# Correlation of skin color and gingival pigmentation patterns in a group of South Indians in India

Deepa Ponnaiyan, MDS
L Gomathy, MDS
JA Anusha, MDS

*Department of Periodontics, SRM Dental College and Hospital, Chennai, Tamil Nadu, India*

*Corresponding Author:*
*Deepa Ponnaiyan, MDS*
*F4 Rajendra Apartments, 9 Babu Rajendra Prasad Street, West Mambalam, Chennai 600033, Tamil Nadu, India*
*Email: deepa_ponnaiyan@yahoo.co.in*

*Conflict of interest: none to declare*

**Background:** Melanin pigmentation of the gingiva occurs in all ethnicities. Excessive pigmentation is an esthetic concern that has increased awareness about depigmentation procedures. The purpose of the present study was to correlate the skin color and gender with the intensity and distribution of gingival melanin pigmentation in a group of South Indians for treatment strategies.

**Method:** Two hundred male and female non smoking healthy subjects aged 18-35 years were included. A clinical examination of gingiva was performed to assess the anatomic distribution of gingival pigmentation. The intensity of gingival pigmentation and the phenotype of gingiva were also assessed. Subsequently, the skin color was visually examined and assessed as fair, wheatish, brown, and dark.

**Result:** Six classes of gingival pigmentation were defined based on the anatomic distribution. Gingival pigmentation was observed as highest in the attached gingiva and interdental papilla (25.4%) and least in the marginal gingiva and interdental papilla (10.2%). The correlation between the skin color and the intensity of pigmentation was statistically significant, with dark skinned subjects having heavy gingival pigmentation. However, no correlation was found between the gender and the phenotype of gingiva with intensity and distribution of pigmentation.

**Conclusion:** South Indians predominantly have pigmentation in the attached gingiva and interdental papilla and their skin color is positively correlated with the intensity of pigmentation. The incidence of pigmentation does not differ between the sexes. We noted that a majority of the subjects had thick gingival phenotype. Anatomic delineation of gingival pigmentation and their contributory factors may help design treatment strategies in depigmentation procedures.

**Keywords:** gingival color, gingiva, melanin, pigmentation, skin color, South indians

*Received: 10 July 2013*
*Accepted: 20 September 2013*

Iran J Dermatol 2013; 16: 94-99

## INTRODUCTION

Melanin is the fundamental pigment that colors the tissues. It appears as early as 3 hours after birth in the oral tissues and is the only sign of pigmentation on the body in some cases [1]. It is a non–hemoglobin-derived pigment formed by the cells called melanocytes, which are dendritic cells of neuroectodermal origin located in the basal and spinous layers of the gingival epithelium [2]. Melanin granules are phagocytosed and contained within other cells of the epithelium and connective tissue, called melanophages or melanophores [3].

 

It is generally accepted that pigmented areas are present only when melanin granules synthesized by melanocytes are transferred to keratinocytes. This close relationship between melanocytes and keratinocytes was labeled by Fitzpatrick and Breathnach as the epidermal-melanin unit [4,5].

The gingiva is the fibrous mucosa surrounding the teeth that covers the coronal portion of the alveolar process [6]. The gingiva is the most frequently pigmented part of the intra-oral tissue as well as the most readily seen part. Dummet [7] queried the frequently used description of normal gingival as 'coral pink' and suggested a more accurate statement of the pattern of normal pigmentation in the following definition. The color of healthy gingiva varies from pale pink to bluish purple. Between these limits of normalcy are a large number of colors which primarily depend on the intensity of the melanogenesis, degree of epithelial cornification, depth of epithelialization and the arrangement of gingival vascularity. Color variation may be uniform, unilateral, bilateral, mottled, macular, or blotched. There are two basic color zones in the oral cavities of most people, which comprise the attached and marginal gingiva on one hand and the adjacent alveolar mucosa on the other hand [2]. Studying gingival color using the Munsell color system in dentistry, Ibusuki [8] reported that gingival color varied with the position of the papillary, marginal and attached gingiva. The color of the healthy gingiva is assumed to vary from pale pink and coral pink in Caucasians [9] to brown and blue black areas in Africans or Asians [10]. Indians have a dramatic variation in their skin color more than any other ethnic group. There are all shades ranging from fair to dark which span out over the entire country. It has been observed that there is a gradient from the north to the south of the sub-continent with the North Indians close to European complexions and South Indian closer to sub-Saharan Africans [11]. Whether this skin pigmentation is also evident in the oral cavity in South Indians needs to be investigated.

Melanin hyperpigmentation of gingiva usually does not present as a medical problem, but many patients may consider their black gums to be unaesthetic. This problem is aggravated in patients with a "gummy smile" or excessive gingival display while smiling [12]. Gingival depigmentation is a periodontal plastic surgical procedure whereby the gingival hyperpigmentation is removed or reduced by various techniques [13]. The foremost indication for depigmentation therapy is the demand by a person for improved esthetics. Understanding the distribution of pigmentation will help in devising better treatment strategies. However, the anatomic distribution of gingival pigmentation and its intensity have not been reported in South Indians in previous studies. Thus, the objective of the present study was to assess the distribution of physiologic gingival pigmentation, to establish whether a correlation exists between the skin color and gender with the intensity of physiologic gingival pigmentation and gingival phenotype.

## PATIENTS AND METHODS

This correlation investigation study was carried out at the Department of Periodontics, SRM Dental College and Hospital, Chennai, Tamil Nadu, India, for a period of six months. A total of 200 non smoking subjects (100 males and 100 females) who fell within the age group of 18-35 years were included in the present study. An informed consent was obtained from all subjects after explaining the nature of the procedures, the objectives, and possible discomforts and risks of the study to them. The study was approved by ethical committee of SRM University. The inclusion criteria were uniformly pigmented and non-mottled gingivae. The skin color had to be distinctly fair, wheatish, brown and dark which is similar to the criteria adapted by Aina et al [14]. The exclusion criteria were patients with periodontitis or any gingival pathology which might induce color changes, drug or chemical pigmentation, and mottling. Others were chemical skin peeling, albinism and mixed racial skin.

### Evaluation of gingival pigmentation and skin color

The method used for the intensity of physiologic gingival pigmentation evaluation in this study was the Dummett-Gupta Oral pigmentation Index (DOPI) [7] (Dummett and Gupta). This index represents the assignment of a composite numerical value to the total melanin pigmentation manifested on clinical examination of various oral tissues. The

criteria are as follows:

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)

The higher the number is, the darker the oral pigmentation. One investigator was calibrated for the examination of the colors after testing for normal color vision and color aptitude [15] using the line test, comparison of observers and of light sources with the use of a color rule [16]. The investigator was also seen to be adapted to daylight because the higher intensity of light available from the day


**Figure 1.** Classification of gingival pigmentation pattern in South Indians.

 

light sources may produce more color change. The observer views the specimen illuminated hence meeting the three conditions as highlighted by the International Commission on illumination (CIE) [17]. Wright [18], however, stated that even after objective scientific evaluation, the eye is still the final judge of color.

To assess distribution patterns of pigmentation, oral photographs were obtained with a digital camera (Sony DSC- T700, Sony Electronics, San Diego, CA) with standardized settings for grey, white and black and a centimeter scale with standard lighting and backdrop conditions. The photographs were reproduced in a computer display. These reproductions exhibited sizes similar to that of the actual mouth. The distribution of pigmentation was assessed in anterior and posterior teeth in the entire anatomical areas of gingiva.

The skin colors were assessed by visual examination under natural light and were divided into four groups depending on the variations in skin color found in South Indians as fair, wheatish, brown, and dark [11]. Skin color was classified by comparing the color of the inner aspect of the upper arm, which is relatively unexposed to sunlight, with color photographs taken of similar areas of individuals who had previously been graded as fair skinned, wheatish, brown, and dark. The macroscopic distribution and color of the pigmentation of all surfaces were recorded in detail. Then, the phenotype of gingiva was assessed by inserting a periodontal probe into the sulcus and assessing the visibility on the outer surface [19]. All examinations were carried out by one single examiner. The phenotype was grouped as thick and thin. Pearson Chi Square test was applied to test the correlation of variables.

## RESULTS

Based on the evaluation of the subjects, a classification scheme describing the patterns of anatomic distribution of gingival pigmentation was formulated. The chart is presented in Figure 1. Six categories were defined. All subjects were subsequently allotted one of the categories. It was observed that pigmentation was more in the attached gingiva and interdental papilla (Class II) and least being in the marginal gingiva and interdental papilla together (Class VI) (Figure 2). There were variations in the skin color and it was observed that the majority of the subjects had wheatish (68%) and fair (67%) complexions with the least being the dark skin color (21%). The correlation of the skin color and the intensity of gingival pigmentation according to Dummett- Gupta Oral pigmentation Index (DOPI) were evaluated and a positive correlation was observed. The skin color was in fact related to the intensity of pigmentation which was highly significant (p value = 0.00). It was observed that fair skinned people had mild gingival pigmentation (18.5%) whereas dark skinned people had heavy pigmentation (10.5%; Figure 3). There was no significant correlation between the gender and distribution of gingival pigmentation (p value = 0.373). The correlation between the gingival phenotype and the intensity of gingival pigmentation was not significant (p value = 0.125); however, it was observed that 68% of the subjects had the thick gingival phenotype.

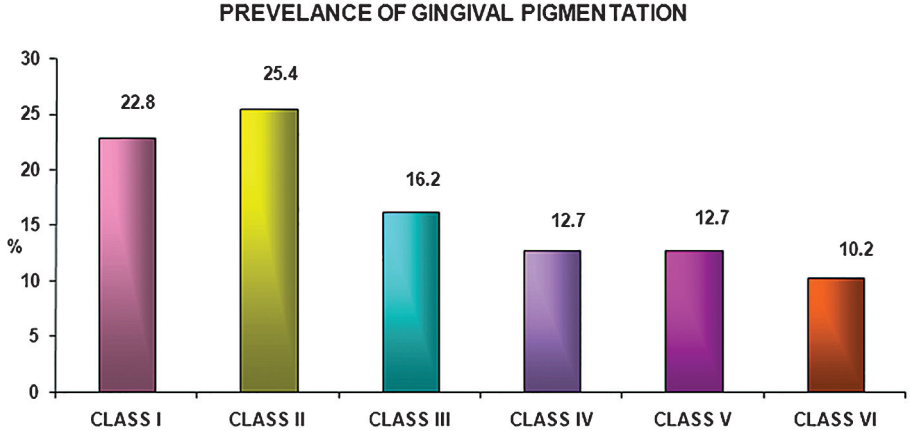


**Figure 2.** Prevalence of anatomic distribution of gingival pigmentation.

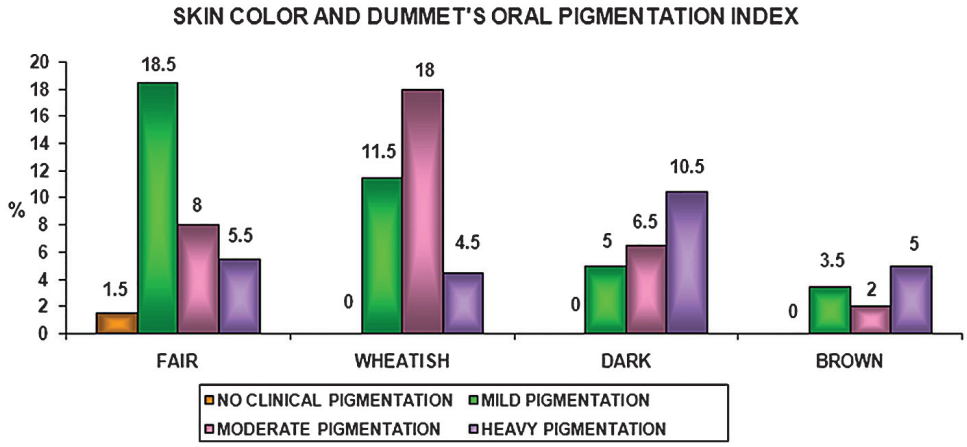


**Figure 3.** Correlation of skin color with intensity of gingival pigmentation.

## DISCUSSION

Gingival hyperpigmentation is seen as a genetic trait in some populations, and is more appropriately termed physiologic or racial gingival pigmentation [20]. The prevalence of melanin pigmentation in different populations has been reported to vary between 0% to 89% with regard to ethnic factors and smoking habits [21]. In the present study, an attempt was made to assess the anatomic distribution of melanin pigmentation in the gingiva and also quantify it in a South Indian population, who have darker skin color owing to more melanin content, and tend to have more oral pigmentation than their counterparts in North and Northeast India. This could be attributed to their genetic traits [11].

The distribution of gingival pigmentation is quite unique in South Indians. In the present study, it was observed that the majority had pigmentation in the attached gingiva and interdental papilla (Class II). This finding is in contrast to a Jewish population study in which the authors found attached gingiva only to be the most common pigmented anatomic division [22] and a South African population in which pigmentation was most frequently seen in the interdental papilla [23]. This establishes the fact that there is racial variation in the pigmentation of the gingiva.

Extra oral tissue color, e.g. cheeks, appears to be an indication of the color of the gingiva and mucosa in about 85% of the cases [24,25,26]. The color of the gingiva was correlated with facial complexion in the present study which was highly significant. It was observed that dark skinned subjects had heavy gingival pigmentation whereas fair skinned subjects had mild pigmentation. These findings are similar to a previous study on an Indian population which showed that the incidence of the pigmentation of the gingiva increased as the complexion changed to the darker shade [27]. It has been observed that in dark complexion people, the reappearance of the pigmentation is more than people with fair complexion after surgical depigmentation. This could be attributed to the increased intrinsic melanogenesis in dark complexion people [28]. Thus, the skin color in fact can be a predictor for mucosal and gingival pigmentation.

There was no significant correlation between the distribution pattern of gingival pigmentation and gender in the present study. This finding is similar to previous studies in other races [28-31].

In the present study, the majority of the subjects had the thick phenotype of the gingiva that showed no significant correlation with gingival pigmentation. This finding is in contrast to a previous study done on Indians. This finding could be attributed to the fact that there are ethnic variations even within the same race for gingival phenotype [19,32].

Establishing a chart for the pattern of gingival pigmentation in South Indians will in the future help to choose a specific depigmentation therapy that will harmonize with skin color. This will enhance the esthetic results and the level of patient satisfaction.

**Acknowledgement**

We would like to thank S.R.M Dental College, Ramapuram, Chennai and S.R.M University for supporting this study.

## REFERENCES

1. Dummett CO. Physiologic pigmentation of the oral and cutaneous tissues in the Negro. J Dent Res 1946; 25:421-32.
2. Dummett CO, Barens G. Pigmentation of the oral tissues. A review of literature. J Periodontol 1967; 39:369-78.
3. Schroeder HE. Melanin containing organelles in cells of the human gingiva. J Periodontal Res 1969; 4:1-18.
4. Bergamaschi O, Kon S, Doine AI, Ruben MP. Melanin repigmentation after gingivectomy: a 5 year clinical and transmission electron microscopic study in humans. Int J Periodontics Restorative Dent 1993; 13:85-92.
5. Goldzieher JW, Roberts IS, Rawls WB, Goldzieher MA. Chemical analysis of the intact skin by reflectance spectrophotometry. AMA Arch Derm Syphilol 1951; 64:533-48.
6. Zimmerman DE, Pomerantz JM, Sanfacan DG. Denture Esthetics (III) Denture Base color. Quintessence Int 1982; 7:747-58.
7. Dummett CO, Gupta OP. The DOPI assessment in gingival pigmentation. J Dent Res 1966; 45:122.
8. Ibusuki M. The color of gingival studied by visual color matching Part II. Kind, location and personal difference in color of the gingival. Bull Tokyo Med Dent Univ 1975; 22:281-92.
9. Manson JD, Eley BM, editors. Outline of periodontics, 4th ed. Butterworth Heinemann: Oxford; 2000.
10. de Krom C, Waas M, Oosterveld P, et al. The oral pigmentation chart: A clinical adjunct for oral pigmentation in removable prosthesis. Int J Prosthodont 2005; 18: 66-70.
11. Stokowski RP, Pant P, Dadd T, et al. A genomewide association study of skin pigmentation in a south asian population. Am J Hum Genet 2007; 81:1119-32.
12. Liebart ME, Deruelle CF, Santini A, et al. Smile line and periodontium visibility. Perio 2004; 1:17-25.
13. Deepak P, Sunil S, Mishra R, Sheshadri. Treatment of gingival pigmentation: a case series. Indian J Dent Res 2005; 16:171-6.
14. Aina TO, Wright SM, Pullen-Warner E. The reproduction of skin color and texture in facial prostheses for Negro patients. J Prosthet Dent 1978; 39:74-99.
15. Günther W, Stiles W, editors. Color science: concepts and methods, quantitative data and formulae, 2nd ed. New York: Wiley series in pure and applied optics; 1982.
16. Hunt R, editor. The reproduction of color, 6th ed. Chichester UK: Wiley–IS&T Series in Imaging Science and Technology; 2004.
17. Powers JM, Capp JA, Koran A. Color of gingival tissues of blacks and whites. J Dent Res 1977; 56:112-6.
18. Wright SM. Prosthetic reproduction of gingival pigmentation. Br Dent J 1974; 136:367-72.
19. Vandhana KL, Savitha B. Thickness of gingiva in association with age, gender and dental arch location. J Clin Periodontol 2005; 22:828-30.
20. Dummett CO, Barens G. Oromucosal pigmentation: an updated review. J Periodontol 1971; 42:726-36.
21. Rosa DA, Aranha AC, Eduardo CP, Akira A. Esthetic treatment of gingival melanin hyperpigmenation with Er:YAG laser: short-term clinical observations and patient follow-up. J Peridontol 2007; 78:2018-25.
22. Gorsky M, Buchner A, Fundoianu-Dayan D, Aviv I. Physiologic pigmentation of the gingiva in Israeli Jews of different ethnic origin. Oral Surg Oral Med Oral Pathol 1984; 58:506-9.
23. van Wyk CW. Mouth pigmentation patterns in a group of healthy South African Bantu. S Afr Med J 1970; 177-80.
24. Cicek Y, Ertas U. The normal and pathologic pigmentation of oral mucous membrane: a review. J Contemp Dent Pract 2003; 3:76-86.
25. Gaeta GM, Satriano RA, Baroni A. Oral pigmenated lesions. Clin Dermatol 2002; 20:286-8.
26. Dummett CO, Sakumura JS, Barens G. The relationship of facial skin complexion to oral mucosa pigmentation and tooth color. J Prosthet Dent 1980; 43:392-6.
27. Raut RB, Baretto MA, Mehta FS, et al. Gingival pigmentation: Its incidence amongst the Indian adults. J.A.I.D.A 1954; 26:9-10.
28. Kaur H, Jain S, Sharma R. Duration of reappearance of gingival melanin pigmentation after surgical removal - A clinical study. J Indian Soc Periodontol 2010; 14:101-5.
29. Oluwole D, Elizabeth D. Gingival tissue color related with facial skin and acrylic resin denture base color in a nigerian population. Afr J Biomed Res 2010; 13:107-11.
30. Brown T. Oral pigmentation in the Aborgines of Kalumburu, Northwest Australia. Arch Oral Biol 1964; 9:555-64.
31. Steigmann S. The relation between physiologic pigmentation of the skin and the oral mucosa in Yemenite Jews. Oral Surg Oral Med Oral Pathol 1965; 19:32-8.
32. Muller HP, Eger T, Schorb A. Gingival dimensions after root coverage with free connective tissue grafts. J Clin Periodontol 1998; 25:424-30.