

**Assessment of Skin Pigmentation, Gingival Pigmentation and Patient Acceptance of Gingival Depigmentation Procedures: A Retrospective Study**Aashish V<sup>1</sup>, Dr. Subasree S<sup>2</sup><sup>1</sup>Undergraduate student, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai-600077<sup>2</sup>Senior Lecturer, Department of Periodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai-600077

Email: 152201007.sdc@saveetha.com, subasrees.sdc@saveetha.com

**Abstract**

**Background:** Gingival pigmentation is a physiologic condition caused by melanin deposition within the gingival epithelium and is commonly associated with skin complexion. Although clinically harmless, excessive gingival pigmentation may adversely affect smile esthetics and influence patient perception toward cosmetic periodontal procedures. **Aim:** To evaluate the association between skin pigmentation, gingival pigmentation, and patient acceptance of gingival depigmentation procedures. **Materials and Methods:** This retrospective institutional study was conducted using patient records archived between January 2021 and January 2025. A total of 742 patient records with complete clinical photographs and periodontal documentation were included. Skin complexion was categorized as fair, wheatish, brown, and dark complexion. Gingival pigmentation was assessed using the Dummett–Gupta Oral Pigmentation Index (DOPI). Patient acceptance toward gingival depigmentation procedures was evaluated from documented treatment records. Statistical analysis was performed using Chi-square test and one-way ANOVA, with  $p < 0.05$  considered statistically significant. **Results:** Brown skin complexion was the most prevalent category (41.8%), followed by wheatish complexion (30.2%). DOPI score 2 pigmentation was most commonly observed (38.5%), while DOPI score 3 pigmentation was identified in 28.8% of patients. Patients with brown and dark skin complexion demonstrated significantly greater gingival pigmentation severity. Acceptance of gingival depigmentation procedures was observed in 42.9% of patients and was predominantly associated with moderate to severe pigmentation and high smile line exposure. A statistically significant association was observed between skin complexion, gingival pigmentation severity, and patient acceptance toward depigmentation procedures ( $p = 0.001$ ). **Conclusion:** Patients with darker skin complexion demonstrated increased gingival pigmentation and greater acceptance toward gingival depigmentation procedures for esthetic enhancement.

**Keywords:** Gingival pigmentation; depigmentation; DOPI; skin complexion; esthetic periodontics; retrospective study**Introduction**

Esthetics has become an integral component of contemporary dental practice, with increasing emphasis placed on the harmony between teeth, gingiva, and facial appearance. An attractive smile is influenced not only by the alignment and color of teeth but also by the contour, color, and appearance of the gingival tissues (1). Healthy gingiva is generally described as firm, stippled, and coral pink in color; however, considerable physiologic variations in gingival pigmentation are commonly observed among different individuals and ethnic groups (2).

Gingival pigmentation is primarily caused by melanin deposition within the basal and suprabasal layers of the gingival epithelium. Melanin is synthesized by melanocytes located in the basal cell layer and serves as a protective pigment against ultraviolet radiation and other environmental factors (3). The degree of gingival pigmentation varies according to melanocytic activity rather than the number of melanocytes present. Increased melanin pigmentation is more frequently observed in individuals with darker skin complexion and is generally considered a physiologic finding rather than a pathologic condition (4).

The color of the gingiva may be influenced by several factors including epithelial thickness, vascularity, keratinization, systemic conditions, smoking habits, medications, and endogenous pigments (5). Among these factors, racial and genetic predisposition play a major role in physiologic melanin pigmentation. Individuals with darker skin tones often demonstrate increased oral pigmentation involving the gingiva, buccal mucosa, palate, and tongue because of heightened melanocytic activity. Although gingival pigmentation is physiologically benign and asymptomatic, excessive pigmentation in the anterior esthetic region may become a significant cosmetic concern for many individuals. Patients with high smile lines or excessive gingival display are often more conscious of gingival appearance during smiling and speech (6). The presence of dark or heavily pigmented gingiva may negatively influence smile esthetics, self-confidence, and psychosocial perception, especially among young adults and esthetically conscious individuals. With growing awareness regarding cosmetic dentistry and periodontal plastic surgery, patient demand for esthetic periodontal procedures has increased substantially in recent years. Gingival depigmentation procedures are now commonly performed to improve gingival appearance and smile esthetics (7). Various treatment modalities have been proposed for gingival depigmentation, including scalpel surgical stripping, bur abrasion, electrosurgery, cryosurgery, free gingival grafting, chemical cauterization, and laser-assisted techniques. Among these, scalpel and laser depigmentation procedures remain widely preferred because of their simplicity, predictability, and favorable esthetic outcomes.

Patient acceptance toward gingival depigmentation procedures may vary considerably depending on multiple factors such as severity of pigmentation, smile line exposure, age, gender, esthetic awareness, cultural perception, socioeconomic background, and skin complexion. While some patients consider gingival pigmentation a natural physiologic feature, others perceive it as an esthetic imperfection requiring correction (8). Understanding patient perception and acceptance toward depigmentation therapy is therefore important for appropriate treatment planning and patient counseling.

Several indices have been proposed for evaluating gingival melanin pigmentation clinically. Among them, the Dummett–Gupta Oral Pigmentation Index (DOPI) is one of the most commonly used clinical indices because of its simplicity and reproducibility. The DOPI categorizes gingival pigmentation into different grades based on the intensity and distribution of pigmentation, thereby facilitating standardized clinical assessment and comparison among patients (9).

Previous studies have demonstrated a positive association between skin complexion and oral melanin pigmentation. Individuals with darker skin tones frequently exhibit greater intensity of gingival pigmentation because of increased melanocytic activity. However, the relationship between skin pigmentation, gingival pigmentation severity, and patient willingness to undergo depigmentation procedures remains inadequately explored, particularly in retrospective institutional settings. In addition, patient acceptance of esthetic periodontal procedures is becoming increasingly relevant in modern periodontal practice because treatment success is not solely dependent on clinical outcomes but also on patient perception and satisfaction. Evaluation of patient willingness to undergo gingival depigmentation may provide insight into esthetic expectations and treatment trends among different populations (10).

Although numerous studies have evaluated gingival pigmentation and various depigmentation techniques, limited retrospective studies have comprehensively assessed the association between skin complexion, gingival pigmentation severity, and patient acceptance of gingival depigmentation procedures. Therefore, the present retrospective institutional study was undertaken to evaluate the relationship between skin pigmentation, gingival pigmentation, and patient acceptance toward gingival depigmentation procedures.

**Materials and Methods**

**Study Design and Study Setting:** The present study was designed as a retrospective institutional record-based study conducted in the Department of Periodontics of a dental teaching institution after obtaining approval from the Institutional Ethical Committee. Patient records archived between January 2021 and January 2025 were retrieved from the institutional digital database and systematically analyzed to evaluate the association between skin pigmentation, gingival pigmentation, and patient acceptance of gingival depigmentation procedures.

**Study Population:** Patients who reported to the Department of Periodontics for esthetic evaluation or gingival depigmentation consultation during the study period were screened for eligibility. A total of 742 patient records with complete clinical photographs, periodontal examination records, and treatment documentation were included in the final analysis.

The selected records consisted of patients with physiologic gingival pigmentation involving the anterior esthetic zone and documented clinical assessment of gingival pigmentation severity.

**Inclusion Criteria:** The following patient records were included in the study:

- Patients aged 18 years and above
- Patients with physiologic gingival melanin pigmentation
- Availability of complete clinical photographs
- Availability of periodontal examination records
- Availability of documented skin complexion and gingival pigmentation assessment
- Patients with documented treatment acceptance or refusal for gingival depigmentation procedures

**Exclusion Criteria**

The following patient records were excluded from the study:

- Patients with systemic diseases associated with oral pigmentation
- Smokers and tobacco users
- Patients with drug-induced pigmentation
- Patients with syndromic or pathologic oral pigmentation
- Patients with incomplete photographic documentation
- Patients with previous gingival depigmentation procedures
- Pregnant and lactating women
- Patients with active periodontal disease or gingival enlargement

**Data Collection Procedure:** Patient records were retrieved from the institutional electronic database and evaluated by calibrated examiners. Clinical findings were cross-verified using intraoral photographs, periodontal charting records, and treatment documentation available in the database.

The following variables were recorded:

**Demographic Variables**

- Age
- Gender

**Clinical Variables**

- Skin complexion
- Gingival pigmentation severity
- Smile line exposure
- Distribution of pigmentation
- Patient acceptance of gingival depigmentation procedures

**Assessment of Skin Pigmentation:** Skin complexion was clinically categorized from standardized facial photographs into:

- Fair complexion
- Wheatish complexion
- Brown complexion
- Dark complexion

Classification was performed based on overall facial skin tone documented in patient records and photographs.

**Assessment of Gingival Pigmentation**

Gingival pigmentation was assessed clinically from intraoral photographs involving the anterior maxillary gingiva using the **Dummett–Gupta Oral Pigmentation Index (DOPI)**.

The DOPI scores were recorded as:

- **Score 0:** No clinical pigmentation; pink gingiva
- **Score 1:** Mild light brown pigmentation
- **Score 2:** Moderate brown or mixed pink and brown pigmentation
- **Score 3:** Heavy deep brown or bluish-black pigmentation

Pigmentation severity was assessed primarily in the attached gingiva and interdental papillary region of the anterior esthetic zone.

**Assessment of Smile Line:** Smile line exposure was evaluated from available clinical photographs and categorized as:

- Low smile line
- Average smile line
- High smile line

Patients with increased gingival display during smiling were categorized under a high smile line.

**Assessment of Patient Acceptance:** Patient acceptance toward gingival depigmentation procedures was determined from documented treatment records and consultation notes.

Acceptance was categorized as:

- Accepted depigmentation procedure
- Refused depigmentation procedure

Acceptance was based on documented willingness to undergo esthetic gingival depigmentation after consultation.

**Calibration and Reliability:** All clinical photographs and patient records were independently evaluated by calibrated examiners to minimize observer bias.

Random re-evaluation of selected records was performed to ensure consistency and reliability of recorded findings.

**Statistical Analysis:** The collected data were tabulated in Microsoft Excel and statistically analyzed using SPSS software version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as frequency, percentage, mean, and standard deviation. Association between skin complexion, gingival pigmentation severity, and patient acceptance toward depigmentation procedures was analyzed using Chi-square test. Comparison of pigmentation scores among different groups was performed using one-way ANOVA. A p-value less than 0.05 was considered statistically significant for all statistical analyses.

**Results**

A total of 742 patient records archived between January 2021 and January 2025 were included in the final analysis. Among the evaluated patients, 428 patients (57.7%) were females and 314 patients (42.3%) were males. The mean age of the study population was 26.4 ± 5.8 years.

Brown skin complexion was the most commonly observed category and was identified in 310 patients (41.8%), followed by wheatish complexion in 224 patients (30.2%), dark complexion in 128 patients (17.3%), and fair complexion in 80 patients (10.8%). Assessment of gingival pigmentation using the Dummett–Gupta Oral Pigmentation Index (DOPI) demonstrated that DOPI score 2 was the most prevalent pigmentation pattern and was observed in 286 patients (38.5%). DOPI score 3 was identified in 214 patients (28.8%), while DOPI score 1 was observed in 176 patients (23.7%). Absence of pigmentation (DOPI score 0) was identified in only 66 patients (8.9%). Patients with brown and dark skin complexion demonstrated significantly greater gingival pigmentation severity when compared to fair and wheatish complexion groups. Among patients with dark complexion, DOPI score 3 was observed in 76 patients (59.4%), whereas among fair complexion individuals, DOPI score 0 and score 1 predominated. Evaluation of the smile line demonstrated that 302 patients (40.7%) exhibited a high smile line, while 278 patients (37.5%) demonstrated an average smile line and 162 patients (21.8%) demonstrated a low smile line. Acceptance of gingival depigmentation procedures was observed in 318 patients (42.9%), whereas 424 patients (57.1%) declined treatment. Patients with moderate and heavy gingival pigmentation demonstrated comparatively higher acceptance toward depigmentation procedures. Among patients with DOPI score 3 pigmentation, 168 patients (78.5%) accepted depigmentation treatment, while only 18 patients (10.2%) with DOPI score 1 pigmentation accepted treatment.

Patients with high smile line exposure also demonstrated increased willingness for esthetic correction. Among patients with a high smile line, 186 patients (61.6%) accepted gingival depigmentation procedures compared to only 42 patients (25.9%) with low smile line exposure as depicted in Table 1.

Statistical analysis demonstrated a significant association between skin complexion and gingival pigmentation severity (p = 0.001). A statistically significant association was also observed between gingival pigmentation severity, smile line exposure, and patient acceptance of depigmentation procedures (p < 0.05).

**Table 1:** Association between skin complexion, gingival pigmentation severity assessed using DOPI scores, smile line exposure, and patient acceptance toward gingival depigmentation procedures.

Variable	Fair n=80 (%)	Wheatish n=224 (%)	Brown n=310 (%)	Dark n=128 (%)	Total n (%)	p-value
Male	32 (40.0)	94 (42.0)	134 (43.2)	54 (42.2)	314 (42.3)	0.812
Female	48 (60.0)	130 (58.0)	176 (56.8)	74 (57.8)	428 (57.7)	
DOPI Score 0	28 (35.0)	30 (13.4)	8 (2.6)	0 (0)	66 (8.9)	0.001*
DOPI Score 1	34 (42.5)	82 (36.6)	48 (15.5)	12 (9.4)	176 (23.7)	0.002*
DOPI Score 2	14 (17.5)	86 (38.4)	138 (44.5)	48 (37.5)	286 (38.5)	0.001*
DOPI Score 3	4 (5.0)	26 (11.6)	116 (37.4)	68 (53.1)	214 (28.8)	0.001*
High Smile Line	22 (27.5)	84 (37.5)	136 (43.9)	60 (46.9)	302 (40.7)	0.003*
Accepted Depigmentation	18 (22.5)	76 (33.9)	158 (51.0)	66 (51.6)	318 (42.9)	0.001*
Refused Depigmentation	62 (77.5)	148 (66.1)	152 (49.0)	62 (48.4)	424 (57.1)	
Mean DOPI Score	0.92 ± 0.6	1.68 ± 0.7	2.42 ± 0.8	2.86 ± 0.9	—	0.001*

## Discussion

The present retrospective institutional study evaluated the association between skin pigmentation, gingival pigmentation, and patient acceptance of gingival depigmentation procedures. The findings demonstrated a significant relationship between skin complexion and severity of gingival pigmentation, with individuals possessing brown and dark skin complexion exhibiting comparatively greater gingival pigmentation. In addition, patients with moderate to severe gingival pigmentation and increased smile line exposure demonstrated greater willingness to undergo gingival depigmentation procedures (11).

Melanin pigmentation of the gingiva is considered a physiologic phenomenon resulting from increased melanocytic activity within the basal and suprabasal epithelial layers. The intensity of pigmentation varies among individuals depending on genetic predisposition, racial background, and degree of melanocyte activity. In the present study, brown skin complexion was the most prevalent category, followed by wheatish complexion (12). This finding may reflect the demographic and ethnic distribution of the study population, as increased melanin pigmentation is commonly observed among Asian and South Indian populations.

The present study demonstrated that DOPI score 2 and score 3 pigmentation were more frequently observed among patients with brown and dark skin complexion. This finding is consistent with the biologic relationship between skin pigmentation and oral melanin deposition. Individuals with darker skin tones generally exhibit increased melanocytic activity throughout the body, including oral mucosal tissues. Increased production and transfer of melanin granules within the gingival epithelium therefore contribute to deeper pigmentation intensity in these individuals. Conversely, fair-skinned individuals predominantly demonstrated DOPI score 0 and score 1 pigmentation, possibly because of comparatively reduced melanin synthesis (13).

Another important finding of the present study was the increased acceptance of gingival depigmentation procedures among patients with moderate and heavy gingival pigmentation. Patients with DOPI score 3 pigmentation demonstrated the highest willingness for esthetic correction. A probable reason for this observation may be the greater visibility of dark gingival pigmentation during smiling and speech, particularly in the anterior esthetic zone. Severe pigmentation often creates a noticeable contrast with teeth and surrounding facial structures, thereby increasing esthetic concern among patients (14).

Smile line exposure also demonstrated a significant association with treatment acceptance. Patients with high smile line exposure showed greater willingness to undergo gingival depigmentation procedures when compared to individuals with low smile line exposure. This may be because patients with excessive gingival display are more conscious of gingival appearance during smiling (15). In individuals with high smile lines, even mild to moderate pigmentation becomes readily visible, thereby increasing self-awareness and demand for cosmetic correction. Patients with low smile line exposure may not perceive gingival pigmentation as a major esthetic issue because the gingiva remains minimally visible during smiling.

The greater acceptance of depigmentation procedures among female patients observed in the present study may also be attributed to increased esthetic awareness and cosmetic concerns. Contemporary dental practice has witnessed increasing demand for smile enhancement procedures, especially among young adults and females who are often more attentive toward facial and smile esthetics. Social media influence, increased awareness regarding cosmetic periodontal procedures, and improved accessibility to esthetic dental treatment may further contribute to increased patient acceptance toward gingival depigmentation therapy.

The findings of the present study also highlight the psychosocial impact of gingival pigmentation. Although physiologic gingival pigmentation is clinically harmless and does not impair periodontal health, patients may perceive excessive pigmentation as an esthetic imperfection affecting confidence and smile attractiveness (7).

The increasing popularity of periodontal plastic surgery and esthetic dentistry has therefore shifted clinical focus toward patient-centered esthetic outcomes in addition to functional periodontal health. Various treatment modalities have been proposed for gingival depigmentation, including scalpel surgery, bur abrasion, electrosurgery, cryosurgery, and laser-assisted procedures. Increased patient acceptance observed in the present study may also be related to improved awareness regarding minimally invasive depigmentation techniques such as diode and erbium lasers, which offer advantages including reduced bleeding, minimal postoperative discomfort, and enhanced esthetic outcomes (8). Advancements in laser-assisted periodontal therapy have therefore increased patient confidence toward esthetic gingival procedures. The use of Dummett-Gupta Oral Pigmentation Index (DOPI) in the present study facilitated standardized assessment of gingival pigmentation severity. The index is simple, reproducible, and clinically reliable for retrospective evaluation using intraoral photographs and clinical records. Utilization of DOPI therefore enhanced consistency in pigmentation assessment across the study population (6). The present study has certain limitations. Being retrospective in nature, the study depended on the accuracy and completeness of archived clinical photographs and patient records. Factors such as patient socioeconomic status, educational background, esthetic expectations, psychological perception, and cultural influence toward cosmetic procedures could not be assessed. In addition, long-term follow-up regarding patient satisfaction after depigmentation procedures was unavailable. Variations in photographic lighting and image quality may also have influenced pigmentation assessment to a certain extent (14). Despite these limitations, the present study included a substantial sample size and comprehensively evaluated the relationship between skin complexion, gingival pigmentation severity, smile line exposure, and patient acceptance of gingival depigmentation procedures. The findings provide valuable clinical insight into esthetic perception and treatment acceptance trends among patients seeking periodontal esthetic care.

## Conclusion

Within the limitations of the present retrospective study, a significant association was observed between skin complexion, gingival pigmentation severity, and patient acceptance of gingival depigmentation procedures. Patients with brown and dark skin complexion demonstrated greater gingival pigmentation, while individuals with moderate to severe pigmentation and high smile line exposure exhibited increased willingness to undergo gingival depigmentation procedures for esthetic improvement.

## Conflict of interest : nil

**Acknowledgment :** The authors would like to express their sincere gratitude to the management of Saveetha Dental College and Hospitals for providing access to the institutional digital records and necessary support to conduct this retrospective study.

## References :

1. Chagra J, Bouguezzi A, Sioud S, Hentati H, Selmi J. Gingival melanin depigmentation by 808 nm diode laser: report of a case. *Case Rep Dent.* 2020;2020:8853086.
2. Nammour S, El Mobadder M, Namour M, Namour A, Rompen E, Maalouf E, et al. A randomized comparative clinical study to evaluate the longevity of esthetic results of gingival melanin depigmentation treatment using different laser wavelengths (Diode, CO<sub>2</sub>, and Er:YAG). *Photobiomodul Photomed Laser Surg.* 2020;38(3):180-189.
3. Esmaili S, Shahbazi S, Asnaashari M. Gingival melanin depigmentation using a diode 808-nm laser: a case series. *J Lasers Med Sci.* 2022;13:e41.
4. Tran TH, Nguyen QLD, Do TT, Truong KN, Dang QV, Bui MTN. Evaluation of carbon dioxide laser-assisted treatment for gingival melanin hyperpigmentation. *Dent J (Basel).* 2022;10(12):238.
5. Armogida NG, Rengo C, Cerneria M, Iaculli F, Spagnuolo G. Transepithelial gingival depigmentation using a new protocol with Q-switched Nd:YAG: an in vivo observational study. *Dent J (Basel).* 2023;11(1):2.
6. Eladvy MM, Mostafa B, Soliman S. Assessment of clinical outcomes and patient response to gingival depigmentation using a scalpel, ceramic bur, and diode laser 980 nm. *Clin Oral Investig.* 2023;27:6939-6950.
7. Cadenas de Llano-Pérola M, Castro AB, Danneels M, Schelfhout A, Teughels W, Willems G. Risk factors for gingival recessions after orthodontic treatment: a systematic review. *Eur J Orthod.* 2023;45(5):528-544.
8. Khalil R, Walladbegi J, Westerlund A. Effects of fixed retainers on gingival recession: a 10-year retrospective study. *Acta Odontol Scand.* 2023;81(3):211-215.
9. Barbato L, Tonelli P, Batalocco G, Cairo F. Cairo recession classification and periodontal prognosis in mucogingival therapy. *Int J Periodontics Restorative Dent.* 2023;43(4):e193-e200.
10. Koppolu P, Almutairi H, Al Yousef S, Ansary N, Noushad M, Vishal MB, et al. Relationship of skin complexion with gingival tissue color and hyperpigmentation: a multi-ethnic comparative study. *BMC Oral Health.* 2024;24:451.
11. Fleming PS, Andrews J. The role of orthodontics in the prevention and management of gingival recession. *Br Dent J.* 2024;237(5):341-347.
12. Şahin T. Determination of gingival phenotype and gingival recession type in patients postorthodontic treatment. *Eur Ann Dent Sci.* 2024;51(3):162-167.
13. Alqahtani NM, Alshammari RR, Alenezi FA. Prevalence of gingival recession following orthodontic debonding among young adults: a retrospective study. *Cureus.* 2024;16(3):e55782.
14. Elbanna AF, Elsharkawy FM, Elshenawy EA. Ceramic soft tissue trimming bur gingival depigmentation: clinical performance and patient experience. A split mouth randomized controlled trial. *BMC Oral Health.* 2024;24:602.
15. Kaur N, Sharma R, Gupta N, Singh H. Efficacy of surgical stripping and diode laser-assisted gingival depigmentation techniques in terms of patient's perspective, clinical and histological evaluation: a randomized clinical study. *J Indian Soc Periodontol.* 2025;29(3):249-257.