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Differences of Tooth Colorimetric Parameters L*a*b* Depended on Age

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Abstract

AIM: The study aimed to analyse differences in colourimetric parameters L*a*b*, depended on age.

MATERIAL AND METHODS: In this study were included 255 subjects with age interval from 20 to 49 years. The subjects were divided into three groups, as follows: in the younger group were 20 to 29 years of age, those in the middle group 30 to 39 years and older group 40 to 49 years. The overall number of analysed teeth in the intercanine sector of the maxilla was 2295. The colour of the teeth was measured using the spectrophotometer VITA Easyshade.

RESULTS: The results for differences in the colourimetric parameters in relation with age were tested with Pearson Chi-square ($\chi 2$). For χ 2 = 572, 87 and df = 124 there was a statistical significant difference between the ages P < 0.001.

CONCLUSION: In this study, it was concluded that the parameter L* - Lightness was decreasing when age increased. In the age group, 20 to 29 years L* was 83.2, whereas in the older group of this investigation; 40 to 49 years was 79.4. In the youngest group, the parameter a* was - 0.7, whereas with increasing of age this parameter was -0.5. The values for parameter b* from the youngest to the older group were from 21.7 to 23.9.

Introduction

The aesthetic of a conservative or prosthodontic restoration depends on the shape, surface form, translucency and colour.

Colorimetry is an important part of dentistry, whereas the spectrophotometry belongs to modern dentistry and can clarify the subjectivity of visual perception [1-12].

Because colour has three dimensions which can be measured, the colour specification system can be described according to the Munsell terms of hue, value and chroma [13]. Hue is the term that describes groups of colour, for example, reds, blues and greens. Lightness describes darkness of colour on a scale from black to white. Color can be described according to the Munsell terms of hue, value and chrome [13]. Hue is the term that describes groups of colour, for example, reds, blues and greens. Lightness describes darkness of colour on a scale from black to white. Chrome is the degree of colour saturation and describes the strength of colour; for example, from orange to red.

Based on literature and our daily routine, the research hypothesis was that colour differences would occur between ages and with increasing of age, natural teeth may become darker and yellower.

The ideal smile has long been considered to be an asset, reflecting both good health and enhancing appearance [14, 15].

Based on statistics, about 50% of the world's population is not satisfied with their natural teeth colour. For this reason, are used all possible methods to make them whiter and shinier [16].

Based on ten Bosch and Coops, the colour of teeth is strongly determined by the dentin, with more

translucent enamel playing a lesser role through scattering at wavelengths in the blue range [17]. The tubules are the predominant cause of light scattering in dentin, and in enamel, the hydroxyapatite crystals contribute significantly to scattering [18].

The teeth colour differences exist among people, teeth, same person and same tooth. Goodkind and Schwabacher in a colorimetric study of maxillary anterior teeth concluded that: the best representation of tooth color was in the vestibular middle third of tooth; women's teeth were lighter, less chromatic and less reddish colored than men's; aging produced darker and more reddish teeth; cuspid teeth were darker than incisors; central incisors had the highest lightness [19].

Discoloration and yellowing of the teeth may be caused by various factors, such as: cigarette smoking, tobacco chewing, Poor dental hygiene (usually in the elderly persons) who may lack the physical ability, consumption of foods and drinks with chemical constituents, like coffee, tea, red wine, coke, age-related erosion of the enamel which then exposes the underlying dentin layer of the tooth which is naturally yellow, excessive use of fluoride, genetic factors that contribute to tooth color [20].

There is a strong relationship between the apical developmental stages of the teeth and the L* values [21].

This study aimed to determine the impact of age on tooth colour analysing differences of colourimetric parameters L*a*b*.

Materials and Methods

This research has been realised in Faculty of Medicine, School of Dentistry, Pristina, Kosovo.

In this study were included 255 subjects with age interval from 20 to 49 years. The subjects were divided into three groups, as follows: in the younger group were 20 to 29 years of age, those in the middle group 30 to 39 years and older group 40 to 49 years. The overall number of analysed teeth in the intercanine sector of the maxilla on the left side was 2295.

The main limitations of this study were the criteria's that, subjects who were included in this investigation had non-restored and non-discoloured teeth and also were non-smokers.

The study has been initiated after the subjects had signed informed consent forms, and the research program had been approved by the Ethical Committee.

The colour of the teeth was measured using the spectrophotometer VITA Easyshade.

Figure 1: Spectrophotometer VITA Easyshade

The program Tooth Areas of the spectrophotometer was used. With it, it is possible to measure the cervical, middle and incisal areas of a tooth. The L*a*b*, C and H values were collected.

Figure 2: Measurements on areas of a tooth

Data analysis

The statistical analyses were performed with the Statistical program: Statistica 7.1 (StatSoft, Inc.2300 East 14th Street Tulsa, OK 74104, USA). The results for differences in the colourimetric parameters in relation with age were tested with Pearson Chi-square test (χ^2).

Results

The teeth colour determination was realised by a spectrophotometer. In the age group, 20-29 years in total have measured the colour of 882 teeth (38.43%), in the group 30 to 39 years were measured 693 teeth (30.20%) and in the older group 40 to 49 years 720 teeth (31.37%). The overall number of analysed teeth on the left side of the maxilla was 2295 (765 central incisors, 765 lateral incisors and 765 canines).The teeth colour shades, which were

registered from the spectrophotometer, were represented from 0.5M2 -4M3, 2L1.5-4L2 and 2R2-4R2.5. For χ^2 = 572, 87 and df = 124 there was a statistical significant difference between the ages P < 0.001.

Table 1: The number of analysed teeth in different age groups

Vita easy shade	*Group I* Years 20- 29	*GroupII* Years 30- 49	*Group III* Years 40-49	%
0.5M2-4M3	882	0	0	38.43%
2L1.5-4L2	0	693	0	30.20%
2R2-4R2.5	0	0	720	31.37%
Total Percentage				100%

Pearson Chi-square: 572.87, df = 124, P < 0.001.

In Table 2 were presented the differences of L*a*b* in different group ages for 255 subjects. In the first group (20-29 yrs) there were involved 98 subjects and the average for parameters L*a*b* was L* = 83.2; a = -0.7 and b* = 22.7. In group age (30-39 yrs) were 77 subjects and the L*a*b* values were as follows: 81.5, -0.7, 21.6, whereas for the age group of 40-49 years, where were involved 80 subjects the L*a*b* were 79.4;-0.5 and 21.7.

Table 2: Differences of colourimetric parameters L*a*b* depended on age

Colorimetric parameters	*Group I* Years 20- 29 N = 98	*GroupII* Years 30- 49 N = 77	*Group III* Years 40- 49 *N* = 80
L*	83.2	81.5	79.4
a*	-0.7	-0.7	-0.5
b*	21.7	21.6	23.9

Discussion

The hypothesis given by the authors was completely accepted. Within the age groups chosen for this study, as a tooth ages, it becomes darker (the parameter L* decreased) and more yellow (parameter b* increased). All age groups shown are significantly different from one another concerning L*.

The same results were described by Procter &Gamble Co. The colour parameters were reported as L* (lightness), a* (red-green) and b* (yellow-blue) and the subjects were divided into four age groups: 13 - 17, 18-34, 35-44 and >45. Using the Student-Newman Keuls test, differences in L* were significantly reduced (p < 0.05) in each age group; 13-17 and 18-34 age groups were significantly increased from 35-44 and >45 age groups on the b* parameter. This study showed the effects of age on tooth colour quantitatively to be a decrease in lightness (L*) and an increase in yellow (b*) [22].

In a study by Watts and Addy about tooth discolouration and staining it was described that the presence of yellowed colouration had negative effects on attractiveness and that these effects were higher in the female. This was the natural discolouration which is coming as a result of age, and for this reason, the whitening did not affect. The authors concluded that teeth become yellower and darker with age. Therefore it was suggested that while the teeth of both sexes act as human ornament displays, the female display is more complex because it additionally signals residual reproductive value [23].

Based on results of this study in younger group age 20-29 yrs, the average for parameters L*a*b* was L* = 83.2; a = -0.7 and b* = 21.7. If we analyse the medium age group the values for the parameter L* decreased from 83.2 to 81.5, whereas the* and b* were almost the same. Furthermore, in the age group of 40-49 years, the L*a*b* was 79.4;-0.5 and 22.7. If analyzing the parameter L* which decreased from 83.2 (20-29 yrs) to 79.4 (40-49 yrs) and also parameter b* from 21.7 to 22.7, we can justify the theory that teeth became yellower and darker with age.

Young et al. concluded that natural teeth significantly and clinically darken with age; however, selections made for denture teeth tend to be relatively constant in colour, despite the age of the patient. They also reported that differences for gender and complexion do not appear to be clinically significant [24]. When selecting a shade tab based on visual criteria, it is recommended that the lightness should be determined first, followed by the chrome. The hue is determined to last by matching to selected shade tabs for which lightness and chrome have been previously determined [25]. However, it has been reported that visual evaluation of shade is unreliable and inconsistent [26].

The colour determination with the spectrophotometer Vita Easyshade, was an advantage for us as clinicians, because it was easy to see different colours of each tooth, we're independent of lighting, clothing, makeup and eye-fatigue. Even though, during the colour determination in our subjects, we detect few disadvantages. In few cases, the machine was obviously incorrect relative to visual perception and the same match, and also the tip of the probe of the spectrophotometer does not entire the tooth surface. In the literature this is known as "loss edge", and it was described by authors van der Burgt et al. [27].

In conclusion, through the spectrophotometric analysis was concluded that teeth become darker and yellower with age because the parameter L* - Lightness decreased when age increased. The values for parameter b* from the youngest to the older group increased, which once again proves the fact of the visual perception, which is evident also in clinical routine, that teeth became yellower with age.

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