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ORIGINAL ARTICLE

The Prevalence and Extent of Physiological and Pathological Gingival Pigmentation in Patients Visiting Riyadh Elm University Clinics

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ABSTRACT

Background: Gingival pigmentation presents as a diffuse deep discoloration or as irregularly shaped brown and light brown or black patches, striate, or strands. It is generally agreed that pigmented areas are solely present when melanin granules, synthesized by melanocytes, are transferred to keratinocytes.

Aim: To study the prevalence, extent, and etiology of gingival pigmentation among Riyadh Elm University clinics' attendees.

Design and Settings: Examinations were done in Riyadh Elm University by four calibrated examiners.

Methods: Patients underwent a Gingival Index examination, followed by an assessment of the presence or absence of gingival pigmentations. If the latter were present, the patient underwent a Hedin's Melanin Index, a Gingival Melanosis Record, and a Von Luschan Scale examination to evaluate the extent, distribution, and color of the pigmentation.

Statistical analysis: Cohen's Kappa Test and Chi-Square Test

Results: A total of 139 (80.3%) patients had gingival pigmentation, of which 79 (56.8%) were males. Gingival pigmentations were found in 42 (93.3%) cigarette smokers, 40 (83.3%) hubbly bubbly smokers, and 20 (86.9%) electronic cigarette smokers. Both arches were affected in 102 patients, the canines' area had the highest incidence of pigmentation (88.9%) while the molars had the least incidence (18.1%). Scores of 2 and 3 on the Hedin's Index were the highest at 51 and 52 patients respectively. The mean color of the pigmentations on the Von Luschan scale was 21.49 ± 4.59, but it was higher for smokers and patients with severe inflammation.

Conclusions : Gingival pigmentation was more prevalent among all types of smokers—cigarettes, hubbly bubbly, and e-cigarettes compared to non-smokers. More pigmentations were also associated with the higher intake. The major patterns of pigmentation distribution were the short-connected-continuous ribbons and the more-than-two-solitary-papillae.

Keywords: Gingival Pigmentation, Hedin's Index, Color, Distribution, Smokers

INTRODUCTION

Pigmentations refers to the color change in the oral mucosa and are commonly found in the oral cavity due to physiological and pathological factors (1). Gingival pigmentation was defined as a diffuse discoloration appearing as a brown, light brown, or black patch as a result of melanin granules that are initially produced by melanoblasts. These pigmentations are more frequently present among darker-skinned individuals compared to lighter-skinned ones[2].

One of the characteristics of an attractive smile is having healthy gingiva; that is, a perfect color, shape, and position of the gingiva around the teeth. In this regard, a healthy gingiva depends on the number & size of the vasculature, epithelial thickness, degree of keratinization, and pigments within the gingival epithelium[3].

Gingival pigmentation is predisposed by multiple factors which can either be of a melanocytic or a non-melanocytic origin (4). The term physiological pigmentation refers to pigmentation caused by an increased melanin count in the gingival tissues. This process is genetically determined and does not reflect any systemic disease[5]. Other pigmentations, however, may be associated with systemic conditions, smoking, iatrogenic causes, or oral lesions[6,7].

This study aimed to evaluate the prevalence, extent, and etiology of gingival pigmentation among patients attending Riyadh Elm University (REU) clinics.

MATERIAL AND METHODS

Design and settings: Patients' examination conducted in this cross-sectional study were completed at REU clinics where a convenience sampling method was used to choose patients.

Data collection: Two examiners were calibrated to limit any intra-examiner or inter-examiner discrepancies associated with Cohen's Kappa test that is used to measure the degree of agreement between multiple readings. The readings' values ranged between 0.83 and 0.89; that is, an "almost perfect agreement" was found between the readings according to the classification set by Viera et al. (8). The calibrated examiners handled the assessment of all patients. A short questionnaire was used to collect the patients' medical and dental histories, their awareness of the pigmentation affecting their gingiva, and their self-perception.

Patients' assessment: Initially, patients underwent a Gingival Index examination[9] to assess for the presence or absence of gingival inflammation. Examined teeth included "Ramfjord teeth" or their substitutes, and each patient was given a final grade representing the severity of his/her gingival inflammation. Additionally, patients underwent a visual inspection of the gingiva using the Hedin's Melanin Index to evaluate the quality of the pigmentation[10]. The Gingival Melanosis Record (GMR) was also used to evaluate the quantity and extent of the pigmentation. The Von Luschan

Scale was used during the assessment to classify the patients' skin tone and pigmentation[11].

The clinical examination included all the teeth up to the 1st molars in both arches. As for the GMR, each arch was divided into 24 sections, with each tooth being divided into two sections, the first extending from the interdental papilla of one side of a tooth to the midline of the tooth, and the second extending from the midline of the tooth to the other interdental papilla. Finally, the GMR was calculated for each patient by dividing the number of affected sections over 42 sections for both arches.

Data analysis: The Hedin's Melanin Index utilizes the interdental papillary areas as starting points. This index gives the term "Solitary Units" to pigmentations limited to the interdental papillae only. "Continuous Ribbons" is used for pigmentations extending between two solitary units. A zero to four scoring system was used— a score of zero signified the absence of pigmentation; a score of one referred to one or two solitary papilla units being affected; a score of two meant that more than two solitary papilla units were affected; a score of three implied that connected short continuous ribbons were affected; while a score of four meant that the connected long continuous ribbon was affected by the pigmentation.

RESULTS

Patients characteristics: In this study, a total of 173 patients were examined; of which 91 (52.6%) were males and 82 (47.4%) were females. The age of patients ranged between 14 and 66 years (32.37 years ± 10.99). Around two-thirds of the patients, 116 (67.1%), were smokers—45 (26%) patients smoked cigarettes, 48 (27.7%) smoked hubbly bubbly, and 23 (13.3%) patients smoke electronic cigarettes. Simultaneously, 86 (49.7%) others were passive smokers having smokers in their households.

The majority of cigarette smokers were smoking more than 5 cigarettes daily where 12 (26.6%) patients smoked 1-5 cigarettes daily, 18 (40%) smoke 5-10 cigarettes daily, 16 (35.5%) smoke more than 10 cigarettes daily. The frequency of doing hubbly bubbly was also variable among its users where the majority, 32 (66.7%), smoke it once daily, 11 (22.9%) smoke it twice daily, and 5(10.4%) smoke it more than twice daily.

Patients' medical history was also reviewed, where it was found that 15 (8.7%) patients had some kind of vitamins deficiency, 3 (1.7%) patients had hypothyroidism, 23 (13.3%) patients had an individual condition (e.g., pregnancy, hypertension, diabetes mellitus, etc.).

Gingival pigmentation occurrence: Out of the 173 observed patients, 139 (80.3%) had gingival pigmentation, the majority of which were males 79 (56.8%) (P = 0.023). The majority of affected patients, 96 (69%), were not interested in treating the gingival pigmentation. Furthermore, around 24 (13.9%) persons of all observed patients noticed gingival pigmentation in a family member. Around 23 (95.8%) of patients who have noticed gingival pigmentation in another family member had the disease themselves.

Almost all of the patients who smoked cigarettes, 42 (93.3%), had gingival pigmentation (P = 0.011). Around 10 (90.9%) patients who had 1 to 5 cigarettes daily had gingival pigmentation (P = 0.69), 16 (89%) of those who have smoked 5 to 10 cigarettes daily gingival pigmentation (P = 0.53), and all of the patients who have smoked more than ten cigarettes daily had gingival pigmentation (P = 0.044). More than three-quarters of those who have smoked hubbly bubbly, 40 (83.3%), had gingival pigmentation; yet, no significant association was found between smoking hubbly bubbly and gingival pigmentation (P = 0.54) . However, the occurrence of gingival pigmentation did not differ based on the frequency of smoking hubbly bubbly although it was evident in 29 (96.2%) of those who have smoked it once daily (P = 0.105) , in 8 (72.7%) who have smoked it twice daily (P = 0.45), and in 4 (80%) patients who have smoked it more than twice daily (P = 0.67) . In addition, around two-thirds, 20 (62.5%), of those who have smoked electronic cigarettes had gingival pigmentation though not statistically significant (P = 0.57). Finally, around 72 (51.8%) of the patients with gingival pigmentation had smokers in their household; however, the number of smokers did not affect the incidence of gingival pigmentation (Table 2).

Gingival pigmentation occurrence was also varied based on the patients' medical conditions where it impacted 10 (66.7%) of patients who had some kind of vitamins deficiency, all hypothyroidism patients,

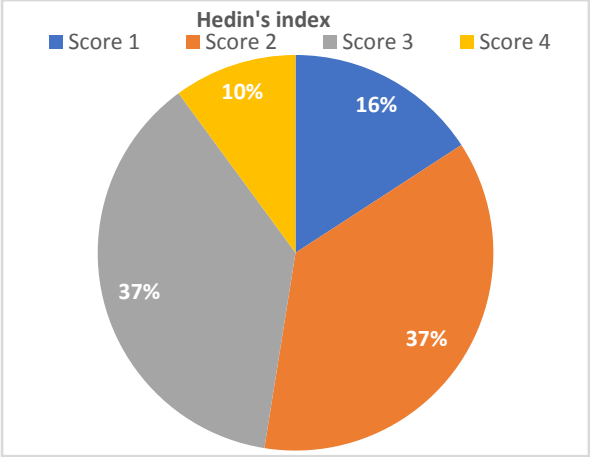

Fig.1: Hedin's Index of Gingival Pigmentation

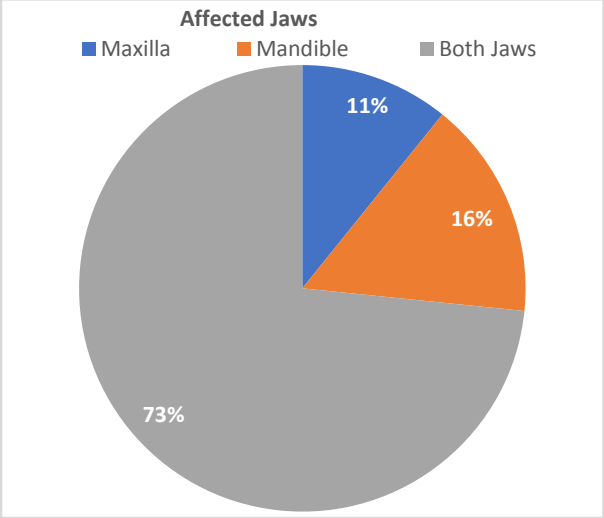

Fig.2: Gingival Pigmentation Distribution Based on the Affected Jaws

Only 61 (43.8%) patients were aware that they had gingival pigmentation; 35 (57.4%) of them were bothered by the pigmentation while the other 26 (42.6%) were not. Yet, the majority of gingival pigmentation patients, 103 (74.1%), reported having no related medical conditions.

Gingival pigmentation characteristics: Examining the gingival pigmentation using the Hedin's Index showed 22 (15.8%) patients had a score of one, 51 (36.7%) had score of two, 52 (37.4%) had a score of three, and 14 (10.1%) had a score of four.

The pigmentation was only affecting the Maxilla in 15 (10.7%) patients, the Mandible only in 22 (15.8%) patients, and both arches in 102 (73.4%) patients. As for the affected teeth, the canines were mostly affected 124 (88.9%), followed by the incisors at 100 (72.2%), the premolars at 89 (63.9%), and the least were the molars at 25 (18.1%) of the patients (Fig.1,2,3).

Association between gingival pigmentation and inflammation: The gingival index of the 173 examined patients showed that all but one had some degree of gingival inflammation, 77 (44.5%) had "Mild Inflammation" with 58 (75.3%) having gingival pigmentation, 82 (47.4%) had "Moderate Inflammation" with 69 (84.1%) having gingival pigmentation, and 13 (7.5%) had "Severe Inflammation" with 12 (92.3%) having gingival pigmentation. When the color of the pigmentation was compared within the groups, it showed that all the groups had almost similar GMR but the "Severe Inflammation" group had a higher mean of Pigmentation Color at 26.38 ± 9.03 on the Von Luschan Scale compared to 18.87 ± 11.29 for the "Mild Inflammation" group, and 22.49 ± 10.63 for the "Moderate Inflammation" group, with the difference being statistically significant (P = 0.001) (Table 2).

The mean of the Von Luschan Scale readings for patients with gingival pigmentation was 21.49 ± 4.59 which is slightly greater than that of patients who did not have any gingival pigmentation at 20.35 ± 3.49. The mean of Von Luschan color chart for the gingival pigmentation itself was 25.94 ± 4.68. The GMR and the Pigmentation Color were higher for cigarette smokers compared to non-smokers (P < 0.01), and a significant association was observed between the number of consumed cigarettes and the means of the GMR (P = 0.001) and the Pigmentation Color (P = 0.005). The same findings were observed among hubbly bubbly smokers (0.037) and e-cigarette smokers (0.001).

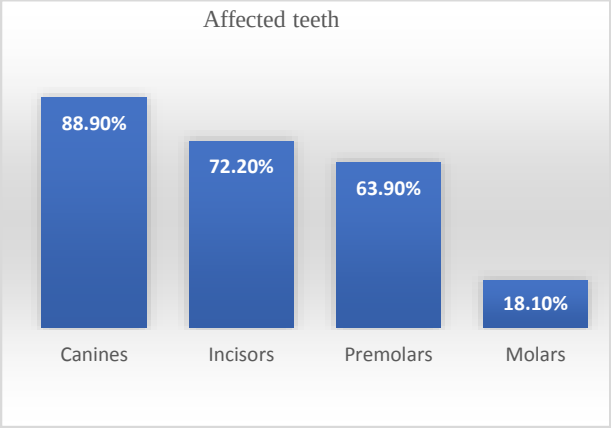

Fig 3: Gingival Pigmentation Distribution Based on the Affected Teeth

Table 1: Characteristics of gingival pigmentation patients (n=139)

Variable		N (%)	p-value
Gender	Male	79 (56.8%)	0.024
	Female	60 (43.2%)	
Smokers	Cigarette	42 (30.2%)	0.011
	Hubbly bubbly	40 (28.8%)	0.54
	e-cigarette	20 (14.4%)	0.57
Frequency of cigarette smoking	None	97 (69.8%)	0.011
	1-5	10 (7.2%)	0.69
	5-10	16 (11.5%)	0.53
	More than 10	16 (11.5%)	0.044
Frequency of hubbly bubbly smoking	None	98 (70.5%)	0.29
	Once	29 (20.9%)	0.105
	Twice	8 (5.7%)	0.45
	Thrice	4 (2.9%)	0.67

Table 2: Means of the GMR and Pigmentation Color for Different Factors (n=173)

	N	Gingival Melanosis Record (GMR)		p-value	Pigmentation Color		p-value
		Mean	Std. Dev		Mean	Std. Dev	
Non-Cigarette Smokers	128	1.97	1.24	< 0.001	19.39	11.67	< 0.001
Cigarette Smoker	45	2.75	0.71		25.71	7.59	
1 to 5 Cigarettes	11	2.73	0.91	0.001[a]	24.09	8.47	0.005[a]
5 to 10 Cigarettes	18	2.67	0.77		24.11	9.46	
More than 10 Cigarettes	16	2.88	0.5		28.63	2.42	
Non-Hubbly Bubbly Smokers	125	2.06	1.21	0.037	20.8	11.3	0.65
Hubbly Bubbly Smokers	48	2.46	1.05		21.67	10.61	
Once	32	2.56	0.95	0.19[a]	23.47	8.44	0.365[a]

Twice	11	2.18	1.25		17.18	12.09	
More than Twice	5	2.4	1.34		23.2	13.27	
Non-E-Cigarette Smokers	150	2.07	1.2	0.001[b] (should have been >0.05)	20.71	11.21	0.193[b] (>0.05)
E-Cigarette Smokers	23	2.89	0.62		23.22	10.25	
Mild Inflammation	77	1.96	1.23	0.016[a] (<0.05)	18.87	11.29	0.001[a] (<0.05)
Moderate Inflammation	82	2.39	1.09		22.49	10.63	
Severe Inflammation	13	2.23	1.09		26.38	9.03	

[a] Kruskal wallis [b] Mann-whitney

DISCUSSION

A good smile reflects in everyone's self-confidence, kindness, and beauty, with the lips and gingiva being key components. Nowadays, with the high demand for esthetics, the gingival pigmentation may appear un-aesthetic. Even if it is not considered a medical problem, but rather a cosmetic problem that can affect the patient's psychology; especially when it is associated with a high smile line or excessive gingival display[5]. The gingiva is considered the most frequently pigmented tissue in the oral cavity[1], there are a lot of factors that can cause pigmentations, ranging from physiological to lifestyle habits (e.g., smoking) to some drugs (e.g., oral contraceptives, hormones, drugs used in chemotherapy)[12]. No variations were found between males and females regarding the prevalence of gingival pigmentation, which echoes the reported findings in the literature[1].

Health professionals identify visible signs of pigmentation in the lips and gingiva among smokers[13]. Smoking has been accepted as a major risk factor for gingival pigmentation[5,14,15], which was also evident in this study in which a greater number of smokers exhibited pigmentation than non-smokers. This could be attributed to the nicotine and benzopyrene content of tobacco smoke which stimulates melanin production from the melanocytes[16]. Indeed, the percentage of melanin pigmentation in different populations has been described to vary between 0% and 89% concerning ethnic factors and smoking habits[17].

Moreover, earlier findings suggest an age-related difference in smoking-induced gingival pigmentation, where it is more significantly evident among younger patients due to increased melanin production (18). A marked decline in gingival pigmentation through smoking cessation is also less prominent among younger patients[19]. More importantly, children are also at increased risk for gingival pigmentation if their parents smoke, due to passive smoking[12].

E-cigarettes are used to stop or reduce smoking consumption of traditional cigarettes[20]. In this study, 20 out of the 23 patients who smoke e-cigarettes had gingival pigmentation, which falls in agreement with the findings of a study that aimed to compare pigmentation among previous smokers and e-cigarette smokers. It is noteworthy that no significant reduction of pigmentation was found among e-cigarette group which negates its benefit in this sense[20].

It was observed that 49.7% of passive smokers had gingival pigmentation, which falls in agreement with a study that found a relationship between exposure to secondhand smoke and gingival pigmentation with a higher prevalence in females and smaller households[1].

It was observed that the highest prevalence of pigmentation was in both arches, the anterior areas were more frequently affected. These agree with the literature as it is reported that the labial gingiva of the anterior segment of both jaws is the most commonly affected site by gingival pigmentation[1]. It was also reported that a localized gingival pigmentation due to Amalgam restoration (Amalgam tattoo) can occur most frequently in the posterior areas[21].

Furthermore, it was reported that the pigmented healthy gingiva and gingivitis showed no significant difference in the gingival pigmentation features between the groups[22]. This opposes the study's findings, as most of the severe inflammation patients had pigmentations and the color of the pigmentations were darker compared to the mild and moderate inflammation groups.

Finally, around half of the patients who were aware of the pigmentation, 40.5%, were not willing to seek any medical treatment to remove it. It could be due to their perspective that there is no need for treatment as long as their smiles and esthetics are not affected. Their treatment refusal was also independent of the type of the presented treatment options which include—abrasion, scrapping, cryosurgery, scalpel technique, electro-surgery, and lasers[23].

CONCLUSION

Gingival pigmentation affected all types of smokers—cigarettes, hubbly bubbly, and e-cigarettes more frequently than it affected non-smokers with an increased pigmentations with higher intake. The major patterns of pigmentation distribution were the short connected continuous ribbons and the solitary papillae. The distribution was highest in both jaws, and the canines' areas, followed by the incisors' area. Pigmentations were also darker in smokers and patients with severe gingival inflammation.

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