Original Article

ISSN: 1735-0344 *Tanaffos 2015; 14(2): 107-114*

TANAFFOS

Relationship of Gingival Pigmentation with Passive Smoking in Women

Elahe Moravej-Salehi [1], Elham Moravej-Salehi [2], Farnaz Hajifattahi [1]

[1] Department of Oral Medicine, Dental Branch, Islamic Azad University, Tehran, Iran, [2] Department of Operative Dentistry, Dental School, Shahed University, Tehran, Iran.

Received: 24 February 2015
Accepted: 27 May 2015

Correspondence to: Hajifattahi F
Address: Department of Oral Medicine, Dental Branch, Islamic Azad University, No 4, 10th Neyestan Street, Pasdaran Avenue, Tehran19486, Iran.
Email address: F_Hajifattahi@dentaliau.ac.ir

Background: Oral mucosal pigmentation is among the most common findings in smokers, affecting smile esthetics. Passive smoking significantly compromises the health of non-smoker individuals particularly women. The purpose of this study was to assess the relationship of passive smoking with oral pigmentation in non-smoker women.

Materials and Methods: This historical-cohort study was conducted on a case group of 50 married women who were unemployed, not pregnant, non-smoker, had no systemic condition causing cutaneous or mucosal pigmentation, were not taking any medication causing cutaneous or mucosal pigmentation and had a heavy smoker husband. The control group comprised of 50 matched females with no smoker member in the family. Both groups were clinically examined for presence of gingival pigmentation and the results were analyzed using chi-square and logistic regression tests.

Results: Gingival pigmentation was found in 27 (54%) passive smokers and 14 (28%) controls (P=0.01). The odds ratio (OR) of gingival pigmentation in women exposed to secondhand smoke of their husbands (adjusted for education and having a smoker parent at childhood) was 3 (95% confidence interval; CI: 1.26 – 7.09). House floor area was correlated with gingival pigmentation in female passive smokers (P=0.025).

Conclusion: This study was the first to describe the relationship between secondhand smoke and gingival pigmentation in women and this effect was magnified in smaller houses.

Key words: Gingiva; Melanin; Tobacco Smoke Pollution; Pigmentation; Women

INTRODUCTION

Oral pigmentation refers to color change of the oral mucosa and/or gingiva (1), which can be exogenous due to amalgam tattoo, lead toxicity, anti-malaria medications and cigarette smoke, endogenous and secondary to various diseases such as Addison's disease and HIV infection, or genetic in the form of a pigmented mole or physiological pigmentation (1, 2). Pigmentation can occur in different areas of the oral cavity such as in the gingiva, palate, labial mucosa, ventral surface of the tongue and rarely floor of the mouth; however, attached gingiva is the most commonly involved site (3). Gingival pigmentations are mainly due to the accumulation of melanin (4). Physiological pigmentation is race-dependent and is more frequent in dark-skinned individuals compared to light-skinned subjects (5). About 15% of Europeans have oral pigmentation and this rate reaches 80% in Asian populations (6). Its prevalence in adults is higher than in adolescents and in males higher than females (3). Prevalence of oral mucosal pigmentation in Iranians

reaches 27.9% (7). Melanin pigmentation of oral mucosa compromises esthetics particularly in patients with high smile line and pigmentation of anterior gingiva (8). The maxillary anterior gingiva is exposed during a full smile. Thus, any observer notices the difference between the normal gingiva and the pigmented area and this raises concerns. Also, gingival pigmentation may be a clinical manifestation of a systemic disease or a side effect of drug intake; thus, it may help in differential diagnosis of such conditions (9). Physiological pigmentation occurs symmetrically (10). Pigmentations due to genetic conditions such as Peutz-Jeghers syndrome, drug intake and hormonal disorders occur in multiple spots and in generalized form (1). However, gingival pigmentation in passive smoker children often manifests with single involvement of the papilla (11).

Smoker's melanosis (oral mucosal pigmentation) is among the most common lesions in smokers' mouth and 30% of Caucasian heavy smokers have oral melanin pigmentation (12). Melanin in the oral mucosa attaches to free radicals produced as the result of exposure to cigarette smoke and polycyclic compounds like nicotine and benzoperylene found in cigarette smoke, and prevents oxidative stress like a protective barrier. This explains its increased production by melanocytes (3, 4). Epidemiologic studies have demonstrated that secondhand smoke contains higher concentrations of toxic compounds particularly nicotine compared to the same amount of smoked tobacco (13). The association of passive smoking with early occurrence of asthma (9), lung cancer (14), death due to cardiac diseases (15), spontaneous abortion (16), changed normal flora of the mouth and nasopharynx and consequent upper respiratory tract infection, periodontal disease (17), decreased alveolar bone density (13), primary and permanent teeth caries (18, 19) and gingival pigmentation in children (9, 11) has been demonstrated in the literature. In 2005, Hanioka et al, in Japan for the first time demonstrated that increased melanin pigmentation of gingiva in children was related to exposure to secondhand smoke at home (11). A similar study by Hajifattahi in 2010 indicated increased gingival pigmentation in children of smoker parents compared to the control group (9).

Secondhand smoke can compromise the health of individuals at all ages (20). Hanioka et al. discussed that showing oral and dental problems due to active and passive smoking to smokers increases their motivation to quit smoking by at least 10%. This increase in motivation was 16.7% when a smoker subject witnessed gingival melanin pigmentation due to passive smoking in his/her family members (21). Also, it has been shown that between the two pictorial warnings on the cigarette packs showing a diseased mouth and a lung tumor, smokers mostly believe that the diseased mouth picture is more influential (22). Thus, gingival pigmentation and its adverse esthetic effects may be alarming for the families with a smoker member, focuses their attention towards the hazardous effects of cigarette smoke on the health of non-smokers and may enhance motivation to quit smoking. Considering the adverse effects of passive smoking on health and esthetics, the effect of passive smoke on adults, particularly women, must be investigated as well because the serious effects of cigarette smoke have reported to be more on the health of females compared to males (12). Considering the high prevalence of smoking among Iranian males and its lower prevalence among Iranian females (23), this study aimed to assess the relationship of gingival pigmentation with passive smoking in adult women for the first time.

MATERIALS AND METHODS

This historical cohort study was conducted on married women presenting to the dental clinic of School of Dentistry, Islamic Azad University in Tehran. After obtaining written informed consent, a data form was completed for subjects. Based on the results of a pilot study, 100 subjects were selected using purposive sampling. Fifty subjects were in the case and 50 subjects were in the control group.

The inclusion criteria were as follows: married women with no systemic disease causing cutaneous or mucosal pigmentation such as Addison's disease, Peutz-Jeghers

syndrome or HIV infection, not taking medications causing pigmentation like minocycline, anti-malaria drugs, anti-adrenocorticotropic hormone medications or contraceptives, unemployment, no pregnancy, no smoking and having a heavy smoker husband smoking a minimum of 10 cigarettes/day and smoking at least one cigarette at home once a day in their presence in the past six months. Fifty matched females with no smoker family member and no contact with any smoker outside the house comprised the control group.

Moreover, all subjects were questioned about having a smoker parent during childhood who smoked in their presence as well as their level of education. Level of education was divided into two groups of (I) high school diploma and higher, and (II) lower than high school diploma.

To further assess the correlation of passive smoking with gingival pigmentation, the followings were questioned from the passive smokers: (A) floor area of their home and (B) number of cigarettes smoked in their presence. Next, the mean value of responses to A and B in the study population was calculated and subjects were divided into two groups of upper and lower than the mean.

To classify the skin tone of subjects in the two groups of cases and controls, Healthy Mix foundation (Bourjois, France) was used. Skin tones #52 and lighter were considered as "light" and skin tones #53 and darker were classified as "dark" skin tones (9,24). The inner side of lower arm (25) was used for skin tone determination, because considering the Islamic dress code for women, this area is less commonly exposed to sunlight. Finally, skin tune distribution and age of subjects were matched in the two groups of cases and controls.

A trained examiner (oral medicine specialist) blinded to the study design and group allocation of subjects examined the attached gingiva of all understudy subjects and recorded the pattern and site of pigmentations. In terms of pattern, absence of a pigmentation macule was defined as "pattern zero", individual and single units of pigmentation were defined as "pattern one" and formation of at least one continuous band between two separate units next to each other was defined as "pattern two".

The obtained results were analyzed using the chi-square test and the logistic regression. We applied the logistic regression models for evaluation of the relationship of gingival pigmentation with passive smoking, level of education and having smoker parents during childhood. The results were expressed as OR with 95% CI. We used the chi-square test for evaluation of the relationship of gingival pigmentation in passive smokers with the floor area of their house, number of cigarettes smoked daily in presence of passive smoker, having smoker parents at childhood and skin tone. Also, chi-square test was used for evaluation of the differences in the pattern of gingival pigmentation between the case and control groups.

Data were analyzed using SPSS version 20.0 software (SPSS Inc., Chicago, IL, USA) and statistical significance was determined at $P < 0.05$.

RESULTS

A total of 100 married women were examined in the two groups of cases and controls. The mean age of subjects was 39.70± 8.76 years in the case and 39.72± 9.03 years in the control group. Characteristics of the study population in the control and case groups are presented in Table 1.In each of the case and control groups, 26 (52%) were light-skinned and 24 (48%) were dark-skinned. Thus, distribution of age and skin tone was similar in the two groups (P=0.9).

The logistic regression model showed a significant association between gingival pigmentation in women and exposure to secondhand smoke of husband taking into account the confounding effects of subject's level of education and having smoker parents during childhood (P=0.01). The OR of occurrence of gingival pigmentation in women exposed to passive smoke was 3 times the rate in controls (OR=3.0; 95% CI [1.26 – 7.09]) (Table 2).

Table 1. Characteristics of the study population in the control and case groups

Variables	Control (*n*=50)	Case (*n*=50)	Total (*N*=100)
	N(%)	*N*(%)	
Education			
High school diploma and higher	45(54.2)	38(45.8)	83
Lower than high school diploma	5(29.4)	12(70.6)	17
Smoker parents			
Yes	19(39.6)	29(60.4)	48
No	31(59.6)	21(40.4)	52
Gingival pigmentation			
Yes	27(65.9)	14(34.1)	41
No	23(39)	36(61)	59

Table 2. Association between gingival pigmentation in women and the study variables

Variables	*P*-value	OR	95% C.I for OR	
			Lower	Upper
Level of education	0.946	1.038	0.346	3.117
Smoker parent (at childhood)	0.994	1.003	0.432	2.332
Exposure to secondhand smoke of husband	0.012	3.001	1.269	7.098
Constant	0.008	0.387		

Among passive smokers, the pattern one of gingival pigmentation (individual units of pigmentation) had the highest prevalence (59.2% versus 40.8%); while in the control group, patterns one (individual units of pigmentation) and two (at least one continuous band between two individual adjacent units) were equally seen. However, the chi square test showed that this difference in pattern between the two groups was not statistically significant (P=0.3).

Evaluation of the site of gingival pigmentation revealed that the most common site of pigmentation was the labial gingiva in the anterior segment of both jaws. Some subjects had multiple sites of pigmentation in both jaws. Of the control subjects with pigmentation (n=14), 7 (50%) had pigmented gingiva in the anterior maxilla and 12 (85.7%) in the anterior mandible. These values were 21 (77.7%) in the anterior maxilla and 18 (66.6%) in the anterior mandible in the case group subjects with pigmentation (n=27). Buccal pigmentation (posterior) was only observed in one subject in each of the case and control groups. Distribution of study groups based on skin tone is presented in Table 3.

Table 3. Distribution of study groups based on skin tone

Skin tone	Group	Gingival pigmentation	
		No	Yes
		N(%)	N (%)
Light	Control	22(84.6)	4(15.4)
	Case	13(50)	13(50)
Dark	Control	14(58.3)	10(41.7)
	Case	10(41.7)	14(58.3)

Distribution of gingival pigmentation in female passive smokers based on the related factors is shown in Table 4. As seen, passive smokers with gingival pigmentation were exposed to higher number of cigarettes smoked in their presence daily (more than 6 cigarettes). Also, the frequency of having a smoker parent (at childhood) and dark skin tone in these subjects was higher. However, none of these differences were statistically significant. Subjects with gingival pigmentation were mostly living in small houses in terms of floor area (smaller than 78m^2) and the correlation in this regard was statistically significant (P=0.025).

Table 4. Distribution of gingival pigmentation in passive smokers based on the related factors

Related factors		Gingival pigmentation		P-value
		Absence (n=23)	Presence (n=27)	
Floor area of the house	More than 78m^2	15(65.2)	9(33.3)	0.025
	Less than 78m^2	8(34.8)	18(66.7)	
Number of cigarettes smoked daily in presence of subject	6 or less	17(74)	16(59.3)	0.3
	More than 6	6(26)	11(40.7)	
Having a smoker parent (at childhood)	No	10(43.5)	11(40.7)	0.9
	Yes	13(56.5)	16(59.3)	
Skin tone	Light	13(56.5)	13(48.1)	0.6
	Dark	10(43.5)	14(51.9)	

The frequency of living in small houses was 3.7 times higher in passive smokers with gingival pigmentation compared to passive smokers without gingival pigmentation (OR=3.7).

DISCUSSION

This study showed that smoking by the husband at home caused gingival pigmentation in female passive smokers. No similar study has investigated the effect of passive smoking on gingival pigmentation in adults and women. Moravej Salehi et al. concluded that passive smoking was correlated with gingival pigmentation in children, periodontal disease, tooth loss, decreased bone density, alveolar bone resorption, change in normal flora of the mouth, dental implant failure, primary and permanent tooth decay and delayed eruption of teeth (26). However, Tanaka et al. stated that secondhand smoke did not increase the prevalence of periodontal disease in women (27). In another study, the authors concluded that tooth loss in women exposed to the secondhand smoke of a companion smoking less than 10 cigarettes a day was not related to passive smoking (28). This indicates the need for further investigations in this regard.

In the current study, number of cigarettes smoked daily in the household in presence of understudy subjects and also floor area of the house which affects the concentration of cigarette smoke in the house were evaluated as two important factors determining the level of exposure of passive smokers to cigarette smoke. We did not find any significant association between number of cigarettes smoked daily in the household and development of gingival pigmentation in female passive smokers. Madani and Thomas did not find a significant correlation between number of cigarettes smoked by parents in the household and occurrence of gingival pigmentation in their children (29). This insignificant association may be due to our small sample size and possible differences in the type of cigarettes smoked (with or without filter). According to Nadeem et al, the relationship between exposure to direct cigarette smoke and oral pigmentation is dose-dependent (30). Sridharan et al. stated that gingival pigmentation increases in children exposed to cigarette smoke for more than 10 years (31). Sanders et al. stated that the correlation of severe periodontitis with cigarette smoke was dose-dependent, relating to the duration (hours) of exposure to secondhand smoke per week (32). Considering the differences in definitions of the dose of cigarette smoke provided by the previous studies and controversy in findings, further studies are required on this topic. However, none of the afore-mentioned studies paid attention to the place of smoking and only exposure to cigarette smoke was evaluated by them.

In the current study, for the first time in investigations on passive smoking, the floor area of the house of passive smokers was evaluated and it was revealed that smaller floor area of the house was significantly correlated with the occurrence of gingival pigmentation in women (due to higher concentration of smoke in smaller areas). A previous study on the relationship of indoor air pollution with risk of lung cancer concluded that living conditions of non-smoker women such as lack of a ventilation system, less window area and rarely having windows open were associated with development of lung cancer in these subjects (33). With regard to the previously confirmed increased risk of gingival pigmentation in passive smokers in small areas, smokers may consider smoking in areas far from their family members, in areas with open windows or well-ventilated areas.

The aim of this study was to assess the relationship between gingival pigmentation and passive smoking in adults, which has not been investigated before. Among adults, the married women were selected for the following reasons: With regard to the lower prevalence of smoking among women compared to men, the frequency of passive smoker women would be higher than men (34). It is known that the adverse effects of passive smoking on women's health are more significant than on men (12). The more significant adverse effects of passive smoking in the household compared to the workplace have been confirmed by Tanaka et al (28). Among family members, a

husband and wife usually spend the most time with each other; thus, the effects of exposure to secondhand smoke of husband would be greater on women's health compared to exposure to the secondhand smoke of parents during childhood.

Results did not reveal any significant difference between cases (passive smoker women) that had a smoker husband and a smoker parent in childhood compared to cases that had a smoker husband only. Considering the correlation of passive smoking with gingival pigmentation in children (9,11,29,31), our study finding may be due to the more significant effect of passive smoking on gingival pigmentation during adulthood and/or fading of the effect of passive smoking on gingival pigmentation during childhood over time; this issue is in need of further investigation.

Since oral mucosal pigmentation is more common and more widely distributed in dark-skinned individuals (1), in the current study subjects were matched in the two groups with light skin and dark skin. Among the previous studies, only Hajifattahi et al. paid attention to this issue in their study (9). The prevalence of gingival pigmentation in passive smokers was found to be 54% in our study; whereas, the prevalence of gingival pigmentation has reported to be 30% in heavy smokers of Caucasian population. This difference may be due to race and needs further investigation (6, 7).

One advantage of our study was accurate examination of subjects and detection of gingival pigmentation by a trained oral medicine specialist who was blinded to the group allocation of subjects.

Hanioka et al. reported that gingival pigmentation in passive smokers was in the form of separate, single units (11). In our study, the separate, single pattern was more commonly observed among passive smokers than the continuous pattern; but, this difference was not statistically significant. Further studies are required to assess patterns of pigmentation in passive smokers in details.

Labial gingiva of the maxilla and mandible was the most commonly pigmented area in female passive smokers; which is in accord with the findings of previous studies (3, 9).

Based on previous studies and the results of the current study, it seems that the effects of passive smoking on gingival pigmentation are through inhalation of cigarette smoke and its entry into the blood circulation. Generally, stimulants present in cigarette smoke have two main routes to reach gingival melanocytes: 1. Dissolution in the saliva and penetration through the mucous membranes and 2. Inhalation of cigarette smoke through the nose, its entry into the blood circulation and exerting indirect effects on melanocytes (1, 6, 11). Considering the significant effect of floor area of the house indicative of the effect of concentration of smoke on gingival pigmentation, the second route seems to be more acceptable.

It may seem that one limitation of this study was that actual smoking status of subjects was determined by asking them and there is a possibility that they might have lied about their smoking status. However, Barnea et al. reported that statements made by young adults regarding their smoking status had a high reliability of 88-100% (35). Smoking by women has a low prevalence in Iran (4.3%) (34). Also, the method used in our study to collect data was non-invasive and thus, did not affect the willingness of subjects to participate in the study. Moreover, all individuals were ensured about the confidentiality of their information.

One confounding factor in the current study was risk of exposure of control subjects to cigarette smoke in other places. We tried to minimize this effect by setting the inclusion criterion of unemployment. Also, Tanaka et al. indicated an association between tooth loss and passive smoking at home, and not in the workplace (28). Thus, it appears that exposure to cigarette smoke from minor sources is negligible.

In conclusion, we found a relationship between exposure to secondhand smoke and gingival pigmentation in women and this effect was magnified in smaller houses.

Acknowledgement

This article was based on a DDS thesis (thesis number 23405) by Dr. Elahe Moravej-Salehi, which was successfully completed under the supervision of Dr. Farnaz Hajifattahi. The authors are grateful to Dr. Siamak Sabour for his help with the statistical analysis.

Conflict of interest

The authors declare that they have no conflict of interest.

REFERENCES

1. Çiçek Y, Ertaş U. The normal and pathological pigmentation of oral mucous membrane: a review. ***J Contemp Dent Pract*** 2003; 4 (3): 76- 86.
2. Soliman MM, Al Thomali Y, Al Shammrani A, El Gazaerly H. The use of soft tissue diode laser in the treatment of oral hyper pigmentation. ***Int J Health Sci (Qassim)*** 2014; 8 (2): 133- 40.
3. Hedin CA, Axéll T. Oral melanin pigmentation in 467 Thai and Malaysian people with special emphasis on smoker's melanosis. ***J Oral Pathol Med*** 1991; 20 (1): 8- 12.
4. Eid HA, Syed S, Soliman AN. The role of gingival melanin pigmentation in inflammation of gingiva, based on genetic analysis. ***J Int Oral Health*** 2013; 5 (4): 1- 7.
5. Eisen D. Disorders of pigmentation in the oral cavity. ***Clin Dermatol*** 2000; 18 (5): 579- 87.
6. Unsal E, Paksoy C, Soykan E, Elhan AH, Sahin M. Oral melanin pigmentation related to smoking in a Turkish population. ***Community Dent Oral Epidemiol*** 2001; 29 (4): 272- 7.
7. Babaee N, Nooribayat S. Frequency of oral pigmentation in patients referred to Babol Dental School (2008-2009). ***The Journal of Qazvin University of Medical Sciences*** 2011; 15 (3): 87- 90.
8. Karydis A, Bland P, Shiloah J. Management of oral melanin pigmentation. ***J Tenn Dent Assoc*** 2012; 92 (2): 10- 5; quiz 16-7.
9. Hajifattahi F, Azarshab M, Haghgoo R, Lesan S. Evaluation of the Relationship between Passive Smoking and Oral Pigmentation in Children. ***J Dent (Tehran)*** 2010; 7 (3): 119- 23.
10. Regezi JA, Sciubba JJ, Jordan RCK. Oral pathology: clinical pathologic correlations. 4th ed. Saunders, Philadelphia; 2003. p.129.
11. Hanioka T, Tanaka K, Ojima M, Yuuki K. Association of melanin pigmentation in the gingiva of children with parents who smoke. ***Pediatrics*** 2005; 116 (2): e186- 90.
12. Vellappally S, Fiala Z, Smejkalová J, Jacob V, Somanathan R. Smoking related systemic and oral diseases. ***Acta Medica (Hradec Kralove)*** 2007; 50 (3): 161- 6.
13. El_Batran MM, Soliman NL, Mikael FF. Passive smoking and alveolar bone density. ***Aust J BasiApplSci*** 2009; 3(2): 713-9.
14. Kurahashi N, Inoue M, Liu Y, Iwasaki M, Sasazuki S, Sobue T, et al. Passive smoking and lung cancer in Japanese non-smoking women: a prospective study. ***Int J Cancer*** 2008; 122 (3): 653- 7.
15. Kaur S, Cohen A, Dolor R, Coffman CJ, Bastian LA. The impact of environmental tobacco smoke on women's risk of dying from heart disease: a meta-analysis. ***J Womens Health (Larchmt)*** 2004; 13 (8): 888- 97.
16. George L, Granath F, Johansson AL, Annerén G, Cnattingius S. Environmental tobacco smoke and risk of spontaneous abortion. ***Epidemiology*** 2006; 17 (5): 500- 5.
17. Brook I. The impact of smoking on oral and nasopharyngeal bacterial flora. ***J Dent Res*** 2011; 90 (6): 704- 10.
18. Shenkin JD, Warren J. Secondhand smoke may be associated with an increased risk of primary tooth caries. ***J Evid Based Dent Pract*** 2009; 9 (2): 95- 6.
19. Ayo-Yusuf OA, Reddy PS, van Wyk PJ, van den Borne BW. Household smoking as a risk indicator for caries in adolescents' permanent teeth. ***J Adolesc Health*** 2007; 41 (3): 309- 11.
20. Vainio H. Is passive smoking increasing cancer risk? ***Scand J Work Environ Health*** 1987; 13 (3): 193- 6.
21. Hanioka T, Tsutsui A, Yamamoto M, Haresaku S, Shimada K, Watanabe T, et al. Impact of various effects of smoking in the mouth on motivating dental patients to quit smoking. ***Int J Stat Med Res*** 2013; 2(1): 40-6.
22. Environics Research Group Ltd. Final Report: Evaluation of New Warnings on Cigarette Packages. Toronto, Canada: Canadian Cancer Society Focus Canada; 2001:33.

23. Sarraf-Zadegan N, Boshtam M, Shahrokhi S, Naderi GA, Asgary S, Shahparian M, et al. Tobacco use among Iranian men, women and adolescents. ***Eur J Public Health*** 2004; 14 (1): 76- 8.
24. Jahangiri L, Reinhardt SB, Mehra RV, Matheson PB. Relationship between tooth shade value and skin color: an observational study. ***J Prosthet Dent*** 2002; 87 (2): 149- 52.
25. Tamai Y, Tsuji M, Wada K, Nakamura K, Hayashi M, Takeda N, et al. Association of cigarette smoking with skin colour in Japanese women. ***Tob Control*** 2014; 23 (3): 253- 6.
26. Moravej-Salehi E, Moravej-Salehi E, Hajifattahi F. Passive Smoking: Oral and Dental Effects. ***Iran J Public Health*** 2015; 44 (4): 600- 1.
27. Tanaka K, Miyake Y, Hanioka T, Arakawa M. Active and passive smoking and prevalence of periodontal disease in young Japanese women. ***J Periodontal Res*** 2013; 48 (5): 600- 5.
28. Tanaka K, Miyake Y, Sasaki S, Ohya Y, Miyamoto S, Matsunaga I, et al. Active and passive smoking and tooth loss in Japanese women: baseline data from the osaka maternal and child health study. ***Ann Epidemiol*** 2005; 15 (5): 358- 64.
29. Madani SM, Thomas B. Evaluation of gingival pigmentation in children exposed to and not exposed to environmental tobacco smoking. ***SRM J Res Dent Sci*** 2014; 5 (1): 21- 5.
30. Nadeem M, Shafique R, Yaldram A, López R. Intraoral distribution of oral melanosis and cigarette smoking in a Pakistan population. ***Int J Dent Clin*** 2011; 3 (1): 25-8.
31. Sridharan S, Ganiger K, Satyanarayana A, Rahul A, Shetty S. Effect of environmental tobacco smoke from smoker parents on gingival pigmentation in children and young adults: a cross-sectional study. ***J Periodontol*** 2011; 82 (7): 956- 62.
32. Sanders AE, Slade GD, Beck JD, Agústsdóttir H. Secondhand smoke and periodontal disease: atherosclerosis risk in communities study. ***Am J Public Health*** 2011; 101 Suppl 1: S339- 46.
33. Mu L, Liu L, Niu R, Zhao B, Shi J, Li Y, et al. Indoor air pollution and risk of lung cancer among Chinese female non-smokers. ***Cancer Causes Control*** 2013; 24 (3): 439-50.
34. WHO report on the global tobacco epidemic? Implementing smoke-free environments. 2009;1-568.
35. Barnea Z, Rahav G, Teichman M. The reliability and consistency of self-reports on substance use in a longitudinal study. ***Br J Addict*** 1987; 82 (8): 891- 8.