CO_2 laser causes minimal damage to the periosteum and bone under the gingiva being treated and it has the unique characteristic of being able to remove a thin layer of epithelium cleanly. Although healing of laser wounds is slower than healing of scalped wounds, laser wound is a sterile inflammatory reaction.^[11,12] Atsawasuan et al have reported four cases of gingival melanin hyper-pigmentation using Nd: YAG laser and demonstrated good results; the complications being gingival fenestration and bone exposure.^[13] Erbium: YAG laser ablation was reported by Tal et al to be quite effective and reliable.^[7]

Method 6 - RADIOSURGERY

These are newer advanced electro-surgery units, which work in 3-4 MHz frequency (FM radio transmission). Radio-surgery produces a fine micro-smooth incision with no overt lateral heat being sent to the surrounding tissues.

Procedure

For smaller areas of pigmentation partially rectified coagulation mode at a power setting of 7 is recommended. It is recommended to touch the pigmented areas lightly with the electrode tip and remove the electrode as soon as the tissue around the electrode becomes whitish.

Method 7- CHEMICALS

These methods are no longer in use because of the destructive nature and difficulty in controlling the depth of their penetration.

A mixture of 90% phenol and 95% alcohol has been used by Hirschfeld and Hirschfeld in 1951.^[14]

Method 8 - FREE GINGIVAL GRAFT (FGG)

Free Gingival Graft was first described by Bjorn in 1963. Free Gingival Grafts are used to create a widened zone of attached gingiva and in root coverage procedures.

Tamizi M and Taheri M in 1996 documented the treatment of physiologic gingival pigmentation with free gingival autografts. No evidence of re-pigmentation was found 4.5 years postoperatively during the study.^[15]

Method 9 - ACELLULAR DERMAL MATRIX ALLOGRAFT

Novaes AB Jr et al in 2002 demonstrated the use of acellular dermal matrix allograft for the elimination of gingival melanin pigmentation.^[16]

Surgical procedure:

After local anesthesia administration, two vertical incisions are performed on the non pigmented tissue both mesial and distal to the pigmented area using a #15 scalpel blade. A horizontal sulcular incision is needed to reflect a partial thickness flap containing pigmented area. Reflected flap should be excised. After adequate hemostasis, the graft should be prepared according to the manufacturer's instructions and trimmed to fit the recipient site. The graft should be rehydrated and placed with the basement membrane side facing the oral cavity. Graft should be secured to adjacent attached gingiva with lateral bio-absorbable sutures. The area should be firmly compressed with moist gauze for 5 min to adapt the tissue to surgical site.

Future Advances

Now- a-days newer non-invasive methods i.e. formulations are gaining their place which may decrease melanin pigmentation and lightens color of skin as well as oral epithelium.

1. Kojic acid,
2. Placenta extract,
3. Vitamin C derivatives.

Their intraoral formulations are still under research.

More recently, Shimada Y et al showed that Ascorbic acid can significantly inhibit tyrosinase activity and melanin formation & has potential for the treatment of gingival melanin pigmentation.^[17]

CLINICAL REPIGMENTATION

Oral repigmentation refers to the clinical reappearance of

melanin pigment following a period of clinical depigmentation of the oral mucosa as the result of chemical, thermal, surgical, pharmacologic or idiopathic factors.

If pigmented gingiva is surgically resected, it will often heal with little or no pigmentation. Recurrence has been documented to occur, following the surgical procedure, within 24 days to 8 years long period. The exact mechanism of repigmentation is unclear but the "migration theory" seems to be favored.

Different studies shows variation in the timing for early repigmentation. To return to the full clinical baseline repigmentation it takes about 1.5 to 3 years.^[17] This variation may be due to the different techniques performed or due to the patient's race. Thus, gingival depigmentation procedure, if performed primarily for cosmetic reason, will not be of permanent value, because pigmentation tends to return to baseline values.^[17]

CONCLUSION

The growing esthetic concern requires the removal of unsightly pigmented gingival areas to create a confident smile, which altogether may alter the personality of an individual. Various de-pigmentation procedures available to a clinician offer versatility and dependability. Research should now focus on finding a solution for preventing the recurrence and till then repeated de-pigmentation should be done to eliminate the unsightly pigmented gingiva.

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