



# Prevalence of Gingival Pigmentation and Its Associated Factors Among Patients Visiting Tertiary Dental Hospital in Nepal

Suraksha Subedi<sup>1</sup>, Rebicca Ranjit<sup>1</sup>, Bikash Kumar Baniya<sup>2</sup>

<sup>1</sup>Department of Periodontology and Oral Implantology, Gandaki Medical College Teaching Hospital and Research Center, Pokhara, Kaski, Nepal.

<sup>2</sup>Department of Periodontology and Oral Implantology, Universal College of Medical Sciences, Bhairahawa, Nepal.

## ABSTRACT

### Background

Gingival pigmentation has gained an esthetic concern in recent years. The objective of the study was to assess the prevalence of gingival pigmentation and its associated factors among patients visiting a tertiary dental hospital.

### Methods

A cross-sectional analytical study was conducted among 370 patients visiting Department of Periodontics, Gandaki Medical College Teaching Hospital and Research Center, Pokhara, Nepal. The demographic details of the participants, assessment of gingival biotype using probe transparency technique and classification of gingival pigmentation using Dummett-Gupta Oral Pigmentation Index (DOPI). Univariate analysis including frequencies and percentage for demographic data, gingival pigmentation and gingival biotype were calculated. Chi-square test was used to determine the association between gingival pigmentation with age, gender and biotype where p-value <0.05 was considered statistically significant.

### Results

Majority of the participants 170(45.34%) belonged to age group 41 to 60 years. The proportion of males 192(51.89%) was higher. Thick gingival biotype 226(61.08%) was found to be more prevalent. The distribution of gingival pigmentation according to *Dummett et al.*, showed DOPI Score 1 was most prevalent 227(61.35%), while Score 3 was least common 8(2.16%). The extent of pigmentation according to *Ponnaiyan et al.*, showed maximum participants 151(40.81%) had Class II pigmentation. Gingival pigmentation was significantly associated with gender (p=0.04) and gingival biotype (p=0.002), but not with age (p=0.112).

### Conclusions

Majority of the participants had DOPI Score 1 and Class II gingival pigmentation. There was an association of gingival pigmentation with gender and biotype but not with age.

**Keywords:** Biotype; Aesthetic; Gingiva; Gingival pigmentation; Prevalence.

**Correspondence:** Dr. Suraksha Subedi, Department of Periodontology and Oral Implantology, Gandaki Medical College Teaching Hospital, Pokhara, Nepal. Email:surakshya691@gmail.com, Phone: +977-9846022297 **Article received:** 2025-10-18. **Article accepted:** 2025-12-25. **Article published:** 2026-03-31.

## INTRODUCTION

Melanin is a non-haemoglobin-derived pigment formed by melanocytes, which are the dendritic cells of neuroectodermal origin found in the basal and spinous layers of epithelium. Dummett reported the occurrence of oral pigmentation as gingival tissues (60%), hard palate (61%), mucous membrane (22%) followed by tongue (15%).<sup>1</sup> Gingival hyperpigmentation is due to excessive melanin deposition by the melanocytes.<sup>2</sup> Although gingival hyperpigmentation is not a disease, it can pose aesthetic concerns. For better treatment strategies, understanding the distribution patterns of pigmentation and its association with various parameters is important. Several studies have been conducted globally regarding the assessment distribution patterns of gingival pigmentation taking age, sex and gingival biotype into consideration with diverse results.<sup>3-5</sup> Limited study has been conducted in Nepalese population.<sup>6</sup> Thus, this study was aimed to assess the prevalence of gingival pigmentation and its' associated factors among patients visiting a tertiary dental hospital.

## METHODS

A analytical cross-sectional study was conducted at Gandaki Medical College Teaching Hospital and Research Centre, Pokhara, Nepal. The patients visiting Department of Periodontics from March 18 to August 19, 2025 who fulfilled the inclusion criteria were taken into the study. Based on the study by *Rijal et al.*,<sup>6</sup> at 95% confidence interval and 40% prevalence, using Cochran sample size formula:  $n = z^2 pq / e^2$ . The caclulated sample size was 370. Ethical clearance was taken from Institutional Review Committee of Gandaki Medical College Teaching Hospital and Research Center, Pokhara, Nepal (Ref No. 28/080/081-F). A infomred written consent was taken from the patients prior to data collection. The participants of either sex above 18 years and those willing to participate in the study were included. Patients with gingivitis, periodontitis and systemic diseases that cause gingival pigmentation, gingival diseases that affect gingival architectures

and smokers were excluded from the study.

After explaining the nature of the study, the demographic details of the participants were recorded. Under strict aseptic condition, clinical examinations were carried out using sterile, calibrated and standardized periodontal probe (University of North Carolina-15). The gingival pigmentation and gingival biotype were recorded in anterior aesthetic region of the gingiva using a mouth mirror to retract the lips. The gingival pigmentation was assessed using classification given by *Dummett et al.*,<sup>1</sup> and *Ponnaiyan et al.*,<sup>7</sup> According to *Dummett et al.*, the pigmentation was classified using Dummett-Gupta Oral Pigmentation Index (DOPI) as; 0: Pink tissue (no clinical pigmentation) 1: Mild, light brown tissue (mild clinical pigmentation) 2: Medium brown or mixed pink or brown tissue (moderate clinical pigmentation) 3: Deep brown or blue/black tissue (heavy clinical pigmentation). This index represents the assignment of a composite numerical value to the melanin pigmentation in the clinical examination of various oral tissues.

According to *Ponnaiyan et al.*, the patterns of pigmentation were divided into six classes from Class I to Class VI. Class I: Pigmentation in the attached gingiva only, Class II: Pigmentation in attached gingiva and interdental papilla, Class III: Diffuse pigmentation involving all parts of the gingiva, Class IV: Pigmentation in marginal gingiva only, Class V: Pigmentation in interdental papilla only, Class VI: Pigmentation in marginal gingiva and interdental papilla. The gingival biotype was determined by transparency of periodontal probe through gingival sulcus (TRANS) technique.<sup>8</sup> In this technique, probing is done in mid facial aspect of the tooth with a gentle force. If the outline of the underlying periodontal probe will be seen through the gingiva, it is categorized as thin; if not, it is categorized as thick. Data were collected by single examiner and recorded in the prepared proforma.

The data were entered into MS Excel and analysed using statistical package for the social sciences (SPSS) version 20. Descriptive statistics summarized the data, and the proportion and mean values for

various parameters were evaluated. The chi-square test was used to determine the relationship of gingival pigmentation with age, gender and gingival biotype, where p-value <0.05 was considered statistically significant.

## RESULTS

A total of 370 participants, 170 (45.34%) belonged to age group 41-60 years and least 54 (14.59%) were from >60 years age group. The proportion of males 192 (51.89%) were higher. (Table 1).

Characteristics	Frequency (%)
<b>Age groups</b>	
18-40	146 (39.45)
41-60	170 (45.34)
>60	54 (14.59)
<b>Sex</b>	
Male	192 (51.89)
Female	178 (48.10)

DOPI Score 1 (mild pigmentation) was most prevalent 227 (61.35%), while Score 3 (heavy pigmentation) was least common 8 (2.16%). The extent of gingival pigmentation according to *Ponnaiyan et al.* showed maximum participants with Class II pigmentation 151 (40.81%) followed by Class I 121 (32.70%), and minimum had Class V pigmentation 3 (0.81%).

<b>DOPI score (<i>Dummett et al</i>)</b>	<b>Frequency (%)</b>
Score 0 (No clinical pigmentation)	39 (10.54)
Score 1 (Mild clinical pigmentation)	227 (61.35)
Score 2 (Moderate clinical pigmentation)	96 (25.94)
Score 3 (Heavy clinical pigmentation)	8 (2.16)
<b>Gingival pigmentation (<i>Ponnaiyan et al.</i>)</b>	
Class 0 (No pigmentation)	37 (10.00)
Class I (Pigmentation in the attached gingiva only)	121 (32.70)
Class II (Pigmentation in attached gingiva and interdental papilla)	151 (40.81)
Class III (Diffuse pigmentation involving all parts of the gingiva)	36 (9.72)
Class IV (Pigmentation in marginal gingiva only)	15 (4.05)
Class V (Pigmentation in interdental papilla only)	3 (0.81)
Class VI (Pigmentation in marginal gingiva and interdental papilla)	7 (1.89)
<b>Gingival biotype</b>	
Thick	226 (61.08)
Thin	144 (38.91)

Furthermore, thick gingival biotype 266 (61.08%) was more prevalent (Table 2).

There was no statistically significant relationship between gingival pigmentation and age (p=0.112). There is statistically significant association between gingival pigmentation with gender (p=0.04) and gingival biotype (p=0.002) was found (Table 3).

\*Chi-square test; \*\* p<0.05 denotes statistical significance

## DISCUSSION

Gingival pigmentation occurs as a diffuse, deep-purplish discoloration or as irregularly shaped brown and light brown patches. It is synthesized by melanocytes present in the basal and suprabasal layers of the epithelium. Melanin, a pigment that occurs naturally in our body, causes pigmentation not only on the skin but also on the gingiva. This may lead to darker gingival colour, which is of major concern to some patients concerned about their aesthetics, especially when the patient has gummy smile. To overcome this concern, gingival depigmentation is done to remove the hyperpigmentation of the gingiva in order to improve the aesthetic quotient of the patient. This article aimed to assess the prevalence of physiological gingival pigmentation and its association with age, gender and gingival biotype. This study showed that the DOPI Score 1 227 (61.35%) was the most prevalent, whereas Score 3 8 (2.16%) was the least prevalent. These findings align with previous studies reporting predominance of Class I pigmentation in the general population.<sup>2,6</sup> From a biological perspective, melanin production in the gingiva is primarily regulated by melanocyte activity within physiological limits. Environmental and behavioural influences, such as smoking, chronic irritation, or exposure to chemical agents, are known to enhance melanocytic activity and increase pigmentation intensity. Moreover, gingival thickness, vascularity, and individual genetic background may also modulate the extent of pigmentation. Furthermore, based on extent of pigmentation *Ponnaiyan et al.*, majority (151, 40.81%) of the population had gingival pigmentation in attached gingiva and interdental area (Class II) and few participants (3, 0.81%) had pigmentation on interdental papilla only (Class V). This pattern may be explained by the higher concentration of melanin in the attached gingiva and interdental regions, as well as the relatively thicker and more vascularized gingival tissue in these areas. Genetic and ethnic factors may also influence the distribution and visibility of pigmentation. These findings are supported by several previous

studies.<sup>2,3,7,9</sup> This contrasts with the study done in Nepal by *Rijal et al.*,<sup>6</sup> and *Kayamkali et al.*,<sup>10</sup> where majority had pigmentation on attached gingiva only (Class I) while *Van et al.*,<sup>11</sup> found interdental papillae only (Class V) to be most common. Such variations may be explained by differences in ethnic background, genetic predisposition, and environmental exposures, including dietary habits, oral hygiene practices, and prevalence of smoking. Methodological differences, such as sample size, age distribution, and criteria used for clinical assessment, may also contribute to discrepancies among studies. This study showed no association of gingival pigmentation with age of the patients. This finding is in accordance to study by *Rijal et al.*,<sup>6</sup> This may be because gingival pigmentation is primarily influenced by genetic and racial factors rather than age, and melanin deposition in the gingiva does not necessarily change over time. However, gingival pigmentation was found more among males which was statistically significant. This association is in accordance with the study by *Verma et al.*,<sup>12</sup> and *Hedin et al.*,<sup>13</sup> In contrast to this finding, most of the studies showed no statistical association between gingival pigmentation and gender.<sup>3,6,10,14-16</sup> This male predominance may be related to hormonal influences, as androgens can stimulate melanin production, as well as genetic factors and differences in environmental exposures. Nevertheless, the literature shows mixed results regarding gender differences in gingival pigmentation, indicating that gender may not be a universal determinant. A significant association was also found between gingival pigmentation with gingival biotype. Thick gingiva was more commonly associated with higher pigmentation scores. This was supported by various other studies.<sup>4,6,10</sup> However, few other studies showed no significant correlation between the gingival biotype and the intensity of gingival pigmentation.<sup>2,7,17</sup> Evaluation of the gingival biotype is of great importance, particularly while determining the aesthetic and functional outcome of periodontal, restorative, and orthodontic therapies. Similarly, amount of gingival thickness largely affects the

outcome of surgical procedures like gingival depigmentation. Thin biotypes may be at higher risk of marginal tissue recession or delayed healing after depigmentation, making preoperative evaluation of biotype essential for optimal aesthetic results. This study bears some limitations. It is a single centered study, which focuses on the pigmentation of anterior gingiva only. The study is reliance on a visually based pigmentation classification, which is inherently subjective. Thus, future studies incorporating additional parameters such as skin colour, smoking habits, periodontal status and objective pigmentation assessment methods to better elucidate factors influencing pigmentation and to improve the validity and generalizability of findings. Although gingival pigmentation is physiological and does not harm the oral mucosa, it has become a growing concern due to its impact on patient aesthetics. Understanding the pattern of gingival pigmentation and its correlation with factors such as age, gender, and gingival biotype is crucial in clinical decision-making, aesthetic treatment planning, and individualized patient management. This research will provide valuable insights for clinicians, enabling them to tailor depigmentation procedures to the specific pigmentation patterns of individual patients, thereby enhancing esthetic outcomes and patient satisfaction.

## CONCLUSIONS

Gingival pigmentation is frequently encountered during routine dental examinations. Most participants in our study exhibited DOPI Score 1 and Class II gingival pigmentation, with a predominance of thick gingival biotype. Gingival pigmentation was significantly associated with gender and biotype, but not with age. The awareness of the prevalence and distribution patterns of gingival pigmentation is important for clinicians in differentiating physiological pigmentation from pathological lesions and in addressing aesthetic concerns of patients.

## REFERENCES

1. Dummett CO. Physiologic Pigmentation of the Oral and Cutaneous Tissues in the Negro. *J Dent*

## Limitations

It is a single centered study, which focuses on the pigmentation of anterior gingiva only. The study is reliance on a visually based pigmentation classification, which is inherently subjective. Thus, future studies incorporating additional parameters such as skin colour, smoking habits, periodontal status and objective pigmentation assessment methods to better elucidate factors influencing pigmentation and to improve the validity and generalizability of findings.

## Acknowledgements

All authors would like to acknowledge the efforts of researchers whose studies were included in this meta-analysis, as their valuable work provided the foundation for this review.

**Conflict of interest:** The authors declare that they have no conflict of interest.

**Funding:** No funding was received from any agency to conduct this study.

**Availability of data and materials:** All data analysed during this study will be made available upon reasonable request from the corresponding author.

## Authors' contributions

**Conceptualization:** Suraksha Subedi, Rebecca Ranjit, Bikash Kumar Baniya.

**Data curation:** Suraksha Subedi, Rebecca Ranjit.

**Formal analysis:** Suraksha Subedi.

**Investigation:** Suraksha Subedi.

**Methodology:** Suraksha Subedi, Rebecca Ranjit, Bikash Kumar Baniya.

**Supervision:** Suraksha Subedi, Rebecca Ranjit, Bikash Kumar Baniya.

**Writing-original draft:** Suraksha Subedi.

**Writing-review & editing:** Suraksha Subedi, Rebecca Ranjit, Bikash Kumar Baniya.

Res. 1946;25(6):421-32. [DOI]

2. Rakhewar P, Patil H, Thorat M. Identification of gingival pigmentation patterns and its correlation

- with skin color, gender and gingival phenotype in an Indian population. 2016;6(2):87-92. [DOI]
3. Gorsky M, Buchner A, Fundoianu-Dayan D, Aviv I. Physiologic pigmentation of the gingiva in Israeli Jews of different ethnic origin. 1984;58(4):506-9. [DOI]
  4. Bharamappa R, Laxman V. Comparative assessment of gingival thickness in pigmented and nonpigmented gingiva. 2013;5(1):19-23. [DOI]
  5. Alhadj M. Prevalence of Melanin Pigmentation in a Yemeni Population and its Relation to Some Risk Factors. *Braz Dent Sci.* 2020;23(2):1-9. [DOI]
  6. Rijal A, Dhami B, Pandey N, Aryal D. Prevalence of Gingival Pigmentation and its Association with Gingival Biotype and Skin Colour. *J Nepal Soc Perio Oral Implant.* 2021;5(9):19-25. [DOI]
  7. Ponnaiyan D, Anusha J, Gomathy L. The correlation of skin color and gingival pigmentation patterns in a group of South Indians in Tamil Nadu, India. 2013;4(2):54. [DOI]
  8. Kan J, Rungcharassaeng K, Umezu K, Kois J. Dimensions of peri-implant mucosa: an evaluation of maxillary anterior single implants in humans. 2003;74(4):557-62. [DOI] [PubMed]
  9. Amin S, Azeez SH. Gingival Pigmentation Pattern in Correlation to Skin Color in a Group of Kurdish People in Sulaimani City. *Al-Kindy Coll. Med. J.* 2022;18(3):237-42. [DOI]
  10. Khayamali J, Khadka R, Lamichhane S, Rijal AH. Prevalence and Associated Factors of Gingival Pigmentation. 2025;23(66):126-31. [DOI]
  11. van Wyk C. Mouth pigmentation patterns in a group of healthy South African Bantu. 1970;44(7):177-80. [PubMed]
  12. Verma J, Ahuja A, Ahuja V, Thosar NR. Reconnoitering the association of gingival melanin pigmentation with skin color, age, and sex in pre-school children of Hazaribag: A cross-sectional study. *Cureus.* 14(10):e30699. [DOI]
  13. Hedin C, Axéll T. Oral melanin pigmentation in 467 Thai and Malaysian people with special emphasis on smoker's melanosis. *J Oral Pathol Med.* 1991;20(1):8-1 [DOI]
  14. Bolden T. Histology of Oral Pigmentation. *J Periodontol.* 1960;31(5):361-74. [DOI]
  15. Eaturi M, Reddy K, Avula H, Bolla V. Evaluation of Prevalence and Severity of Gingival Pigmentation and its Correlation with Skin Complexion. Vol. 5. 5(8):596-610. [DOI]
  16. Steigmann S. The relationship between physiologic pigmentation of the skin and oral mucosa in Yemenite jews. *Oral Surg Oral Med Oral Pathol.* 1965;19(1):32-8. [DOI]
  17. Sriram K, G. K. Prevalence of gingival pigmentation patterns and its correlation with gingival phenotype and gender in an Indian population. Vol. 12. 2020;12(4):3203. [DOI]

**Citation:** Subedi S, Ranjit R, Baniya B. Prevalence of Gingival Pigmentation and Its Associated Factors Among Patients Visiting Tertiary Dental Hospital in Nepal. *JCMS Nepal.* 2026; 22(1):36-41.