ORIGINAL RESEARCH

Prevalence of Oral Melanin Pigmentation among Children of 4–14 Years of Age and its Association with Passive Smoking

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Abstract

Background: Smoking is one of the reasons for melanin pigmentation in the oral mucosa. This study was done to determine the prevalence of oral melanin pigmentation in children and its association with passive smoking.

Aim: To determine the prevalence of oral melanin pigmentation in children among 4–14 years of age and its association with passive smoking.

Materials and methods: This observational study was carried out among 600 children from oral health screening camps conducted in the government schools of Waghodia district, Vadodara, Gujarat. Gingival pigmentation was assessed on the basis of the Dummett oral pigmentation index (DOPI), and evaluation of exposure to environmental tobacco smoke (ETS) was done by taking through history.

Results: Gingival pigmentation was seen in 395 children (65.83%). The Chi-square analysis is used to find the significance of study parameters on the categorical scale. The analysis of variance (ANOVA) is used to find the significance of study parameters between the groups (intergroup analysis). About 23.50% showed no pigmentation, 24.80% showed mild clinical pigmentation, 23.50% showed moderate clinical pigmentation, and 26.30% showed heavy clinical pigmentation.

Conclusion: According to the result of this study, we could conclude that there is correlation between passive smoking and oral-melanin pigmentation in children.

Keywords: Children, Melanin pigmentation, Oral pigmentation, Passive smoking.

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Introduction

Oral pigmentation is discoloration of the oral mucosa and the gingiva that interferes with esthetics, of which melanin pigmentation is the most common form. Melanin pigmentation in the oral mucosa can be due to various local and systemic factors like physiological pigmentation, smoker's melanosis, pigmented nevus, melanotic macula, Addison's disease, Peutz-Jeghers syndrome, HIV infection, and drugs (minocycline and antimalarial drugs).[1] Prevalence of oral pigmentation in the Indians is about 89% and least prevalence is detected among Europeans, which is not more than 15%.[2,3] Changes in color of the oral mucosal surfaces can be of paramount significance as it frequently represents diagnostic evidence of either local or systemic disease.

Pigmentation is genetically acquired, but the intensity is influenced by physical, chemical, and hormonal factors. For example, all forms of tobacco, hormonal changes during puberty, and a variety of drugs have been shown to increase the intensity of physiologic pigmentation, presumably by stimulating melanin production.[4]

The exposure to environmental tobacco smoke (ETS) has been described as one of the major etiological factors to increase the gingival pigmentation in nonsmokers.[2] In children exposed to ETS, an increased incidence of caries and pigmentation of gingiva has been documented.[3]

In a developing country like India where no stringent smoke-free policies exist and where there is a whole slew of joint family systems that is increasing in presence, popularity, prevalence, and percentage in rural population, children are at a greater health risk when either one of the family member is a smoker. Chronic exposures to smoking cause accumulation of harmful substances like nicotine, cotinine, and other volatile components like acrolein and acetaldehyde. Nicotine has the tendency to accumulate in higher concentrations in melanin-containing tissues and thus people of Indian subpopulation are at a higher risk of nicotine accumulation in ETS exposure. Hence, gingival pigmentation can be a definitive, easy, as well as helpful method to assess and educate the parents for their child's health.[2]

The aim of the present study is to determine the prevalence of oral melanin pigmentation in children among 4–14 years of age and its association with passive smoking.

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Materials and Methods

The present study is an observational study. Oral health screening camps were conducted in the government schools of Waghodia district, Vadodara, Gujarat. A sample size of 600 was derived (sample size $n = [\text{DEFF} \times Np(1-p)]/[(d^2/Z^2_{1-\alpha/2} \times (N-1) + p \times (1-p)])$.

The purpose and nature of the study was explained to the participants and their parents prior to the study through a patient information sheet.

After taking an informed written consent from the school principals and patient's guardians in English/local language (Gujarati), the assent form was obtained from participants. All the necessary demographic details were recorded. Confidentiality of study subjects was maintained. Standard sterilization and infection control protocols were followed throughout the study period.

The principal investigator conducted oral examinations of the participants.

Children between age 4 years and 14 years were screened for the presence or absence of oral melanin pigmentation based on the selection criteria. Children with a healthy gingiva, i.e., absence of gingival inflammation or gingivitis, were included in the study. A brief history regarding dental trauma, drug therapy, and systemic illness was asked before oral examination.

Children absent on the day of screening and parents not willing to give a written consent were excluded from the study. Children included were completely healthy, did not take any medications, and did not report any past traumatic injuries. A child was interpreted as a member of a smoker family when at least one member of family smoked cigarette/s once at home in the presence of child within last 6 months or more.

Evaluation of Gingival Pigmentation

Gingival pigmentation was assessed by a single examiner and evaluated on the basis of the Dummett oral pigmentation index (DOPI).

Oral pigmentation index (DOPI)[5]

- No clinical pigmentation (pink-colored gingiva)
- Mild clinical pigmentation (mild light brown color)
- Moderate clinical pigmentation (medium brown or mixed pink and brown color)
- Heavy clinical pigmentation (deep brown or bluish black color)

Evaluation of Exposure to ETS

The parents/guardian were asked about tobacco smoking history for both the parents and other family members/caretakers.

Statistical Analysis

Collected data were analyzed using the SPSS software. Descriptive and inferential statistical analyzes were carried out. The level of significance was fixed at $p = 0.05$ and any value less than or equal to 0.05 was considered to be statistically significant. The Chi-square analysis was used to find the significance of study parameters on the categorical scale. The analysis of variance (ANOVA) was used to find the significance of study parameters between the groups (intergroup analysis).

Results

The presence or absence of gingival pigmentation in children can serve as a diagnostic tool to determine any underlining pathological condition such as passive smoking. It can also aid in educating and creating awareness among parents regarding the association between the oral health and passive smoking.

A total of 600 children between 4 years and 14 years of age were examined. Out of which 48.80% ($n = 307$) were females and 51.20% ($n = 293$) were males. The demographics distribution of children based on gender and age is as shown in Table 1.

On recording DOPI and exposure to environment tobacco smoke, the children were divided into four categories. And it was found that 23.50% ($n = 141$) showed no pigmentation, 24.80% ($n = 149$) showed mild clinical pigmentation, 23.50% ($n = 152$) showed moderate clinical pigmentation, and 26.30% ($n = 158$) showed heavy clinical pigmentation as shown in Table 2.

Using the Chi-square test, occurrence of clinical pigmentation was compared between male and female children as shown in Table 3. About 21.8% ($n = 67$) male children and 25.3% ($n = 74$) female children showed no clinical pigmentation. Mild clinical pigmentation was observed in 27.4% ($n = 84$) and 22.2% ($n = 65$) male and female children, respectively. Moderate clinical pigmentation was seen in 25.4% ($n = 78$) male children and 25.3% ($n = 74$) female children. Heavy clinical pigmentation was observed in 25.4% ($n = 78$ and 27.3% ($n = 80$) male and female children, respectively.

On recording history of ETS exposure, out of total children screened 44.5% ($n = 267$) children were exposed to ETS, whereas 55.5% ($n = 333$) were not exposed to ETS. From this observation, it can be noted that for children who were exposed to passive smoking, the relative risk was 1.23 and the attributed risk of oral pigmentation in passive smokers was 14%.

Table 1: Demographic characteristics of the study participants ($N = 600$)

Variables	*Subgroups*	*n*	*(%)*
Gender	Male	307	51.2
	Female	293	48.8
Age	4 years	50	8.3
	5 years	47	7.8
	6 years	58	9.7
	7 years	58	9.7
	8 years	59	9.8
	9 years	60	10.0
	10 years	55	9.2
	11 years	47	7.8
	12 years	51	8.5
	13 years	64	10.7
	14 years	51	8.5

Table 2: Distribution of study participants based on Dummett oral pigmentation index (DOPI) and exposure to environmental tobacco smoke (ETS) ($N = 600$)

Variables	*Subgroups*	*n*	*(%)*
DOPI	No clinical pigmentation	141	23.5
	Mild clinical pigmentation	149	24.8
	Moderate clinical pigmentation	152	25.3
	Heavy clinical pigmentation	158	26.3
ETS	Yes	267	44.5
	No	333	55.5

Table 3: Comparison of gender and clinical pigmentation using the Chi-square test

			DOPI visual				
			No clinical pigmentation	*Mild clinical pigmentation*	*Moderate clinical pigmentation*	*Heavy clinical pigmentation*	*Total*
Gender	Male	Count	67	84	78	78	307
		% within gender	21.8	27.4	25.4	25.4	100.0
	Female	Count	74	65	74	80	293
		% within gender	25.3	22.2	25.3	27.3	100.0
Total		Count	141	149	152	158	600
		% within gender	23.5	24.8	25.3	26.3	100.0

Chi-square value: 2.576; *p* value: 0.462

Table 4: Comparison of gender and environmental tobacco smoke using the Chi-square test

			ETS		
			Yes	*No*	*Total*
Gender	Male	Count	136	171	307
		% within gender	44.3	55.7	100.0
	Female	Count	131	162	293
		% within gender	44.7	55.3	100.0
Total		Count	267	333	600
		% within gender	44.5	55.5	100.0

Chi-square value: 0.010; *p* value: 0.919

Table 5: Comparison of environmental tobacco smoke and clinical pigmentation using the Chi-square test

			DOPI visual				
			No clinical pigmentation	*Mild clinical pigmentation*	*Moderate clinical pigmentation*	*Heavy clinical pigmentation*	*Total*
ETS	Yes	Count	65	75	56	71	267
		% within gender	24.3	28.1	21.0	26.6	100.0
	No	Count	76	74	96	87	333
		% within gender	22.8	22.2	28.8	26.1	100.0
Total		Count	141	149	152	158	600
		% within gender	23.5	24.8	25.3	26.3	100.0

Chi-square value: 5.822; *p* value: 0.121

Exposure to ETS of both genders was also compared. Here, the result seen was that female children were exposed more to ETS as compared to male children. The data are shown in Table 4.

On comparison of results between exposure to environmental smoke and clinical pigmentation, it was found that 202 children of both genders showed mild to severe clinical pigmentation who had positive ETS exposure history.

From this observation, it was noted that female children showed more clinical pigmentation as compared to male children as they are more exposed to ETS. But the difference was not statistically significant as shown in Table 5.

Discussion

Pigmentation of the gingiva basically is discoloration of the gingival tissue due to the physiological or pathological cause. Among all the oral pigmentation, melanin pigmentation is most commonly seen in children as well as adults. The degree of melanin pigmentation may vary with age, gender, skin color, race, habits, and other few environmental factors.

Presence of melanin pigmentation can be a concern for esthetics. This study suggests that children who are passive smokers have presence of mild to heavy melanin pigmentation.

Pigmentation was seen more in children whose parents were smokers compared to nonsmokers and where regularly exposed to ETS. Similarly, girls showed higher results of presence of pigmentation as compared to boys.

Two mechanisms have been hypothesized through which stimulatory substances reach the melanocytes by ETS; first mechanism is directly through the saliva, which affects the oral epithelium and the second mechanism hypothesized is inhalation of the smoke containing nicotine and its products, which stimulate melanocyte activity.[6] This mechanism is considered to be the main cause of oral pigmentation.

A case-control study by Hanioka et al.[3] in a Japanese population determined 61% of children with at least one smoking member among the family. Gingival pigmentation was observed in 71–78% of children in this study. The percentage of parents smoking was higher in children with gingival pigmentation (70–71%) than in those who lacked pigmentation (35%). Hence, this study suggested

that there is correlation between passive smoking and presence of pigmentation in the gingiva of children.

The dose-dependent relation between level of smoking and pigmentation of gingiva is yet not found. Studies need to be conducted extensively to find out this relationship.[7]

In spite of the fact that melanocytes are normal cells in the gingiva and there is an established relationship between skin color and gingival pigmentation, in children this may not be necessarily a sign of their parents smoking.[8] But gingival pigmentation in children may be an alarm for their family.[9]

Conclusion

Within the limitations of this cross-sectional observational study, we are able to conclude that there exists a correlation between oral melanin pigmentation in children who are exposed to ETS.

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