Correlation of Amount of Gingival Pigmentation with Gingival Biotype and Skin Pigmentation: An Observational Study

Aim: There is an increased awareness about esthetics and depigmentation procedures these days. Examining the amount of pigmentation helps in better treatment planning as skin color can be a predictor for gingival pigmentation. Also, gingival biotype appears to differ in pigmented and nonpigmented gingiva. Hence, the aim of this study was to find the correlation of the amount of gingival pigmentation with gingival biotype and skin pigmentation.

Materials and methods: Five-hundred subjects aged 18 to 35 years were included in this study. Skin color was assessed using Von Luschan’s chromatic scale. Dummett’s oral pigmentation index (DOPI) was used to score gingival pigmentation on the labial gingival surfaces of maxillary central and lateral incisors. Gingival biotype was checked using the probe transparency method.

Results: Correlation coefficient of 0.4119 was found when comparing gingival pigmentation with skin pigmentation. Among subjects with no gingival pigmentation and mild gingival pigmentation, a maximum percentage showed dark intermediate skin tone (49.70 and 51.20% respectively). In subjects with moderate and heavy gingival pigmentation, a maximum percentage showed dark skin tone (76.40 and 76.10% respectively). Correlation coefficient of 0.4044 was found while comparing gingival pigmentation with gingival biotype. In subjects with no gingival pigmentation and mild gingival pigmentation, a maximum percentage showed thick gingival biotype (83.40 and 62.30%, respectively). In subjects with moderate and heavy gingival pigmentation, a maximum percentage showed thick gingival biotype (54.90 and 62.30%, respectively).

Conclusion: This study found a positive correlation between gingival pigmentation, gingival biotype, and skin pigmentation. Pigmented gingiva was thicker when compared to nonpigmented gingiva. Dark skin tone was seen mostly in moderate and heavy gingival pigmentation and dark intermediate skin tone was mostly seen in no gingival pigmentation and mild gingival pigmentation.

Clinical significance: A knowledge of the correlation between gingival pigmentation, gingival biotype, and skin pigmentation can help in better treatment planning for depigmentation procedures in the anterior esthetic areas of the mouth.

Keywords: Gingival biotype, Gingival pigmentation, Skin pigmentation.


Source of support: Nil

Conflicts of interest: None

INTRODUCTION

The gingiva is the part of the oral mucosa that covers the alveolar processes of the jaws and surrounds the necks of the teeth.1 The oral tissues that usually evidence melanogenous pigmentation are the gingivae, buccal mucous membranes, tongue, hard palate, and lips. The gingiva is the most frequently pigmented of the intraoral tissues as well as the most visible.2

Color variation may be uniform, unilateral, bilateral, mottled, macular, or blotched. The color of the healthy gingiva is assumed to vary from pale pink to coral pink/light brown to dark brown.3 This color variation may depend on the amount of physiological melanin pigmentation in the epithelium, the degree of keratinization of the epithelium, the vascularity, and the fibrous nature of the underlying connective tissue.3 Oral pigmentation which is minimal in white people can be found as brown or blue black areas in Africans or Asians.4

It may be noted that a definite correlation exists between the color tone within the oral cavity and the skin pigmentation of the individuals in White, African, Asiatic, and Indian populations.5

The microscopic examination of areas of pigmentation of the gingival tissues shows a picture which is identical with that of pigmentation of the skin.5

Excessive pigmentation is an esthetic concern among patients. There is an increased awareness about depigmentation procedures these days. Examining the amount of pigmentation helps in better treatment planning and skin color could be used as a predictor for gingival pigmentation.
Thickess of gingiva is of significance and is an issue of concern in esthetic and functional outcome of the periodontal, restorative, and orthodontic therapy. It has been observed that the gingival thickness (GT) appears to differ in pigmented and nonpigmented gingiva. Therefore, this study was done to assess the correlations between skin complexion, gingival pigmentation, and gingival biotype.

**MATERIALS AND METHODS**

The study was conducted after approval from the Scientific Review Committee and the Institutional Ethical Committee of Bharati Vidyapeeth Deemed University Dental College and Hospital, Navi Mumbai, India. Students of 1st to 4th year and Interns of BDS course of Bharati Vidyapeeth Deemed University Dental College, Navi Mumbai were enrolled after obtaining informed written consent. Out of 500 students, 32 students were absent on the day of examination. Thus, a total of 468 individuals were included in the study. Students above the age of 18 years having all anterior teeth present in the upper jaw were included. Subjects having pathologic conditions that produce oral pigmentation, such as Addison’s disease, Albright syndrome, Peutz–Jegher’s syndrome and melanoma, subjects exposed to heavy metals or those on antimalarial drugs, tobacco chewers/smokers, subjects having had restorations or other treatments which could cause gingival pigmentation were all excluded from the study.

Skin color was assessed behind the ear (area not exposed to sunlight) by visual examination using a Von Luschan’s chromatic scale (Fig. 1, Table 1). The shade was evaluated in natural daylight against a neutral background (white).

For the purpose of this study, only Type III, IV, and V were considered, taking into account the variations encountered in Indian population.

The gingival biotype was assessed by using the probe-transparency method. A UNC-15 probe was inserted into the gingival sulcus at the midfacial aspect of maxillary central and lateral incisors. If the outline of the underlying probe was seen through the gingiva, it was categorized as thin. If not, it was categorized as thick.

Evaluation of the amount of gingival pigmentation was done using the Dummett’s oral pigmentation index (DOPI) given by Dummett and Gupta in 1966. The gingiva of the maxillary anterior region was divided into four unit spaces, which included the labial gingival surfaces of the right central incisor, right lateral incisor, left central incisor, and left lateral incisor. Each unit space included an area of gingiva measured from the gingival crest to a distance of 4 to 5 mm in an apical direction. A score was assigned to each of the four units, and a mean was computed.

The scoring criteria were as follows.

0 = No clinical pigmentation (pink tissue).
1 = Mild clinical pigmentation (mild light brown color).
2 = Moderate clinical pigmentation (medium brown or mixed pink and brown coloration).
3 = Heavy clinical pigmentation (deep brown or blueblack tissue).

The resulting score was designated as the DOPI score for that particular patient; the higher the score, the darker was the oral pigmentation.

All examinations were carried out by a single examiner.

The DOPI inference is as follows:
0 = No clinical pigmentation of the gingivae
0.031 to 0.97 = Mild gingival pigmentation
1.0 to 1.9 = Medium gingival pigmentation
2.0 to 3.0 = Heavy gingival pigmentation.

**RESULTS**

**Correlation between Gingival Pigmentation and Skin Pigmentation**

The correlation of the amount of gingival pigmentation and skin pigmentation was evaluated using correlation...
Correlation of Amount of Gingival Pigmentation with Gingival Biotype and Skin Pigmentation: An Observational Study


167

Correlation analysis test and a positive correlation was observed between the two \( (r = 0.4119) \). This was found to be statistically significant \( (p < 0.0001) \).

Among subjects with no gingival pigmentation, a maximum percentage showed dark intermediate skin tone \( (49.70\%) \). In patients with mild gingival pigmentation also, a maximum percentage showed dark intermediate skin tone \( (51.20\%) \). Among patients with moderate gingival pigmentation, a maximum percentage showed dark skin tone \( (76.40\%) \). In patients with heavy gingival pigmentation, a maximum percentage showed dark skin tone \( (76.10\%) \) (Table 2 and Graph 1).

**Correlation between Gingival Pigmentation and Gingival Biotype**

The correlation of the amount of gingival pigmentation and gingival biotype was evaluated using correlation analysis test and a positive correlation was observed between the two \( (r = 0.4044) \). This correlation was found to be statistically significant \( (p < 0.0001) \).

Out of 468 subjects, 58.3% of subjects had thin biotype and 41.7% had thick biotype. Mostly, thin biotype was seen in subjects with no gingival pigmentation \( (83.4\%) \) and mild gingival pigmentation \( (85.40\%) \), whereas mostly thick gingival biotype was seen in subjects with moderate gingival pigmentation \( (54.90\%) \) and heavy gingival pigmentation \( (62.30\%) \) (Table 2 and Graph 2).

**DISCUSSION**

The present study showed that there is a positive correlation between gingival pigmentation and skin pigmentation and also between gingival pigmentation and gingival biotype.

In recent years, dimensions of various types of masticatory mucosa, especially gingiva, has become a subject of considerable interest in dentistry, from an epidemiologic, esthetic as well as therapeutic point of view. Thickness of gingiva is of significance in various specialties like periodontics, orthodontics, prosthodontics, and implantology as it is an issue of concern in the esthetic and functional outcome of the treatment.7-9 Gingival biotype plays an important role in the position of marginal gingiva; unfortunately, periodontal literature attributes limited importance to gingival biotype when compared to width of attached gingiva. The actual functions of attached gingiva, such as resistance to masticatory, tensional, traumatic forces, and inflammation are possibly related to thickness as much as they are to the width of gingiva.10 Hence there is a need to interpret gingival biotype.

Many methods (both invasive and noninvasive) have been used to evaluate the thickness of facial, gingival, and other parts of the masticatory mucosa. These methods include conventional histology on cadaver jaws, injection needles, transgingival biopsy, histological sections, cephalometric radiographs, probe transparency, ultrasonic
devices, and cone-beam computed tomography. Using a metal periodontal probe in the sulcus to evaluate gingival tissue thickness is the simplest way to determine gingival biotype. With a thin biotype the outline of the probe is visible through the gingiva. This method is minimally invasive. Moreover, periodontal probing procedures are routinely carried out during periodontal treatment.

In this study, there was found to be a statistically significant correlation between gingival biotype and gingival pigmentation. Thin gingival biotype was seen in 83.40% of subjects with no gingival pigmentation and 85.40% of subjects with mild gingival pigmentation. A higher percentage of thick gingival biotype was seen as compared to thin biotype as gingival pigmentation increased. Thick gingival biotype was seen in 54.90% of subjects with moderate gingival pigmentation and 62.30% of subjects with heavy gingival pigmentation. These results are in accordance with the study done by Bharamappa and Laxman in 2015 where they found that thickness of pigmented gingiva (1.16 ± 0.23) was significantly higher than that of nonpigmented gingiva (0.99 ± 0.31). Another study conducted in the South Indian population showed no significant correlation between gingival biotype and gingival pigmentation. This could be attributed to the fact that there may be ethnic variations among various populations for gingival biotype and pigmentation.

In this study, we had used the Dummett–Gupta oral pigmentation index as a clinical tool in estimating the quantitative occurrence of pigmentation of the gingiva. It has been found to be a useful epidemiologic tool in estimating and comparing the amount of pigmentation occurring in the various oral tissues. The DOPI assessment represents the assignment of a composite numerical value to the total melanin pigmentation seen on clinical examination of the various tissues comprising the oral cavity.

This study was also in accordance with a study done by Dosumu and Dosumu in 2010, which showed that there is statistically significant correlation between facial skin pigmentation and gingival pigmentation. The method used in their study for grading facial pigmentation was that described by Aina et al, which categorizes skin tones into dark, medium, and light shades. This was used in the African populations. This method is very subjective and cannot be used in the Indian population. Hence, to overcome these limitations, Van Luschan’s chromatic scale was used in this study.

In a previous study done by Patel et al in 2015, skin color was recorded both on the region of the zygoma of the face as well as behind the ear. Since the skin behind the ear is less exposed to the sun, examining the skin behind the ear is a more accurate method for skin color estimation. Hence, this method was used in this study for recording skin color.

In this study, we found a statistically significant correlation between gingival pigmentation and skin pigmentation. Moreover, 76.40% of subjects with moderate gingival pigmentation and 76.10% of subjects with heavy gingival pigmentation showed dark skin tone. A similar study done by Ponnaian et al in 2013 concluded that there is a highly significant correlation between facial pigmentation and gingival pigmentation. Raut et al on conducting a study on the Indian population concluded that the incidence of the gingival pigmentation increased in subjects with darker skin tones. Also, a study done in 2010 by Kaur et al stated that the reappearance of pigmentation after depigmentation procedures was found to be more in subjects with dark skin tones, which can be attributed to increased melanogenesis in such populations.

CONCLUSION

We can conclude from the data obtained from this study that dark skin tone was seen mostly in moderate and heavy gingival pigmentation, and dark intermediate skin tone was mostly seen in no gingival pigmentation and mild gingival pigmentation. Thus, skin tone can be used as a predictor for gingival pigmentation.

We can also conclude from this study that nonpigmented and mildly pigmented gingiva is mostly thin, whereas moderately pigmented and heavily pigmented gingiva is mostly thick. Thus, greater the gingival pigmentation, thicker was the gingival biotype.

CLINICAL SIGNIFICANCE

A knowledge of the correlation between gingival pigmentation, gingival biotype, and skin pigmentation can help in better treatment planning for depigmentation procedures in the anterior esthetic areas.

As the reappearance of gingival pigmentation after depigmentation procedures was found to be more in subjects with dark skin tone, this may help in predicting the treatment outcome in individuals with dark skin tone.

REFERENCES

Correlation of Amount of Gingival Pigmentation with Gingival Biotype and Skin Pigmentation: An Observational Study


