



Gingival Pigmentation among E-cigarette Smokers in Vaping Community in Palembang

Muhammad Thareq Afif Ayuti^{1*}, Sulistiawaty¹, Bambang Nuryadi¹

¹Dentistry Study Program, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

*Correspondence author email:sulistiawati@fk.unsri.ac.id

Abstract

Introduction: Gingival pigmentation is a color alteration of gingiva caused by melanin produced by melanocytes. The etiologic factors include genetic, local, and systemic factors. One of the local factors is the smoking habit. The liquid content in e-cigarettes could cause gingival pigmentation. **Purpose:** To describe gingival pigmentation in electric smokers. **Methods:** This was a descriptive survey with the cross-sectional approach, involving 35 respondents from the vaping community in Palembang, using consecutive sampling and quota sampling techniques. The research instrument was using a questionnaire on google form to observe the gingival pigmentation. **Results:** The frequency distribution of gingival pigmentation was 82.9% of respondents experienced gingival pigmentation and 17.1% of respondents did not experience gingival pigmentation. **Conclusion:** Gingival pigmentation was found in most heavy e-cigarette smokers in the vaping community in Palembang. Visually, the color changes in gingiva were darker in dual-use smokers than the e-cigarette smokers alone. However, the difference was not statistically significant.

Keywords: E-cigarette; Gingival pigmentation; Nicotine

Introduction

Gingival pigmentation is the coloration of the gingiva caused by excessive melanin deposition in the basal and suprabasal cell layers of the epithelium.¹ The degree of pigmentation varies from one person to another and depends on various factors. In general, gingival pigmentation can be caused by endogenous and exogenous factors, and can be classified into physiological and pathological. One of pathologic gingival pigmentation is related to smoking habit.¹

Various ways are used to smoke tobacco including using cigarettes, cigars, water pipes, bidis and kreteks. Tobacco cigarettes contain nicotine which can cause melanosis on the gingiva because the polycyclic compounds contained in nicotine stimulate melanocytes to produce excess melanosomes that lead to increased deposition of melanin pigment.² A previous study involved subjects who used filter cigarettes, and the results showed that all participants had gingival pigmentation.² Another study involving 109 smokers and an equal number of non-smoker controls showed that all the smokers



who smoked at least once a day at the time of the study had lip and gingival pigmentation.³

Alternative nicotine products appeared on the market in the early 2000s and attracted public interest, including electronic nicotine delivery systems (ENDS), one of the most common is electronic cigarettes (E-cigarettes). This nicotine delivery system is an electronic device that replaces the burning process of tobacco leaves with liquid which is converted into hot and moist vapor inhaled by the user.⁴ E-cigarette companies claim the resulting vapor is free of thousands of toxic chemicals and carcinogens known to be produced by combustion in cigarettes, hence it is advertised as healthier than conventional cigarettes.⁵

The liquid mixture stored in the cartridge contains nicotine at different concentrations or maybe nicotine free. In addition, it typically contains propylene glycol, glycerin, water, and flavors.⁴ Studies reported that the level of toxic chemicals was lower than in conventional cigarettes. However, there are data inconsistencies, and some brands did not clearly state how much nicotine they contain. Goniewicz et al. evaluated the nicotine content of a cartridge of various models of e-cigarette brands and found that nicotine was also detected in one of two cartridges labeled as containing no nicotine.⁶ Tadakamadla et al. reported that nicotine can stimulate melanin production from melanocytes, causing discoloration of the gingiva.⁷

There have been many studies on gingival pigmentation in conventional smokers. However, the appearance of gingival pigmentation in electric smokers is still limited. Therefore, this study aims to overview the gingival pigmentation in electric smokers, particularly in a vaping community in Palembang.

Methods

This is a descriptive survey research with a cross-sectional approach design. The subjects of this study were the vape community in Palembang from February to March 2021. Consecutive 35 respondents were selected based on quota sampling techniques and instructed to fill a questionnaire on google form to observe gingival pigmentation. No direct clinical examination was carried out because it was amid the Covid 19 pandemic.



The inclusion criteria were male smokers who heavily smoked e-cigarettes with a dripping frequency of 12-20 times per day, had no history of systemic disease, and never used long-term routine drugs. Exclusion criteria in this research were having used conventional cigarettes more than four cigarettes per day, having systemic disorders or diseases, having physiological pigmentation, and taking drugs such as anti-malarial drugs or minocycline.

The questions in the questionnaire included the types of cigarettes used daily, the frequency and amount of smoking, and the color of the gingiva. Participants were also asked to submit photos of their gingiva.

Results

A study of gingival pigmentation in e-smokers was performed on February to March 2021, involving members of the Palembang vape community. The number of samples was 35 respondents who are heavy electric smokers with a dripping frequency of 12-20 times per day. Gingival pigmentation in this study is color changes into brown in the anterior labial gingiva. Most respondents in this study were in the age range of 21-30 years (82,9%) (Table1).

Table 1. Age distribution of respondents

Age	Total	Percentage (%)
≤ 20 years	5	14,3
21-30 years	29	82,9
> 30 years	1	2,9
Total	35	100

Table 2 shows that 82,9 % of heavy smokers experienced gingival pigmentation. Figure 1 shows photos sent by respondents showing the condition of the gingiva.

Table 2. Distribution of Gingival Pigmentation Based on Heavy E-Cigarette Users

Gingival Pigmentation	Total	Percentage (%)
Yes	29	82,9
No	6	17,1
Total	35	100



Figure 1. Gingival condition of (a) non-smoker respondents and (b) respondents who smoke electric and conventional cigarettes.

It can be seen from Table 3 that there were 16 respondents of 35 who only used e-cigarettes, and 19 respondents used both electric and conventional cigarettes. Based on the questionnaire, the use of conventional cigarettes in the subjects of this study was 1-4 cigarettes per day. In e-cigarette users alone, gingival pigmentation was found in 13 respondents (81.2%). In both electric and conventional cigarette users, gingival pigmentation was found in 16 respondents (84.2%). The Chi-Square test was carried out to see if there is a significant difference in the incidence of gingival pigmentation between e-cigarettes and both electronic and conventional cigarette users.

Table 3. Distribution of Gingival Pigmentation by Type of Cigarette Used.

Type of Cigarettes	Total	Gingival Pigmentation	
		n	Percentage (%)
E-cigarettes	16	13	81,2
E-cigarettes and conventional cigarettes	19	16	84,2
Total	35	29	82,9



Table 4 shows that the gingival pigmentation in e-cigarettes only and e-cigarettes with conventional smokers not statistically significant ($p>0.05$).

Table 4. Results of Chi-Square Test Differences in Gingival Pigmentation between Electric Smokers Only and Electric Smokers with Conventional Cigarettes

Type of Cigarettes	Total	Gingival Pigmentation	<i>p-Value</i>
E-cigarettes	16	13	1,000
E-cigarettes and conventional cigarettes	19	16	

Discussion

E-cigarettes were invented as an alternative to smoking and marketed as a smoking cessation tool. Previous studies found that there was a significant reduction in the use of conventional cigarettes among young people. However, nicotine consumption generally increased with e-cigarettes and pod mod devices in America and European countries. It can be attributed to the expectancies among young e-cigarette users, including the expectation of increasing social status and gaining popularity, gaining calmness and reducing stress, and the pleasure of the wide choice of flavors.⁸

In this study, participants who use electric cigarettes were predominantly in the age range of 21-30 years old (Table 1). It is in line with Afandi et al., who found that the average e-cigarette smokers are males between the ages of 21–30. It is related to the characteristics of respondents aged > 20 who want to try something new, with the increasingly widespread use of e-cigarettes with various flavors and brands.⁹ Kato et al. evaluated the gingival pigmentation of 259 patients aged 19 to 79 years and found the most widely distributed gingival pigmentation in patients in their 30s. This is related to the high activity of melanocytes in young people, which leads to the production and accumulation of melanin.¹⁰

Melanin is an endogenous pigment located in the basal layer of the epidermis. It is the primary determinant for human tissue coloration, including gingiva. Clinical manifestations of physiological gingival pigmentation are multifocal or diffuse melanin pigmentation with no significant differences between males and females. Gingival pigmentation increases with increasing cigarette consumption.¹¹



Table 2 shows that 82.9% of respondents with smoking habit experienced gingival pigmentation. This finding corresponds to Haresaku et al., which investigated 213 males (31.8 ± 8.9 years of age) who were employees of an institute at Fukuoka that had an annual medical check-up. Among all subjects, 50% were smokers, and 87% of those smokers had gingival pigmentation.¹² Nadeem et al. also found that oral melanosis is more frequent in smokers than non-smokers, and the second most common place is the gingiva after the buccal mucosa, and the relationship was dose-dependent.¹³ Although the majority respondents in this study showed gingival pigmentation, there was a small percentage of heavy e-cigarette smokers who did not. It is in contrast with Multani's results that all the smokers in the study had lip and gingival pigmentation.¹⁴ It shows that there are influencing factors such as the frequency and duration of smoking.

Our finding shows that gingival pigmentation is reported more by dual-use smoking respondents than e-cigarette smokers alone (Table 3). Moreover, the photos submitted by the respondents showed that the gingival pigmentation in dual-use smokers is darker than in e-smokers alone. However, the difference was not statistically significant (Table 4). There is a weakness in this study, that the manifestations of gingival pigmentation were self-reported instead of direct examination. In addition, this study did not measure the degree of pigmentation based on the melanin index category.

Conclusion

Gingival pigmentation was found in most heavy e-cigarette smokers in the vaping community in Palembang. Visually, the color changes in gingiva were darker in dual-use smokers than the e-cigarette smokers alone. However, the difference was not statistically significant.

References

1. Moneim RA, Deeb ME, Rabea AA. Gingival pigmentation (cause, treatment and histological preview). *Future Dental Journal*. 2017:1-7.
2. Multani S. Interrelationship of smoking, lip and gingival melanin



- pigmentation, and periodontal status. *Addict Health*. 2013 Winter-Spring;5(1-2):57-65.
3. Pratiwi WO, Lestari C, Bakar A. Prevalensi dan distribusi smoker's melanosis pada buruh bangunan yang perokok di PT. Trikencana Sakti Utama Ketaping. *Jurnal B- Dent*. 2017;4(1):23-31.
 4. Rom O, Pecorelli A, Valacchi G, Reznick AZ. Are E-cigarettes a safe and good alternative to cigarette smoking? *Ann N Y Acad Sci*. 2015 Mar;1340:65-74.
 5. Rahman MA, Hann N, Wilson A, Worrall-Carter, L. Electronic cigarettes: patterns of use, health effects, use in smoking cessation and regulatory issues. *Tobacco Induced Disease*. 2014;12(21):1-9
 6. Goniewicz ML, Kuma T, Gawron M, Knysak J, Kosmider L. Nicotine levels in electronic cigarettes. *Nicotine Tob Res*. 2013 Jan;15(1):158-66.
 7. Tadakamadla J, Kumar S, Nagori A, et al. Effect of smoking on oral pigmentation and its relationship with periodontal status. *Dental Research Journal*. 2012;9(7):112-4
 8. Fadus MC, Smith TT, Squeglia LM. The rise of e-cigarettes, pod mod devices, and JUUL among youth: Factors influencing use, health implications, and downstream effects. *Drug Alcohol Depend*. 2019 Aug 1;201:85-93.
 9. Afandi A, Kurniawan VA. Kajian epidemiologi pengguna rokok elektrik di wilayah Kabupaten Semarang. *Pro Health Jurnal Ilmiah Kesehatan*. 2019;1(1):9-13.
 10. Kato T, Mizutani S, Takiuchi H, Sugiyama S, Hanioka T, Naito T. Gingival pigmentation affected by smoking among different age groups: A quantitative analysis of gingival pigmentation using clinical oral photographs. *International Journal of Environmental Research and Public Health* 2017;14:880.
 11. Gulati N, Dutt P, Gupta N, et al. Gingival pigmentation: revisited. *Journal of Advanced Medical and Dental Sciences Research*. 2016;4(1):48-57.
 12. Haresaku, S., Hanioka, T., Tsutsui, A., & Watanabe, T. Association of lip pigmentation with smoking and gingival melanin pigmentation. *Oral Diseases*.



2007;13(1), 71–76.

13. Nadeem M, Yaldrum A, Shafique R, Lopez R. Intraoral distribution of oral melanosis and cigarette smoking in a Pakistan population. *International Journal of Dental Clinics*.2011;3(1):25-8
14. Multani S. Interrelationship of smoking, lip and gingival melanin pigmentation, and periodontal status. *Addict health, Winter & Spring*. 2013;5(2):57-65.