

Correlation of the intensity of gingival melanin pigmentation with gingival inflammation – an observational pilot study

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Abstract

Melanin is a non-haemoglobin derived pigment formed by melanocytes, which are dendritic cells of neuroectodermal origin and located in the basal and spinous layers of the gingival epithelium. It is known that as a course of inflammation, free radicals are released which cause oxidative stress. Oral mucosal melanin has been shown to act as a defense barrier, thereby preventing oxidative stress by scavenging antioxidants. Thus, the aim of the present study was to correlate the intensity of gingival melanin pigmentation with the severity of gingival inflammation. **Materials and methods:** A total of 100 subjects with brownish to dark skin complexion between the age group of 18 to 60 were selected and were categorized as Group A (50 subjects) and Group B (50 subjects). Group A comprised of subjects with healthy gingiva and Group B comprised of subjects with moderate to severe periodontitis. The intensity of gingival melanin pigmentation was recorded using the Dummet-Gupta gingival melanin pigmentation index, and the severity of gingival inflammation was evaluated by the gingival index. **Results:** In Group B patients, the melanin pigmentation and gingival index scores showed a statistically significant weak inverse relationship between severity of gingivitis and level of melanin pigmentation. **Conclusion:** There is a correlation between the intensity of the gingival melanin pigmentation and gingival inflammation, thus suggesting that gingival melanin pigmentation has a protective role against gingival inflammation.

Key words: Free radicals, gingival inflammation, melanin granules, melanin pigmentation, oxidative stress

Introduction

Melanin is formed by melanocytes that are located in the basal and spinous layers of the gingival epithelium.¹ It is a non-haemoglobin-derived pigment which is known to appear in the oral tissues three hours after the birth. Their synthesis begins only when the melanin granules synthesized by melanocytes are transferred to keratinocytes.^{2, 3} This inter relationship between melanocytes and

keratinocytes has been called as the epidermal-melanin-unit by Fitzpatrick and Breathnach.⁴ The colour of the gingiva depends on the degree of epithelialization, the degree of the thickness of the epithelium, gingival vascularity and melanin pigmentation. Although the gingival melanin pigmentation is considered to be racial, it is accepted to be genetic.^{5,6,7} Moreover, oral mucosal melanin can act as defense barrier by preventing the oxidative

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stress.⁸ Thus, with this background, the aim of this study was to correlate the intensity of gingival melanin pigmentation to the severity of gingival inflammation.

Materials and methods

This observational pilot study was performed in the department of Periodontics, SDM Dental College, Dharwad, from 14th January 2017 to 5th February 2017. A total of 100 subjects with brownish to dark skin complexion between the age group of 18 to 60 were selected, and were categorized as Group A (50 subjects) and Group B (50 subjects). Group A comprised of subjects with healthy gingiva, and Group B with subjects having moderate to severe periodontitis (criteria as given by AAP 1999). The study design was explained to all the patients and an informed consent was obtained. The inclusion criteria comprised of subjects with healthy gingiva in Group A and subjects with moderate to severe chronic periodontitis in Group B. The exclusion criteria comprised of subjects with drug or chemical pigmentation on the gingiva, those with systemic diseases like type 1 diabetes mellitus which could produce gingival colour changes, subjects with syndromes, pigmentation disorders, chemical skin peeling and albinism, patients who had undergone any dental treatment in the past six months to one year and subjects with history of smoking or tobacco chewing. Two examiners were involved in this single blinded pilot study, where one examiner recorded only the gingival melanin pigmentation and the other recorded the plaque and gingival indices.

Skin colour was classified by performing the colour test according to the criteria adapted by Aina *et al.*,⁹ wherein the colour of the inner aspect of the upper arm was graded as fair, brown and dark. The present study included the subjects with brown and dark coloured skin complexion which was confirmed by interexaminer calibration, where both the examiners were adapted to see the daylight, and did agree with the specific skin colour of the subject. This method of assessing the skin colour is called as colour test.¹⁰ For evaluating gingival melanin pigmentation,¹¹ the gingiva of the maxillary and mandibular arches were each divided into 32 unit spaces; 16 on the

buccal and labial surfaces and 16 on palatal surfaces. Each unit space approximated the area of the marginal gingiva and extended from the gingival crest apically about 4mm to 5mm, up to the level of attached gingiva. The unit spaces did correspond to the buccal and lingual gingival areas. In cases with partially or completely edentulous areas, this division into 32 unit spaces was still maintained, since the oral pigmentation is independent of the presence or absence of teeth. The unit spaces were graded as follows:

- 0 = No clinical pigmentation (pink tissue)
- 1 = Mild clinical pigmentation (mild light brown colour)
- 2 = Moderate clinical pigmentation (medium brown or mixed pink and brown coloration)
- 3 = Heavy clinical pigmentation (deep brown or blue-black-tissue)

Following the assignment of ratings, the numerical estimates in the maxillary arch were totaled and divided by 32. The result was the Oral pigmentation index (DOPI) assessment for the maxillary arch. The mandibular arch was treated similarly. Thus, the DOPI assessment for maxillary and mandibular gingivae was calculated as the sum of assigned estimates of components divided by 32 unit spaces¹¹ according to the following scales:

- 0 = No clinical pigmentation of the gingivae
- 0.031 – 0.97 = Mild gingival pigmentation
- 1.0 – 1.9 = Medium gingival pigmentation
- 2.0 – 3.0 = Heavy gingival pigmentation

Assessment of plaque was done with plaque index (Silness and Lo)¹² depending upon the plaque at the gingival area of the tooth. The presence of gingival bleeding was determined by gingival index (Loe and Silness).¹³

Thus, the DOPI, plaque index and gingival index was evaluated separately for maxillary and mandibular arches, so as to evaluate the intensity of gingival melanin pigmentation to that of gingival inflammation.

Statistical Analysis: The results were subjected to statistical analysis, wherein spearman rank

correlation test was used to correlate the intensity of gingival melanin pigmentation to gingival inflammation.

Results

The present observational pilot study correlated the intensity of gingival melanin pigmentation to that of gingival inflammation. The descriptive statistics in healthy subjects (Group A) revealed a moderate gingival melanin pigmentation with mild plaque index and mild gingivitis (Table 1), while in the periodontitis subjects (Group B) there was a mild form of gingival melanin pigmentation with moderate plaque index and severe form of gingival inflammation (Table 2). The Spearman correlation between melanin pigmentation, scores of plaque index and gingival index showed a positive correlation (r-value 0.27 for plaque index score and r-value as 0.26 for gingival index scores) and a statistically significant p-value at 0.05 amongst healthy individuals (Table 3). In the diseased subjects, the Spearman correlation between melanin pigmentation and gingival index scores also showed a statistically significant weak inverse relationship between severity of gingivitis and level of melanin pigmentation (Table 4).

Table 1: Descriptive statistics of healthy individuals (Group A)

	Minimum	Maximum	Mean	Standard Deviation	Median
Age	18	51	23.88	7.31	
Melanin pigmentation	0.1	2.1	0.7	0.5	Moderate
Plaque Index scores	0.2	2.1	0.9	0.5	Mild
Gingival index scores	0	1.5	0.42	0.51	Mild

Table 2: Descriptive statistics of people with chronic periodontitis (Group B)

	Minimum	Maximum	Mean	Standard Deviation	Median
Age	20	65	40.7	12.74	
Melanin pigmentation	0	2.2	0.38	0.44	Mild
Plaque Index scores	0.3	3.1	1.73	0.68	Moderate
Gingival index scores	0.4	2.6	1.8	0.56	Severe

Table 3: Spearman correlation between melanin pigmentation, plaque index scores and gingival scores in among healthy individuals (Group A)

		Plaque index scores	Gingival index scores
Melanin pigmentation	Correlation Coefficient (r-value)	0.278	0.262
	Sig. (2-tailed) (p-value)	0.051	0.066
	N	50	50

Statistical Significance with p-value <0.05

Table 4: Spearman correlation between melanin pigmentation, plaque index scores and gingival scores among subjects with Chronic Periodontitis (Group B)

		Plaque index scores	Gingival index scores
Melanin pigmentation	Correlation Coefficient (r-value)	0.065	-0.301*
	Sig. (2-tailed) (p-value)	0.654	0.033
	N	50	50

Statistical significance with p-value <0.05

Discussion

Melanin is a pigment that is absorbed by light and gives colour to the mammalian tissues. It is a non-haemoglobin-derived pigment formed by the melanocytes that phagocytose melanin granules and impart the brownish-black discoloration on the gingiva.^{1,2} Its intensity depends on the activity of melanocytes, genetic trait and ethnic group.¹⁴

The present study made an attempt to correlate the intensity of gingival melanin pigmentation to gingival inflammation, wherein it was noticed that in Group A there was moderate degree of gingival melanin pigmentation with mild plaque index and mild gingivitis, which suggested that when there was more gingival melanin pigmentation, there was less plaque and mild gingival inflammation. In Group B, there was mild melanin pigmentation, moderate plaque index with severe gingivitis.

The findings in Group A are attributed to the protective role of melanin against inflammation, as the oral mucosal melanin acts as a defense barrier by binding to the free radicals and preventing oxidative stress.¹⁵ Free radicals play a potential role

in matrix destruction in inflamed periodontium.¹⁶ The presence of melanin results in the “respiratory burst” of phagocytosis, and protecting the gingiva against inflammation. Thus, the presence of melanin pigmentation plays a role in reducing the gingival inflammation.¹⁷ However, the mild gingivitis seen could be attributed to the mild plaque or local factors in the gingiva.¹³

The findings in Group B could be attributed to the extension of inflammation from the gingiva to the periodontium. In periodontal disease, oxygen derived from the free radicals activate neutrophil collagenase and initiate the matrix degradation. Thus, this sequel could minimize the melanin expression reducing its activity, further affecting its role as a scavenger against inflammation.⁸

Thus, there was a correlation found between the gingival melanin pigmentation and gingivitis, clinically in both the groups, and the results were statistically significant.

Conclusion

Within the limitations of this study, it can be concluded that there is a correlation between the intensity of the gingival melanin pigmentation and gingival inflammation, thus suggesting that gingival melanin pigmentation has a protective role against gingival inflammation. A similar study with a larger sample size is necessary to confirm the results of the present study.

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