INFLUENCE OF TOBACCO ON COLOR PARAMETERS OF CANINES IN ADOLESCENTS

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ABSTRACT
This study is conducted to determine the differences between the color parameters of the users of tobacco and/or nicotine products and the non-consumers in late adolescents. The spectrophotometer Vita easyshade V (VITA Zahnfabrik H. Rauter GmbH & Co. KG, Germany) was utilized in this work to measure the CIE L*, a*, b* values of the anterior teeth. Specifically, only the canines were selected and the determinations were on the vestibular surface. Each tooth was divided into three areas: cervical, central, and incisal. The selected option for the Vita easyshade V (VITA Zahnfabrik H. Rauter GmbH & Co. KG, Germany) was shade determination of the tooth area. The spectrophotometer was utilized in accordance with the guidelines provided by the manufacturer. A total of fifty-eight individuals took part in this study. Among them, 50% (n=29) participants, reported being consumers of tobacco and/or nicotine, while the remaining 50% (n=29) persons were not users. A statistically significant correlation in 1.3 central area L* is seen among consumers and non-consumers (p-value 0.012057). It is crucial to provide late adolescents with education regarding teeth staining, along with other oral health issues.

Key words: tobacco, teeth, color, canine, adolescence

INTRODUCTION

The visual appeal of teeth and their shade is a significant subject for numerous individuals. These individuals encompass clinicians seeking to choose the appropriate tooth shade and esthetic restorative material to optimize the replication of natural tooth structure, dental technicians striving to reproduce the form and quality of tooth appearance, and patients aspiring to improve their smiles [1,2,3,4,5].

Whiteness of teeth decreases when there are changes in the way dentine and enamel absorb and scatter light (intrinsic staining), or when substances stick to the surface of the tooth (extrinsic staining). [6, 7] Brushing and using toothpaste can effectively eliminate extrinsic staining [6,8,9]. In contrast, bleaching is a suitable method for reducing intrinsic staining. Yellowness is a perceptual term occasionally employed in the field of dentistry. Typically, the yellowness of an object will intensify as it becomes stained or ages, resulting in a higher level of color intensity and a drop in brightness. Bleaching is likely to diminish this yellowness. [6]

In a dental aesthetics attitudes survey, it was discovered that the appearance of teeth is of greater significance to women than men. Furthermore, younger individuals place much more importance on dental aesthetics compared to older individuals.[10]

Tooth discoloration can occur as a result of dentine color degradation, which is commonly associated with aging. [11,12,13] This issue is worsened when the enamel becomes thinner or when there is gum recession, which exposes the tooth surface closer to the cementoenamel junction. [11,14]

Recently, a range of clinical color-measuring instruments, including the spectrophotometer and the colorimeter, have been attainable [15,16]. These instruments have enabled the exact and effortless analysis of tooth color, rendering color-measuring devices essential for esthetic dental treatment [15,17].

The colors measured by instruments are typically represented by Commission Internationale de l´Eclairage (CIE) XYZ tristimulus values or CIELAB values. Both the

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CIE XYZ and CIELAB color systems necessitate the use of three numbers to completely describe any color [18,19]. In the CIELAB system, the variable L* denotes the contrast in lightness between light (L* = 100) and dark (L* = 0). The variables a* and b* indicate color values on the red-green and yellow-blue axes. [18]

Smokers commonly experience the formation of tobacco stains on their teeth, which can range in color from yellow to brown, dark brown, or even black. The intensity of these stains is influenced by the length of time and frequency with which the individual smokes. [20]

Studies have shown that smokers experience a higher rate of both tooth and bone loss compared to non-smokers. [21,22,23]

The condition of health is influenced by various interconnected elements, including genetic inheritance, socioeconomic status, and choices made about lifestyle behaviors, attitudes, and values in connection to health risk factors. [24,25]

Health systems vary across countries in terms of medical policies, the level of attention given to it, and the extent of coverage provided by the gross domestic product. [26]

MATHERIALS AND METHODS

Approval from the bioethics commission of the Ovidius University in Constanta was obtained. The study took place in the first half of the year 2024. The participants were students chosen from the University of Ovidius, Constanta, from different enrollment years. All completed the consent form and agreed to participate in the study. Only late adolescents, those in the 18-24 years age category were chosen, males and females. Exclusion criteria: participants under 18 years and over 24 years old, teeth that on the anterior group (canines, lateral incisors and central incisors) had fillings on the vestibular surfaces, dental veneers, dental crowns, vestibular orthodontic appliances, teeth that had undergone whitening treatments during this life. The teeth were examined with sterile single-use consultation kits and were checked for any food debris. In this study, the spectrophotometer Vita easyshade V (VITA Zahnfabrik H. Rauter GmbH & Co. KG, Germany) device was used to determine the CIE L*,a*,b* of the anterior teeth, respectively only the canines were chosen at the level of the vestibular surface, the tooth being divided into 3 areas: cervical, central and incisal. The option chosen for the Vita easyshade V (VITA Zahnfabrik H. Rauter GmbH & Co. KG, Germany) was shade determination of the tooth area. The spectrophotometer was used according to the manufacturer's instructions. One individual determined the tooth color for all participants in the study in a room with consistent ambient lighting. The OptraGate (Ivoclar Vivadent, Liechtenstein) was used for retracting the lips and cheeks. Data was collected and recorded in Microsoft Excel and a T-test was utilized to establish correlations between different groups and derive a p-value. The chosen significance level for the p-value was 0.05. The participants were asked if they are consumers of products based on tobacco and/or nicotine and the color parameters were noted and examined to determine the difference between the consumers and the ones that have not used.

RESULTS

Fifty-eight (100%) individuals participated in this study out of which 29 (50%) were consumers of tobacco and/or nicotine and 29 (50%) were not. It is represented in chart 1.

The ones that were not consumers were 21 participants with the canines from the maxillary arches and 28 individuals with canines from mandibular arches. The users of tobacco and/or nicotine recorded were 24 participants with canines from maxillary arches and 29 individuals with canines from

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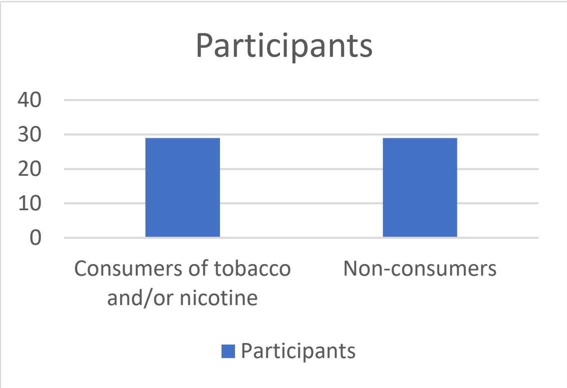
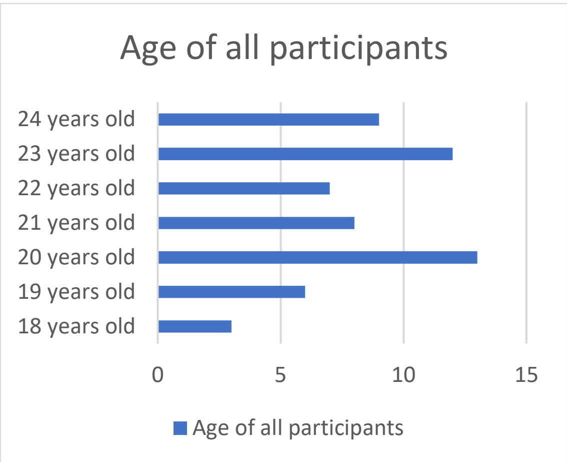
mandibular arches. The L*a*b* average was calculated for each area of the tooth.

Chart 1: The participants who consume tobacco and/or nicotine and those who do not



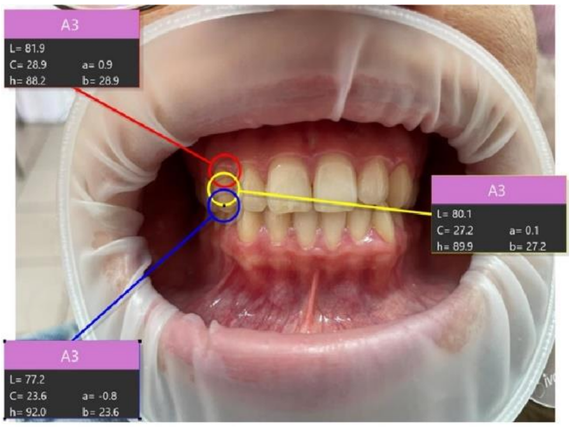
The participants distribution by age is as follows: there are 3 individuals in the 18-year-old category, 6 individuals in the 19-year-old category, 13 individuals in the 20-year-old category, 8 individuals in the 21-year-old category, 7 individuals in the 22-year-old category, 12 individuals in the 23-year-old category, and 9 individuals in the 24-year-old category. It is represented in chart 2.

Chart 2: Age for all of the participants in this study



There is a statistically significant difference at the non-consumers between teeth 1.3 and 2.3 cervical, central and incisal L* (p-value 0.026299, 0.005292, 0.000926). There exists also a considerable difference only for the b* incisal (p-value 0.039879). The results are in table 1.

Figure 1: Picture of a participants teeth with CIE L*a*b* values for tooth 1.3. The red circle indicated the cervical area, the yellow circle is for the central area and the blue circle signifies the incisal area. The values were transferred with Bluetooth from the spectrophotometer Vita easyshade V (VITA Zahnfabrik H. Rauter GmbH & Co. KG, Germany) to a computer using the VITA Assist. 5 application.



For the mandibular arch of the non-consumers, there is only one significant difference with statistical relevance (p-value 0.015852) for L* value at the cervical area calculated for teeth 3.3 and 4.3. Table 2 displays the results.

The tables 3 and 4 contain the statistically significant correlation for the consumers of tobacco and/or nicotine products. There is a difference between 1.3 and 2.3 at the central and incisal area of the teeth (L* p-value 0.024579, 0.041631). Between 3.3 and 4.3, with L* cervical and central (p-value 0.008271, 0.020297), a* incisal (p-value 0.033654) and b* incisal (p-value 0.024142), the noteworthy variations were observed.

Table 5 highlights the p-value differences between the non-consumers and the users of tobacco and/or nicotine products. There is a statistically significant variation seen for the 1.3 central L* identified between consumers and non-consumers (p-value 0.012057).

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Table 1: CIE L*a*b* average values and p values for the maxillary arch from non-consumers

	1.3 cervical	2.3 cervical	1.3 central	2.3 central	1.3 incisal	2.3 incisal
L* average	79.69048	77.52857	77.89048	74.28571	72.83333	67.92381
a* average	0.642857	0.628571	0.319048	0.319048	-0.25238	-0.16667
b* average	28.39524	27.58571	25.99524	24.58571	22.8	20.65238
L* p-value	**0.026299**		**0.005292**		**0.000926**	
a* p-value	0.476815		0.5		0.39925	
b* p-value	0.21557		0.085336		**0.039879**	

Table 2: CIE L*a*b* average values and p values for the mandibular arch from non-consumers

	3.3 cervical	4.3 cervical	3.3 central	4.3 central	3.3 incisal	4.3 incisal
L* average	77.76429	80.01429	78.38929	79.45357	76.94286	76.28571
a* average	1.996429	1.532143	0.428571	0.257143	-0.23929	-0.55357
b* average	28.80714	29.62143	25.95714	26.10714	23.41429	22.13929
L* p-value	**0.015852**		0.10646		0.253904	
a* p-value	0.159545		0.243449		0.113678	
b* p-value	0.184309		0.427631		0.086745	

Table 3: CIE L*a*b* average values and p values for the maxillary arch from consumers

	1.3 cervical	2.3 cervical	1.3 central	2.3 central	1.3 incisal	2.3 incisal
L* average	77.79583	77.25417	75.46667	73.67083	71.25	68.625
a* average	0.929167	0.6625	0.4	0.466667	-0.1875	-0.00417
b* average	27.66667	27.32917	25.54167	24.90417	22.4125	21.65417
L* p-value	0.328692		**0.024579**		**0.041631**	
a* p-value	0.16092		0.358316		0.200047	
b* p-value	0.360556		0.23072		0.206882	

Table 4: CIE L*a*b* average values and p values for the mandibular arch from consumers

	3.3 cervical	4.3 cervical	3.3 central	4.3 central	3.3 incisal	4.3 incisal
L* average	76.31034	79.04828	77.65862	79.26897	76.5069	76.16552
a* average	1.893103	1.593103	0.351724	0.275862	-0.02759	-0.43448
b* average	27.55517	29.24828	26.37931	26.3	24.53448	22.97586
L* p-value	**0.008271**		**0.020297**		0.33654	
a* p-value	0.252612		0.329118		**0.033654**	
b* p-value	0.053077		0.458618		**0.024142**	

Table 5: CIE L*a*b* p-values for the non-consumers and the users of tobacco and/or nicotine products

	L* p-value	a* p-value	b* p-value
1.3 cervical	0.061667	0.158797	0.218163
1.3 central	**0.012057**	0.37139	0.301431

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1.3 incisal	0.091583	0.408109	0.348549
2.3 cervical	0.401343	0.440151	0.402181
2.3 central	0.311225	0.270605	0.376344
2.3 incisal	0.342524	0.285866	0.191937
3.3 cervical	0.132181	0.424477	0.100854
3.3 central	0.197183	0.369934	0.296652
3.3 incisal	0.269089	0.190253	0.095687
4.3 cervical	0.104002	0.430648	0.350256
4.3 central	0.404509	0.460935	0.404433
4.3 incisal	0.454809	0.309141	0.166627

DISCUSSIONS

In the study conducted by Gupta S. et. al. [27], multiple comparisons revealed statistically significant differences between smokers and never smokers for the variable b* (p = 0.001). E-cigarettes (ECs) and heated tobacco products (HTPs) have the ability to significantly reduce exposure to pigmented tar-like compounds that are present in cigarette smoke, when compared to tobacco cigarettes. However, there is not enough of information about the effects of aerosol emissions from nicotine delivery devices that do not include tar on tooth discoloration. [27]

Individual characteristics such as age, sex, and toothbrushing frequency had an important effect on dental color measures. [27]

In another study by Đozic A. et. al. [28], the statistical analysis revealed significant differences in the cervical, middle, and incisal segments between the central incisor and canine. The L*a*b* values exhibited a statistically significant difference from each other ($p < 0.001$). [28] A statistically significant correlation was seen between the lateral incisor and central incisor for all color values, except for the a* value of the incisal segment. Additionally, a significant correlation was identified between the lateral incisor and canine for all values, except for the L* and a* value of the incisal segment. [28]

The bonding and debonding procedures used in fixed orthodontic treatment result in alterations in the color of the enamel.[29,30] Color changes resulting from bonding occur when coloring chemicals from meals and corrosion products from orthodontic brackets are absorbed by resin tags, which then enter the enamel irreversibly up to a depth of 50 mm.[29,31,32] Tooth discoloration is particularly noticeable in the central portion of the vestibular surfaces of teeth, where the brackets are attached. Even after the brackets are removed, these teeth remain susceptible to staining from pigments in food. [29]

In a study conducted on a Chinese urban population consisting of 405 individuals, it was shown that age and sex were the primary determinants of tooth color, with a statistically significant association ($P < 0.05$). Approximately 48.9% of the individuals in the research had tooth discoloration, while 52.6% expressed dissatisfaction with the color of their teeth. Both education and smoking had a notable impact on self-satisfaction with tooth color, with a statistically significant effect ($P < 0.05$). [33]

Given the study's limitations, there were statistically significant differences found between the left and right canines in the maxillary arch at the cervical, central, and incisal areas for non-consumers (L* p-values: 0.026299, 0.005292, 0.000926). Additionally, significant differences were observed in the central and incisal areas when compared maxillary canines of the consumers (L* p-values: 0.024579, 0.041631). A significant distinction has been seen in the central area of the teeth 1.3 between individuals who use

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tobacco and/or nicotine and those who do not consume (L* p-value 0.012057).

CONCLUSIONS

There had been noted significant differences between the groups studied. The consumers had statistically significant correlation from the mandibular arch between 3.3 and 4.3 cervical and central areas (L* p-value 0.008271, 0.020297) and between a* and b* incisal (a* p-value 0.033654 and b* p-value 0.024142). The non-consumers had a correlation between only at the cervical area of teeth 3.3 and 4.3 (L* p-value 0.015852). It is important to educate late adolescents about the teeth discoloration, as well as other oral health problems. Programs that specifically target the aesthetic effects of tobacco use, such as teeth yellowing, may be more successful in discouraging tobacco consumption.

The long-term effects of tobacco on teeth color may not only be a cosmetic issue but also it can be a sign of more extensive oral health problems. Regular dental check-ups can provide an opportunity to advise adolescents about the hazards of tobacco consumption and promote healthy behaviors.

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