

DIFFERENT SURGICAL TECHNIQUES FOR GINGIVAL DEPIGMENTATION AND THEIR OUTCOMES. A LITERATURE REVIEW

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Abstract

The aim of this review is to evaluate the outcome, post-operative pain and recurrence rate of different techniques used for gingival depigmentation, including scalpel surgery, rotary abrasion, gingival graft, laser, cryosurgery and electrosurgery. Dentistry is greatly involved in facial aesthetics and appearance. Gingival pigmentation has a great impact on patients' smile and self-confidence. Different depigmentation techniques have been proposed in order to eliminate gingival hyperpigmentation and improve gingival color. Many reports have discussed and compared the efficacy of each technique. An electronic search was carried out in the following databases: pubmed, midline, web of science, science direct. Animal studies, patients with systemic treatment of gingival pigmentation, disease patients who consumed melanin-related drugs were excluded from the review. Diode laser has shown to have a good aesthetics and a low recurrence rate. However, further studies with longer follow-up duration are required to improve the understanding of repigmentation.

Keywords: *gingival depigmentation, surgery techniques, repigmentation.*

1. INTRODUCTION

Gingival tissue constitutes a major part of facial appearance and aesthetics and gingival color can affect patient's smile, thus having a psychological impact, especially in patients with high smile line. The color of the gingiva is mainly dependent on the depth of epithelialization, degree of keratinization, vascularity and pigments within the epithelium [1]. The most common natural pigment that contributes to endogenous gingival pigmentation is melanin, which is synthesized from melanocyte. Gingival hyperpigmentation, defined as an increased intensity of gingival color through excessive melanin deposition [2], has a multifaceted etiology, including genetic factors, such as physiologic or racial pigmentations, being mostly observed in dark-skin populations [3,4]. It might be attributed to a systemic condition or

disease, like: endocrine disturbance, Albright's syndrome, malignant melanoma, Peutz-jeghers syndrome chronic pulmonary disease and Addison's syndrome, or to a medication induced as antimalarial therapy [5-7]. Furthermore, environmental factors can lead to gingival hyperpigmentation caused by tobacco smoking, as gingival hyperpigmentation was higher in smokers than non-smokers [8]. Melanin, a brown pigment, is the most common natural pigment contributing to endogenous pigmentation of the gingiva.

Gingival depigmentation is the procedure used for the removal of hyperpigmented gingival tissue to improve the aesthetics. Different surgical techniques are used for the management of gingival hyperpigmentation, including the scalpel technique [9-14], the rotary abrasive technique [9,13,15], cryosurgery [11,15], electrosurgery [16-19], gingival graft [20-22], acellular dermal matrix allograft [19,20,23] and laser surgery [12-14,16,24]. The studies available in literature are mostly case reports and case series which compare the different techniques and their rate of re-pigmentation. The aim of this review is to compare the outcome, post-operative pain and recurrence rate of different surgical techniques used for gingival depigmentation, including scalpel surgery, rotary abrasion, cryosurgery, electrosurgery, tissue graft and laser surgery.

2. MATERIALS AND METHODS

An electronic search was carried out in the following databases: Saudi digital library, pubmed, midline, web of science, science direct. The keywords used in the search included "gingiva", "melanin", "pigmentation", "hyperpigmentation", "depigmentation", "techniques" and "repigmentation".

Inclusion Criteria

1. The case report, case series and clinical studies considered the following criteria:
2. A definite follow-up time
3. Obvious results of depigmentation
4. Number of subjects who experienced repigmentation.

Exclusion Criteria

1. Animal studies
2. Patients with systemic TREATMENT OF GINGIVAL PIGMENTATION disease
3. Patients who consumed melanin-related drugs.

3. SCALPEL SURGICAL TECHNIQUE

The scalpel surgical technique, involving the surgical removal of pigmented gingival epithelium, alongwith the underlying connective tissue, is one the most widely used methods for the treatment of gingival pigmentation [25]. The advantages of this technique were discussed in several studies. Kathariya *et al.* reported that the scalpel deepithelization technique was easy and technically friendly, giving excellent results and patient satisfaction, compared with bur abrasion and electrosurgery techniques [19]. Also, they stated that the scalpel technique still serves as a gold standard for gingival depigmentation. Moreover, Khalid *et al.* reported that using scalpel surgical technique results in a good patient satisfaction, excellent treatment results and absence of postsurgical complications, such as infection or scar [26]. Furthermore, Kanakamedala *et al.* mentioned no postsurgical pain for any of the participants, no bleeding, infection or scar, acceptable healing, good patients' satisfaction, and excellent treatment outcomes [27].

Humangain *et al.* also found out no postsurgical difficulties or complications, observing a pink healthy gingiva with a normal consistency and patients' satisfaction using scalpel surgical technique [28]. Another study conducted by Saeed R *et al.* found that the patients who have undergone scalpel technique reported no symptoms during or after the operation and were absolutely satisfied [29]. However, Ribeiro *et*

al. concluded that the use of the scalpel technique presented disadvantages in terms of more discomfort and pain during the post therapy period and longer procedure time, compared to Nd:YAG laser [30].

4. CRYOSURGERY

Cryosurgery is considered one of the most widely accepted methods of gingival depigmentation, that involves destroy tissue by its freezing using cryogens [15,31]. The effect of cryogen on gingival tissue causes cryonecrosis of the epithelium, which helps eliminate gingival pigmentation [32]. The advantages of cryosurgery are that there is no need of local anesthesia, being also associated with less postoperative pain and bleeding [10]. The study conducted by Singh *et al.*, comparing the efficacy of TFE and diode laser, showed that the cryosurgical approach by TFE was less painful, caused less discomfort and hence was more acceptable, compared to laser [33]. Moreover, Kumar *et al.* reported that TFE can be used safely and efficiently for depigmentation procedures [32]. They also found out that TFE can destroy gingival epithelium effectively, without causing any damage to the underlying connective tissue. Another study carried out by Kumar *et al.*, comparing TFE and gingival abrasion [15], concluded that the use of cryogen tetrafluoroethane is easy, practical and inexpensive, as compared to gingival abrasion, due to its high rate of recurrence. Therefore, it is more acceptable for both patients and operator.

5. GINGIVAL ABRASION TECHNIQUE

Gingival abrasion is a treatment method involving denuding of the pigmented gingival epithelium by superficial abrasion using grit football-shaped or doughnut-shaped coarse diamond burs in a low-speed handpiece [15,34]. It is a simple, safe and non-aggressive method that can be easily performed and readily repeated, if necessary, to eradicate any residual repigmentation [35]. However, extra care should be taken to control the speed and pressure of the handpiece bur, for not causing unwanted abrasion or pitting of the tissue [35]. It is associated with

various drawbacks, such as increased treatment duration, technique sensitivity, post-treatment pain, placement of periodontal dressing, and high recurrence rate [15,34].

6. LASER

Recently, laser devices have been used increasingly in periodontal therapy. The most commonly used types of lasers in gingival depigmentation are carbon dioxide (CO₂, 10,600 nm) lasers, neodymium: yttrium, aluminum and garnet (Nd: YAG, 1,064 nm) and diode (980 nm) lasers, erbium-doped Er:YAG laser (2,940-nm). Laser is well known for its advantages of enhanced hemostasis, good visibility at the surgical site, reduced pain, discomfort and impaired wound healing and infection postoperatively.^{24,14} It is distinguished for its ease of access to interdental papilla and better aesthetic results. However, lasers can be technique-sensitive, requiring more sophisticated equipments, expensive and special training, unlike the conventional method [13,36]. A wavelength specific and well-absorbed by a certain chromophore, with which the laser light must be compatible, was stated. The diode laser has been found as the most effective type of lasers, due to its optimal wavelength well-absorbed by melanin pigments. Inappropriate use of laser may cause tissue damage, leading to gingival recession or damage of the underlying bone [34,37].

7. FREE GINGIVAL GRAFTING (FGG)

This technique involves taking of an unpigmented free gingival graft from the palate of the patient and placing it over the prepared recipient site [22]. It does not eliminate the hyperpigmented tissue, it only masks the pigmented area. It was successfully performed by Tamizi *et al.*, no evidence of repigmentation being observed after 4.5 years. However, it has its own limitations which make it unfavorable and less used, like having two surgical sites, post-operative discomfort due to pain, technique sensitivity, and ghost-like appearance of the treated site due to hypopigmentation [22,34].

8. ACELLULAR DERMAL MATRIX ALLOGRAFT (ADMA)

The free gingival graft has been substituted with acellular dermal matrix allograft. It is non-immunogenic and scarring is limited, because healing occurs by repopulation and revascularization rather than by granulation [20,38]. Pontes *et al.* and Novaes *et al.* reported the effectiveness of using ADMA for the elimination of gingival hyperpigmentation [20,23]. It is superior to FGG, since it has the advantage of eliminating a second surgical site, decreased post-operative complications, giving access to an unlimited amount of graft material and a predictable and satisfactory aesthetic result. However, ADMA is an expensive technique and requires high clinical expertise [19,23].

9. ELECTROSURGERY

Electrosurgery is a surgical technique using a high-frequency electrical energy to disintegrate the molecules of the melanin cells. This technique is sophisticated and necessitates more expertise, characterized by its reduced bleeding and scar tissue formation [39]. However, it was associated with significant post-operative pain and discomfort [17,19]. A pronounced limitation of the electrosurgery technique is that its prolonged or repeated application may induce heat accumulation and undesired tissue destruction [16].

10. GINGIVAL REPIGMENTATION

A major concern in the treatment of gingival hyperpigmentation is the recurrence of pigmentation or repigmentation. The exact mechanism of re-pigmentation is not fully understood and the behavior and reaction of melanocyte after the intervention is not clear yet. However, according to the migration theory, the melanocytes from the adjacent sites migrate to the depigmented sites, leading to repigmentations [40,41]. Also, it is assumed that some melanocyte might be left during surgery, later on becoming activated, thus leading to the recurrence of pigmentation [42]. Repigmentation

was mostly seen on the interdental papilla and, in some cases, on small areas in the attached gingiva or mucogingival junction, as light brown, very small spots, dots, or streaks [43,44]. Recurrence is dependent on the technique used and follow-up period, most of the studies reporting no recurrence within 6 months with different techniques. In addition, smoking is a major factor, as it was observed that smokers had a higher recurrence rate at 6 month follow-up [45,46]. In the available literature, the lowest recurrence rate was reported with laser therapy, specifically the diode laser showing the least recurrence among the laser group [37].

11. CONCLUSIONS

In order to ensure a complete success of gingival depigmentation, its potential causative or aggravating agent should be identified and eliminated, to reduce the chance of recurrence. Various depigmentation techniques are widely available, with their won advantages and disadvantages. Although a technique with low recurrence rate is preferred, like diode laser, selection of the appropriate techniques is dependent on individual preference, clinical expertise and patient affordability. Moreover, further studies with longer follow-up duration are required to improve the understanding of repigmentation.

References

- Kaur H, Jain S, Sharma RL. Duration of reappearance of gingival melanin pigmentation after surgical removal – A clinical study. *J Indian Soc Periodontol.* 2010;14(2): 101-5.
- El-Shenawy H, Fahd A, Ellabban M, Dahaba M, Khalifa M. Lasers for esthetic removal of gingival hyperpigmentation: A systematic review of randomized clinical trials. *Int J Adv Res.* 2017;5(3):1238-48.
- Dummet CO. Clinical observations on pigment variations in healthy oral tissues of the Negro. *J Dent Res.* 1945;24(1):7-13.
- Dummet CO, Barends G. Oromucosal pigmentation: An updated literary review. *J Periodontol.* 1971;42(11):726-36.
- Regezi JA, Sciubba J. *Oral Pathology, Clinical Pathologic Correlations.* Philadelphia: W. B. Saunders Co;1993.
- Savage NW, Barber MT, Adkins KF. Pigmentary changes in rat mucosa following anti-malarial therapy. *J Oral Pathol.* 1986;15(9):468-71.
- Shafer WG, Hine MK, Levy BM. *A Textbook of Oral Pathology.* Philadelphia: W.B. Saunders Co; 1984.
- AlShoubaki RE, AlZahrani AS. Outcomes of Gingival Depigmentation Among Smokers and Non-Smokers: A Comparative Study. *Int J Pharm Res. Allied Sci.* 2018;(1):148-55.
- Bhanu MM, Kaur J, Das R. Treatment of gingival hyperpigmentation with rotary abrasive, scalpel, and laser techniques: A case series. *J Indian Soc Periodontol.* 2012;16(4):614-9.
- Narayankar SD, Deshpande NC, Dave DH, Thakkar DJ. Comparative evaluation of gingival depigmentation by tetrafluoroethane cryosurgery and surgical scalpel technique. A randomized clinical study. *Contemp Clin Dent.* 2017;8(1):90-5.
- Patil KP, Joshi V, Waghmode V, Kanakdande V. Gingival depigmentation: A split mouth comparative study between scalpel and cryosurgery. *Contemp Clin Dent.* 2015;6(1):97-101.
- Giannelli M, Formigli L, Bani D. Comparative evaluation of photoablative efficacy of erbium: yttrium-aluminium-garnet and diode laser for the treatment of gingival hyperpigmentation. A randomized split-mouth clinical trial. *J Periodontol.* 2014;85(4): 554-61.
- Lee K-M, Lee D-Y, Shin S-I, Kwon Y-H, Chung J-H, Herr Y. A comparison of different gingival depigmentation techniques: ablation by erbium: yttrium-aluminum-garnet laser and abrasion by rotary instruments. *J Periodontal Implant Sci.* 2011; 41(4):201.
- Nagati RR, Ragul M, Al-Qahtani N, Ravi KS, Tikare S, Pasupuleti MK. Clinical effectiveness of gingival depigmentation using conventional surgical scrapping and diode laser technique: A quasi experimental study. *Global J Health Sci.* 2017;(9):296-303.
- Kumar S, Bhat GS, Bhat KM. Comparative evaluation of gingival depigmentation using tetrafluoroethane cryosurgery and gingival abrasion technique: Two years follow up. *J Clin Diag Res.* 2013;7(2):389-94.
- Chandna S, Kedige SD. Evaluation of pain on use of electrosurgery and diode lasers in the management of gingival hyperpigmentation: A comparative study. *J Indian Soc Periodontol.* 2015;19(1):49-55.
- Patel KA, Patil SS, Agrawal C, Patel AP, Kalaria J. Gingival depigmentation: Case series. *Int J Appl Dent Scien.* 2015;(1):37-9.
- Gupta G, Kumar A, Khatri M, Puri K, Jain D, Bansal M. Comparison of two different depigmentation techniques for treatment of hyperpigmented gingiva. *J Indian Soc Periodontol.* 2014;18(6):705-9.
- Kathariya R, Pradeep A. Splitmouth de-epithelization techniques for gingival depigmentation: A case

- series and review of literature. *J Indian Soc Periodontol.* 2011;15(2):161-8.
20. Pontes AEF, Pontes CC, Souza SL, Novaes AB, Grisi FM, Taba M. Evaluation of the efficacy of the acellular dermal matrix allograft with partial thickness flap in the elimination of gingival melanin pigmentation. A comparative clinical study with 12 months of follow-up. *J Esthet Restor Dent.* 2016;(3):135-43.
 21. Malhotra S, Sharma N, Basavaraj P. Gingival esthetics by depigmentation. *J Periodontal Med Clin Pract.* 2014;1(1):79-84.
 22. Tamizi M, Taheri M. Treatment of severe physiologic gingival pigmentation with free gingival autograft. *Quintessence Int.* 1996;27(8):555-8.
 23. Novaes AB Jr, Pontes CC, Souza SL. The use of a cellular dermal matrix allograft for the elimination of gingival melanin pigmentation: case presentation with 2 years of follow-up. *Pract Proced Aesthet Dent.* 2002;14(8):619-23.
 24. Soliman MM, Al Thomali Y, Al Shammrani A, El Gazeera H. The use of soft tissue diode laser in the treatment of oral hyper pigmentation. *Int J Health Sci (Qassim).* 2014; 8(2): 133-40.
 25. Prasad S, Agrawal N, Reddy N. Gingival depigmentation: a case report. *People's Journal of Scientific Research.* 2010;3(1):27-9.
 26. Almas K, Sadig W. Surgical treatment of melanin-pigmented gingiva; an esthetic approach. *Indian J Dent Res.* 2002;13(2):70-3.
 27. Kanakamedala AK, Geetha A, Ramakrishnan T, Emadi P. Management of Gingival Hyperpigmentation by the Surgical Scalpel Technique - Report of Three Cases. *J Clin and Diag Res.* 2010;4(2):2341-46.
 28. Humagain M, Nayak DG, Uppoor AS. Gingival depigmentation: A case report with review of literature. *J Nepal Dental Association.* 2009;(10):53-6.
 29. Rahmati S, Darijani M, Nourelahi M. Comparison of surgical blade and cryosurgery with liquid nitrogen techniques in treatment of physiologic gingival pigmentation: short term results. *J Dent (Shiraz).* 2014;15(4):161-6.
 30. Ribeiro FV, Cavaller CP, Casarin RCV, Casati MZ, Cirano FR, Dutra-Corrêa M, Pimentel SP. Esthetic treatment of gingival hyperpigmentation with Nd:YAG laser or scalpel technique: a 6-month RCT of patient and professional assessment. *Lasers Med Sci.* 2014;29(2):537-44.
 31. Ho DK, Ghinea R, Herrera LJ, Angelov N, Paravina RD. Color range and color distribution of healthy human gingiva: A Prospective clinical study. *Sci Rep.* 2015;5:18498. doi: 10.1038/srep18498.
 32. Kumar S, Bhat GS, Bhat KM. Effectiveness of cryogen tetrfluoroethane on elimination of gingival epithelium and its clinical application in gingival depigmentation histological findings and case series. *J Clin Diagn Res.* 2013;7(12):3070-2.
 33. Singh V, Bhat SG, Kumar S, Bhat M. Comparative evaluation of gingival depigmentation by diode laser and cryosurgery using tetrafluoroethane: 18 month followup. *Clinic Adv Periodontics.* 2012;2(3):12934.
 34. Agha MT, Polenik P. Laser Treatment for Melanin Gingival Pigmentations: A Comparison Study for 3 Laser Wavelengths 2780, 940, and 445 nm. *Int J Dent.* 2020; 2020: 3896386. doi: 10.1155/2020/3896386.
 35. Putter OH, Ouellet D, Putter A, Vilaboa D, Vilaboa B, Fernandez M. A non-traumatic technique for removing melanotic pigmentation lesions from the gingiva: Gingiabrasion. *Dent Today.* 1994;13(10):58-60.
 36. Khalilian F, Nateghi Z, Janbakhsh N. Gingival depigmentation using lasers: A literature review. *Br J Med Med Res.* 2016;12(12):1-7.
 37. Lin YH, Tu YK, Lu CT, Chung WC, Huang CF, Huang MS, Lu HK. Systematic review of treatment modalities for gingival depigmentation: A random-effects poisson regression analysis. *J Esthet Restor Dent.* 2014;26(3):162-78.
 38. Tal H. Subgingival acellular dermal matrix allograft for the treatment of gingival recession: a case report. *J Periodontol.* 1999;70(9):1118-24.
 39. Urmi D, Jasuma RJ, Deepak D, Vandana R. Comparison of patient perception on gingival depigmentation using scalpel and diode laser. *IOSR-JDMS.* 2013;11(4):33-8.
 40. Perlmutter S, Tal H. Repigmentation of the gingiva following surgical injury. *J Periodontol.* 1986;57(1):48-50.
 41. Farnoosh AA. Treatment of gingival pigmentation and discoloration for esthetic purposes. *Int J Periodontics Restorative Dent.* 1990;10(4):312-9.
 42. Ginwalla TM, Gomes BC, Varma BR. Surgical removal of gingival pigmentation. *J Indian Dent Assoc.* 1966;38(6):147-50.
 43. Mahajan G, Kaur H, Jain S, Kaur N, Sehgal N, Gautam A. To compare the gingival melanin repigmentation after diode laser application and surgical removal. *J Indian Soc Periodontol.* 2017;21(2):112-8.
 44. Gholami L, Moghaddam SA, Ladiz M, Molai ZM, Hashemzahi H, Fallah A, Gutknecht N. Comparison of gingival depigmentation with Er,Cr:YSGG laser and surgical stripping, a 12-month follow-up. *Lasers Med Sci.* 2018;33(8):1647-56.
 45. Esen E, Haytac MC, Oz IA, Erdogan O, Karsli ED. Gingival melanin pigmentation and its treatment with the CO2 laser. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2004; 98(5):522-7.
 46. AlShoubaki RE, AlZahrani A. Outcomes of Gingival Depigmentation Among Smokers and Non-Smokers: A Comparative Study. *Int J Pharm Res Allied Sci.* 2018;7(1):148-155.