Intraoral distribution of oral melanosis and cigarette smoking in a Pakistan population

Muhammad Nadeem, Rabia Shafique, Ali Yaldram, Rodrigo López

Abstract

Aims: To assess the intraoral distribution of oral melanosis and its association with cigarette smoking. Material and methods: A cross-sectional study conducted during June 2009 in Karachi, Pakistan involving 378 adult volunteers aged 18-35 years attending a dental camp organized by Liaquat College of Medicine and Dentistry. A total of 440 subjects consulted in the outpatient department and 378 (86%) fulfilled the inclusion criteria and participated in the study. Information on demographic factors and dimensions of cigarette smoking was obtained using a questionnaire. Each subject received a clinical examination for the presence of melanosis on the buccal-lingual mucosa, gingiva, palatal tissue, and floor of the mouth. Statistics: Analyses included χ² statistics, the differences between proportions and the corresponding 95% confidence intervals for the differences between groups. Results: Both, the duration of smoking in years (χ²=24.6; P<0.001); the severity of smoking (χ²=68.6; P<0.001); and the type of cigarette (χ²=25.6; P<0.001) were significantly associated with the occurrence of melanosis. Among smokers, melanosis was more frequently found on the buccal mucosa (χ²=35.1; P<0.001); whereas among non-smokers the lingual mucosa was more frequently affected (χ²=0.02; P=0.53). Conclusion: There is a significant dose response relationship between oral melanosis and cigarette smoking.

Key words: Melanocytes; Melanosis; Pakistan; Smoking.

Received on: 21/07/2010 Accepted on: 13/10/2010

Introduction

The results of several studies have consistently suggested a strong association between melanin pigmentation of the gingiva and smoking (1-5) and the results from cross-sectional studies indicates that the prevalence estimates for this type of pigmentation ranges between 21% and 90% among cigarette smokers (1,6). The term smoker’s melanosis was coined by Hedin back in 1977 (7) and it has been hypothesized that this condition may be due to the physical effect of tobacco smoke on the oral tissues by heat and/or the direct effect of nicotine stimulating melanocytes located along the basal cells of the epithelium to produce more melanosomes, thus resulting in increased deposition of melanin (2,8).

While several authors have investigated the intraoral distribution of melanin pigmentation (1,2,4,6,9,10), most focus has been invested on the gingival tissues and smoking (2,6,10) and it is unclear whether the oral mucosa can be affected in a similar manner and whether the distribution of the lesions is different among non-smokers. In addition to this, while the results of several studies suggest the existence of a dose response in the relationship between melanin pigmentations and smoking, with heavy cigarette smokers presenting more frequently with pigmentations than mild smokers (1,4,10) and with subjects who have smoked cigarettes for longer periods of time presenting more frequently with melanin pigmentations than subjects who have been exposed for shorter periods of time (1,4,10), to the best of our knowledge, the potentially influential role of the type of cigarette smoked has not been investigated.

The aims of this study were to investigate the association between selected dimensions of exposure to cigarette smoking and oral melanosis and to explore the intra-oral distribution of melanin pigmentations according to smoking status in a young adult population of volunteers attending a free dental camp in Gulshan Town, Karachi, Pakistan for general dental checkups.

Materials and methods

The Department of Community Dentistry and Periodontology of the Liaquat College of Medicine and Dentistry in Karachi, Pakistan organized a dental camp in which people could consult for routine dental checkups at the Darul Sehat hospital during the month of June 2009. The hospital covers the rural and urban areas of Gulshan Town and counts with clinical facilities that provided the opportunity for conducting this cross-sectional study. The exercise did not include acute consultations due to pain or infections and was restricted to intraoral examination and advice to the
participants on how to improve and maintain their oral health. Participants were also informed on the presence of caries and/or need for dental scaling.

**Study population:** A total of 440 subjects aged 18-35 years consulting for check-ups were invited to participate in the study. Exclusion criteria included self-reported diabetes, self-reported hypertension, self-reported complains of bleeding gums, having received radiation therapy, having clinical signs of oral carcinoma, and history of pan and/or betel nut use. From the group of eligible subjects, 2 were excluded due to alcoholism, 20 because they presented with diabetes or hypertension, 27 were not excluded because of pan and/or betel nut consumption, and 5 were excluded due to concomitant oral carcinoma and/or exposure to radiation therapy. A total of 8 individuals did not want to participate in the study thus leaving 378 (86%) volunteers. The dimensions of cigarette smoking investigated included the type of cigarettes smoked (with or without filter), the duration of smoking in years (< 5 years, 5 to 9 years, 10 to 14 years and >14 years), and the number of cigarettes smoked. A subject was considered a cigarette smoker if she smoked at least one cigarette every day. No attempts were made to identify ex-smokers.

**Sample Size:** The sample size estimated for the study (n=323) was originally calculated considering a precision of 5%, a 95% level of the confidence interval, and assuming a 50% prevalence in the underlying referral population. Ethical Considerations: The study protocol was approved by the Department of Research and Ethics of the Liaquat College of Medicine and Dentistry Karachi and written informed consent was provided by each participant.

**Variables:** All participants filled a self-administered questionnaire containing information on age, gender, smoking status (current smoker/no smoker); the duration of smoking in years (< 5 yrs, 5-9 yrs, 10-14 yrs and > 14 yrs); and the type of cigarettes smoked (with or without filter).

Clinical outcome: A trained oral pathologist (AY) and a dentist (MN) who had been calibrated against the pathologist conducted all the clinical examinations. The examiners were blinded to information on smoking habits. Each participant was examined for the presence of melanosis in five areas of the mouth: 1) the buccal mucosa; 2) the lingual gingiva; 3) the buccal gingiva; 4) the hard and soft palate; and 5) the floor of the mouth. The term ‘oral pigmentation’ is frequently applied to a wide range of lesion or conditions featuring a change of colour of oral tissue. Lesions not associated with an accumulation of melanin pigment (e.g., Fordyce spots) were not classified as pigmented lesions (11). The presence of oral melanosis was dichotomized (Yes/No). For the purpose of the present analysis, the site with most prominent melanin pigmentation was considered at the individual level.

**Statistical Analysis:** We used $\chi^2$ statistics to compare overall differences between groups, the differences between proportions and the corresponding 95% confidence intervals for the differences between groups.

**Results**

The study group comprised 103 smokers and 275 non-smokers and a total of 1,890 sites were examined for the presence of melanin pigmentation. There were 40 (38.8%) pigmented sites among smokers and 26 (9.5%) sites affected among non-smokers.

Intraoral distribution of melanin pigmentation according to smoking status: Among smokers, pigmentations were most frequently found in the buccal mucosa (17.5%), while among non-smokers the lesions were more frequent in the lingual mucosa (5.5%). The second largest number of pigmented sites in smokers was found in the gingival area (7.8%) (Table 1).

<table>
<thead>
<tr>
<th>Sites</th>
<th>Smokers (n=103)</th>
<th>Non-Smokers (n=275)</th>
<th>Diff</th>
<th>95% CI</th>
<th>$\chi^2$ statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Buccal</td>
<td>18</td>
<td>17.5</td>
<td>4</td>
<td>1.5</td>
<td>16</td>
</tr>
<tr>
<td>Lingual</td>
<td>6</td>
<td>5.8</td>
<td>15</td>
<td>5.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Gingival</td>
<td>8</td>
<td>7.8</td>
<td>3</td>
<td>1.1</td>
<td>6.7</td>
</tr>
<tr>
<td>Palatal</td>
<td>6</td>
<td>5.8</td>
<td>2</td>
<td>0.7</td>
<td>5.1</td>
</tr>
<tr>
<td>Floor of the Mouth</td>
<td>2</td>
<td>1.9</td>
<td>2</td>
<td>0.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>38.8</td>
<td>26</td>
<td>9.5</td>
<td>29.4</td>
</tr>
</tbody>
</table>

$\chi^2$= Chi square statistics  
95% CI= 95% confidence intervals for the differences between groups  
Diff= Differences between proportions

Table 1. - Intraoral distribution of melanin pigmented sites according to smoking status
Distribution of melanin pigmentation according to the duration of smoking: The highest numbers of pigmented sites were observed in individuals who had smoked more than 14 years (67.5%). The occurrence of melanin pigmentation was similar for individuals who had smoked between 5 to 9 years and for those who had smoked 10 to 14 years (12.5%). The occurrence of pigmented sites was significantly associated with the duration of smoking in years ($\chi^2=24.56, p<0.001$) (Table 2).

<table>
<thead>
<tr>
<th>Duration of Smoking</th>
<th>Pigmented Smokers (n=40)</th>
<th>Non Pigmented Smokers (n=63)</th>
<th>Diff $\chi^2=24.56, df=3, p&lt;0.001$</th>
<th>95% CI for the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5 years</td>
<td>3</td>
<td>11</td>
<td>8</td>
<td>[28.7; 62.3]</td>
</tr>
<tr>
<td>5-9 years</td>
<td>5</td>
<td>12.5</td>
<td>7</td>
<td>[63.0; 88.4]</td>
</tr>
<tr>
<td>10-14 years</td>
<td>5</td>
<td>12.5</td>
<td>7</td>
<td>[63.0; 88.4]</td>
</tr>
<tr>
<td>&gt;14 years</td>
<td>27</td>
<td>67.5</td>
<td>47.6</td>
<td>[28.7; 62.3]</td>
</tr>
</tbody>
</table>

The intraoral distribution of melanin pigmentations differed for smokers and non-smokers, with smokers presenting most frequently with pigmentations on the buccal mucosa whereas non-smokers presented most frequently with pigmentations on the lingual mucosa. This finding is in agreement with previous findings reported for a Nigerian population (4), but deviate from the results of other studies in which the attached gingiva has been found to be the most common location for pigmentations among Swedish (1), Thai and Malaysian (6), and Turkish (9) smokers.

Our finding on the statistically significant association between the type of cigarette smoked (non-filtered) and higher frequency of melanin pigmentation is novel for the oral sites investigated but is in agreement with the results of a previous study concerning ‘reverse smoking’ suggesting that palatal mucosal changes are more frequent among users of non-filtered cigarettes (12). Our finding on the type of cigarette smoked may reflect an additional dimension of the severity of exposure to smoking. However, this should be interpreted with caution because the habit of smoking cigarettes without filter may also be related to unknown determinants of melanin pigmentation.
A limitation of this study is the inclusion of volunteers for dental check-ups because this strategy for selecting participants in a study is more likely to overestimate the occurrence of oral melanosis and other oral conditions because people with self-perceived oral conditions are more likely to consult than what would be expected for subjects in the underlying population of Karachi. However, while this may affect prevalence estimates, it is not likely to affect the results of the associations found in the study. It can also be seen as a limitation that no attempts were made to indentify ex-smokers. However, the disappearance of melanosis after reducing or quitting smoking has been reported in the literature (8) and we do not expect that earlier exposure to smoking among ex-smokers affects the results of this cross-sectional investigation.

Conclusion
Smokers presented more frequently with oral melanin pigmentation than non-smokers and the relationship suggested a dose-response effect. Oral melanosis among smokers was most commonly found on the buccal mucosa and subjects smoking non-filtered cigarettes were more commonly affected.

Acknowledgments
The authors appreciate the support received from the Liaquat College of Medicine and Dentistry Research Centre, in Karachi in the person of Professor Navid Rashid Qureshi and the input received from Darul Sehat Hospital during the organization of the dental camp. The statistical advice received from Professor Nazeer Khan is greatly appreciated.

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Source of Support: Liaquat College of Medicine & Dentistry, Conflict of Interest: None Declared