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Comparative Evaluation of Gingival Depigmentation using Scalpel, Diode Laser, Vitamin C, and Bur Abrasion Techniques

Pooja Yadav, Bipin Kumar Yadav, Rajesh Kumar Thakur, Prerna Kataria, Pavneet Kaur Soni

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ABSTRACT

Background: Gingival hyperpigmentation is a common physiological condition caused by excessive melanin deposition within the basal and suprabasal layers of the gingival epithelium.[1,2] Although benign, excessive pigmentation often presents an esthetic concern, particularly in patients with a high smile line.[2] Various surgical and non-surgical techniques have been introduced to eliminate gingival pigmentation, each possessing distinct advantages and limitations.[3,4]

Aim: To compare the clinical outcomes of four gingival depigmentation techniques using scalpel, diode laser, vitamin C injection, and bur abrasion.

Materials: Patients presenting with moderate to severe gingival pigmentation (Dummett Oral Pigmentation Index ≥3)[2] underwent gingival depigmentation using one of the four treatment modalities. Clinical evaluation included postoperative pain using the Visual Analog Scale (VAS).[7] wound healing using the Modified Healing Index described by Landry et al.[6] and assessment of gingival pigmentation using the Dummett Oral Pigmentation Index.

Results: The scalpel technique demonstrated rapid healing, excellent esthetic outcome, and remained the most economical approach, although intraoperative bleeding was comparatively greater. The diode laser provided a relatively bloodless surgical field with minimal postoperative discomfort but was associated with a burning odor during treatment and slower healing. Bur abrasion achieved satisfactory depigmentation but required meticulous technique because of the risk of thermal injury. Vitamin C injection produced the least satisfactory depigmentation among the evaluated techniques.

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INTRODUCTION

Gingival pigmentation results primarily from melanin produced by melanocytes located in the basal layer of the gingival epithelium.[1,2] Physiologic melanin pigmentation varies considerably among individuals depending upon genetic predisposition, ethnicity, age, and environmental influences.[1] Although, physiologic pigmentation is not considered a pathological condition, excessive pigmentation frequently compromises smile esthetics and may negatively affect patient confidence and quality of life.[2]

Department of Periodontology, Faculty of Dental Sciences, Uttar Pradesh University of Medical Sciences (UPUMS), Saifai, Etawah, Uttar Pradesh, India

***Correspondence:** *Pooja Yadav (poojayadav91695@gmail.com)*

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Figure 1: Depigmentation By scalpel Method.



Figure 2: Excised epithelial tissue containing some part of connective tissue.



Figure 3: Gingival depigmentation using laser method.

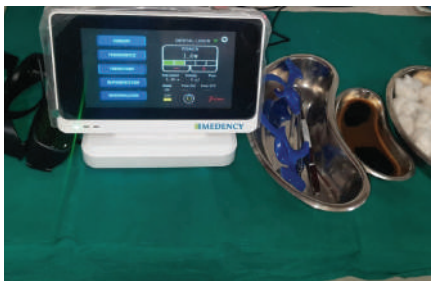

Figure 4: Laser used for depigmentation procedure.



Figure 5: Vitamin C used for depigmentation.



Figure 6: Injection of Vitamin C into gingiva.



Figure 7: Bur used for gingival depigmentation.



Figure 8: Periodontal dressing placed after depigmentation Procedure.



Figure 9: Result of depigmentation using scalpel.



Figure 10: Result of depigmentation using laser.



Figure 11: Result of depigmentation using Vitamin C.



Figure 12: Result of depigmentation using Bur.

Demand for cosmetic periodontal procedures has increased substantially over recent years.[3,4] Gingival depigmentation aims to eliminate or reduce melanin pigmentation by removing the pigmented epithelial layer or suppressing melanocyte activity.[3] Numerous techniques have been described, including scalpel surgery, bur abrasion, electrosurgery, cryosurgery, laser therapy, radiosurgery, and chemical agents.[5] Recently, injectable vitamin C has emerged as a minimally invasive appr oach because of its ability to inhibit tyrosinase activity and decrease melanin synthesis.[10]

Despite the availability of several treatment options, no single technique is universally accepted as the gold standard because each exhibits unique advantages and disadvantages regarding patient comfort, operative time, healing, recurrence, cost, and equipment requirements.[8,9] Therefore, comparative clinical evaluation remains important to guide clinicians in selecting the most appropriate treatment modality.

The present case series compares four commonly employed gingival depigmentation techniques—scalpel surgery, diode laser, vitamin C injection, and bur abrasion—to assess their clinical performance and postoperative outcomes.

MATERIALS AND METHODS

Patients presenting with generalized moderate to severe gingival pigmentation (Dummett Oral Pigmentation Index score ≥3)[2] seeking esthetic correction were included in this case series. The clinical parameters used for evaluation included:

- Visual Analog Scale (VAS) for postoperative pain.[7]
- Modified Healing Index by Landry *et al.*[6]
- Dummett Oral Pigmentation Index (DOPI)

Scalpel Technique

Following infiltration anesthesia using 2% lidocaine with adrenaline, the pigmented gingival epithelium was excised using a no. 15 surgical blade with partial-thickness incisions parallel to the long axis of the teeth.[5,8] The surgical area was irrigated with sterile saline, bleeding was controlled using pressure packs, and a periodontal dressing was placed.

Diode Laser Technique

Following topical anesthesia, depigmentation was performed using an 810-nm diode laser operating in pulsed mode.[3,4] The laser tip was moved in light brushing strokes over the pigmented tissue to minimize thermal damage. The area was irrigated with saline and protected with a periodontal dressing.

Bur Abrasion Technique

After local anesthesia, a high-speed diamond bur with copious irrigation was gently moved over the pigmented gingival surface using feather-light strokes.[9] Care was taken to avoid prolonged contact at a single site to minimize thermal injury.

Vitamin C Injection Technique

Vitamin C (200–300 mg) was injected into the epithelial-connective tissue interface using a 30-gauge insulin syringe once weekly for four weeks.[10] Patients were recalled periodically to assess pain, healing, and pigmentation reduction.

RESULTS

All four techniques successfully reduced gingival pigmentation to varying degrees. The scalpel technique produced excellent clinical results with rapid epithelial healing and favorable esthetic appearance. Although intraoperative bleeding was greater than with other techniques, healing occurred uneventfully and postoperative discomfort remained minimal.

The diode laser technique offered excellent hemostasis and superior surgical visibility because of its coagulative properties. Patients appreciated the absence of bleeding; however, several experienced discomfort related to the characteristic burning odor during laser application. Bur abrasion effectively removed superficial pigmentation and produced acceptable esthetic improvement.[9] However, excessive pressure or inadequate irrigation could induce thermal injury.

Vitamin C injection represented the least invasive approach but demonstrated comparatively limited depigmentation, requiring multiple treatment sessions.[10] Overall, the scalpel technique demonstrated the most favorable balance between clinical effectiveness, healing, treatment cost, and patient satisfaction.[8,9]

DISCUSSION

Management of gingival hyperpigmentation has evolved considerably because of increasing esthetic demands.[3,11] Scalpel surgery remains the most widely accepted depigmentation technique because of its simplicity, affordability, and predictable clinical outcomes.[5,8] Although, bleeding during surgery is inevitable, healing generally occurs rapidly through secondary intention.[5]

Laser-assisted depigmentation has become increasingly popular because lasers provide excellent hemostasis, sterilization, reduced postoperative discomfort, and minimal tissue trauma.[4,11] However, laser systems require considerable investment and operator training. Bur abrasion offers an economical alternative and produces satisfactory results when performed carefully.[9] Nevertheless, inadequate technique may result in thermal damage and delayed healing.

Vitamin C inhibits tyrosinase activity, thereby reducing melanin production. Despite its minimally invasive nature, current evidence indicates that injectable vitamin C is less effective than conventional surgical techniques, especially in severe pigmentation.[10]

The findings of this case series agree with previous studies demonstrating superior overall clinical outcomes with the scalpel technique, while acknowledging the advantages of diode laser in minimizing bleeding and improving patient comfort.[8,9,12] Long-term randomized clinical trials with larger sample sizes are recommended to determine recurrence rates, and establish standardized treatment guidelines.

CONCLUSION

All four treatment modalities demonstrated varying degrees of clinical success. Scalpel surgery remains the most practical and cost-effective technique because of its simplicity, rapid healing, and excellent esthetic outcomes.[5,8] Diode laser provides superior hemostasis and patient comfort but requires specialized equipment.[3,4] Bur abrasion is a useful alternative when performed carefully,[9] whereas injectable vitamin C appears less effective for moderate to severe gingival pigmentation.[10]

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