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# Relationship Between the Face and the Tooth Form

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## A B S T R A C T

*The aim of this study was to re-examine Leon Williams geometric theory and to find the degree of correspondence between the face and the tooth form in the population of Zenica, Bosnia and Herzegovina. Two thousand individuals with intact frontal teeth, in age between 17 and 24 years, were measured for 3 horizontal distances on the face: temporal width (Ft-Ft), zygomatic width (Zyg-Zyg) and gonial width (Go-Go) and for 3 horizontal distances on the both upper incisors: cervical width (CW), contact point width (CPW) and incisal width (IW). The length of the face (Tr-Gn) as well as the length of the central maxillary incisors were also measured. The results revealed: 1. Men had significantly larger dimensions for all facial and tooth dimensions ($p < 0.05$) than women, except for the cervical tooth width ($p > 0.05$); the left and the right central incisors were of identical dimensions and forms ($p > 0.05$). 2. The width of upper central incisors were smaller approximately 1.5 mm than in west Europeans. 3. Upon the relation between the 3 horizontal dimensions measured on the face and upper maxillary incisor, 11 facial forms and 10 upper central tooth forms could be recognised in the study population, but 98% of the population had only 3 tooth and face forms. Face shapes: oval face – 83.3%, square-tapered face – 9.2% and tapered face – 7%; tooth forms: tapered-square incisor – 53%, oval incisor – 30%, tappered incisor – 16%. 4. Reversed and enlarged tooth form was in line associated with the facial form in only 30%, while the most common combination was of the oval face form and the tapered-square central incisor (45%). 5. These results disapprove William's theory and may be helpful for the choice of artificial teeth in complete denture construction and the dental industry.*

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## Introduction

Facial appearance has important social and psychological effect on the human personality; the features most commonly associated with facial attraction are the eyes and mouth[1,2]. The loss of natural anterior teeth can be shocking for some persons and their replacement with artificial teeth is necessary for the restoration of function and for aesthetics. If some natural teeth remain in mouth, the procedure is to select artificial teeth that blend with natural dentition. However, the choice of artificial teeth can be more complex if patients request reproduction of features present in the natural dentition such as staining, tooth irregularities or tooth wear. The choice of tooth mold, colour and arrangement becomes far more difficult for the patients with no preextraction records available. The dentist must rely on his/her own clinical judgement, along with the patient's aesthetic preferences for tooth selection. The importance of aesthetics in patient's acceptance of any prosthodontic appliance has been already underlined with aesthetics being one of the most important factors in patient's satisfaction with the prosthodontic restoration[3–5].

Several factors have been suggested as aids for artificial tooth selection[6–11] and numerous methods have been devised for the evaluation of reliable aesthetic factors in determining artificial tooth form[12,13]. The temperamental theory was the first one adopted in dentistry, which classified patients in four categories upon their temperament and therefore aesthetics. Dentogenics is a theory derived from observation based on personality, age and sex and relies on the sole discretion of the dentist[14–17].

Leon Williams observed that the outline of the face, when inverted, may correspond to the maxillary central incisor, resulting in desirable aesthetic. This, so called geometric theory[12] on the matching of the form of the face and the form of upper central incisor, although postulated at the beginning of the century, is still the most common theory for the choice of artificial teeth. It is mentioned in almost all the prosthodontic textbooks in the world. Many authors agree with this theory, but some studies lead to the opposite results[18–25]. The aim of this study was to re-examine Leon Williams geometric theory and to find the degree of correspondence between the face and the tooth form.

## Material and Methods

Two thousand individuals between 17 and 24 years were measured for 3 horizontal distances on the face: temporal width (Ft-Ft), zygomatic width (Zyg-Zyg) and gonial width (Go-Go) and for 3 horizontal distances on the both upper incisors: cervical width (CW), contact point width (CPW) and incisal width (IW). The length of the face (Tr-Gn) as well as the length of the central maxillary incisors were also measured. Individuals were selected upon the criteria of not having any restorations or signs of tooth wear on their upper incisors. There were 920 males and 1080 females. Measurements were performed by a precise calliper (MEBA, Zagreb) with precision of 0.1 mm and by a cephalometar. Statistical analysis was made by means of descriptive statistics, Kruskal Wallis test and $^2$ test. Facial forms were determined upon the relation between Ft-Ft, Zyg-Zyg and Go-Go (all differences smaller than 2 mm were considered equal). Upper central incisor shapes were determined upon the relation between CW, CPW and IW of maxillary central incisor (all differences smaller than 0.1 mm were considered equal). Comparison between the face form and the tooth shape were made by $^2$ test.

## Results and Discussion

Results of the measurements performed on the face and the upper central intact incisors of 2000 individuals of both sexes, are shown in the Table 1, as well as the results for the males (n=920) and females (n=1080) separately. Sign test revealed no significant differences for the tooth measurements between the maxillary central incisors on the right and the left side of the arch ($p > 0.05$). Kolmogorov-Smirnov test revealed that males had all facial and teeth measurements significantly larger than females ($p < 0.01$), except for the cervical width of the upper central incisors. This findings are in agreement with the results of other studies[26–29].

However, the width of upper central incisors were on average about 1.5 mm smaller in the study population (mean width 7 mm, Table 1.) than reported by other authors for the European Caucasian population[27–31] (mean width = 8.65 mm[30], or 8.86 mm[31], or 8.84 mm[28], or 8.8 mm in British males[27]), or Chinese population (mean width = 8.85 mm[26]) or in African population (mean width = 9.9 mm[27]) whose upper incisors' width are proved to be larger than in Caucasians and Chineses[27,32].

Considering the face measurements, on average, Zyg-Zyg was larger than Ft-Ft and from Go-Go, which revealed the average face being of an oval shape.

**TABLE 1**
VARIABLES MEASURED ON THE FACE AND UPPER CENTRAL INCISORS (IN MM)

| | All (n=2000) | | Females (n=1080) | | F:M | Males (n=920) | |
|---|---|---|---|---|---|---|---|
| Variable (mm) | X | SD | X | SD | Z | X | SD |
| Ft-Ft | 130.53 | 6.85 | 127.98 | 5.72 | 8.2** | 133.5 | 6.8 |
| Go-Go | 123.70 | 6.79 | 121.42 | 5.92 | 7.1** | 126.38 | 6.76 |
| Zyg-Zyg | 138.48 | 6.43 | 135.98 | 5.74 | 8.3** | 141.40 | 5.94 |
| Length of the face: Tr-Gn | 179.30 | 10.77 | 174.12 | 8.98 | 10.6** | 185.38 | 9.44 |
| Length of URI* | 8.465 | 1.169 | 8.296 | 1.10 | 3.2** | 8.663 | 1.22 |
| Length of ULI* | 8.468 | 1.164 | 8.296 | 1.09 | 3.1** | 8.668 | 1.22 |
| CW-L* | 3.991 | 0.77 | 3.988 | 0.80 | 0.8 ns | 4.030 | 0.78 |
| CW-R* | 4.013 | 0.80 | 3.957 | 0.77 | 0.8 ns | 4.043 | 0.80 |
| CPW-R* | 6.973 | 0.82 | 6.870 | 0.82 | 2.1** | 7.092 | 0.81 |
| CPW-L * | 6.985 | 0.82 | 6.891 | 0.82 | 1.9** | 7.095 | 0.82 |
| IW-R* | 6.843 | 0.91 | 6.720 | 0.85 | 2.2** | 6.987 | 0.97 |
| IW-L* | 6.855 | 0.91 | 6.753 | 0.86 | 1.9** | 6.975 | 0.96 |

Ft-Ft = Frontotemporale-Frontotemporale; Go-Go = Gonion-Gonion; Zyg-Zyg = Zygion-Zygion; Tr-Gn = Thrichion-Gnathion; URI = upper left incisor; ULI = upper right incisor; CW-L = cervical width-left incisor; CW-R = cervical width – left incisor; CPW-R = width of URI at contact point; CPW-L = width of ULI at contact point; IW-R = width of URI at incisal edge; IW-L = width of ULI at incisal edge;
* = significance of the differences between the left and the right side (CW-L:CW-R, $Z = -1.65$, $p = 0.11$; CPW-L:CPW-R, $Z = -1.68$, $p = 0.10$; IW-L:IW-R, $Z = -1.58$, $p = 0.113$; length of URI: length of ULI, $Z = -1.2$, $p = 0.23$);
Z = Z values of the comparison between males and females (F:M);
** = p 0.01; ns = $p > 0.05$

Upper central incisors were the narrowest at the cervix, while the width at the contact point and incisal edge was almost the same, indicating the most common shape of the central maxillary incisor to be the tapered-squared.

From the different relations between the 3 horizontal distances measured on the upper central incisors, 10 different tooth forms were derived for the measured population, which are presented (in percentages) in the Figure 1.

From the different relations between the 3 horizontal distances measured on the face, 11 different facial forms were derived, which are presented (in percentages) in the Figure 2.

Some facial or tooth forms appeared in a very small percentage (Figure 1 and 2). The forms that appeared in less than 0.2% were excluded from the further analysis. Three different oval forms could be recognised on the face and on the upper central incisor. They were categorised into one oval form. When the three different oval forms were categorised into only one oval form and when some forms which appeared in less than 0.2% were excluded, then only the three basic tooth forms and the 3 basic face shapes remained in the whole study population. Face forms: oval face – 83.3%; square-tappered face – 9.2% and tappered face – 7%; tooth forms: tappered-square incisor – 53%; oval incisor – 30%; tappered incisor – 16% (Table 2). There were no significant differences in the form of the face and for the form of the maxillary central incisor between males and females ($p > 0.05$, Kolmogorov-Smirnov test), although males had a little bigger percentage of tapered face forms than females.

As assessed by $^2$ test, tooth and face form corresponded in only 30% of population. Tapered-square tooth and square-tapered face corresponded in 4.4%, tapered tooth and tapered face corresponded in 0.9% and oval tooth and face corresponded in 25.3%, which is the 30% of the tooth and the face forms matching to each other. The most common combination – which comprised nearly 45% of population was the oval face shape and the tapered-square tooth form. Tapered tooth form and oval face corresponded in 13.6%; tapered tooth corresponded to square-tapered face in 1.9%; oval tooth corresponded to square-tapered face in 3% and oval tooth corresponded to tapered face in 1.9%. Tapered-square tooth form corresponded to tapered face in

**TABLE 2**
FACE FORMS AND UPPER CENTRAL MAXILLARY INCISOR'S FORMS IN ALL INDIVIDUALS AND IN MALES AND FEMALES SEPARATELY

| | All | | Females | | Males | |
|---|---|---|---|---|---|---|
| Face form | N | % | N | % | N | % |
| Oval | 1665 | 83.3 | 927 | 85 | 738 | 80.2 |
| Square-tapered | 183 | 9.2 | 99 | 9.2 | 84 | 9.1 |
| Tapered | 140 | 7.0 | 51 | 4.7 | 89 | 9.7 |
| Missing | 12 | 0.6 | 3 | 0.3 | 9 | 1.0 |
| Total | 2000 | 100 | 1080 | 100 | 920 | 100 |
| Tooth form | N | % | N | % | N | % |
| Oval | 599 | 30 | 333 | 30.8 | 266 | 28.9 |
| Tapered-square | 1057 | 52.9 | 564 | 52.2 | 493 | 53.6 |
| Tapered | 326 | 16.3 | 169 | 15.6 | 157 | 17.1 |
| Missing | 18 | 0.9 | 14 | 1.3 | 4 | 0.4 |
| Total | 2000 | 100 | 1080 | 100 | 920 | 100 |

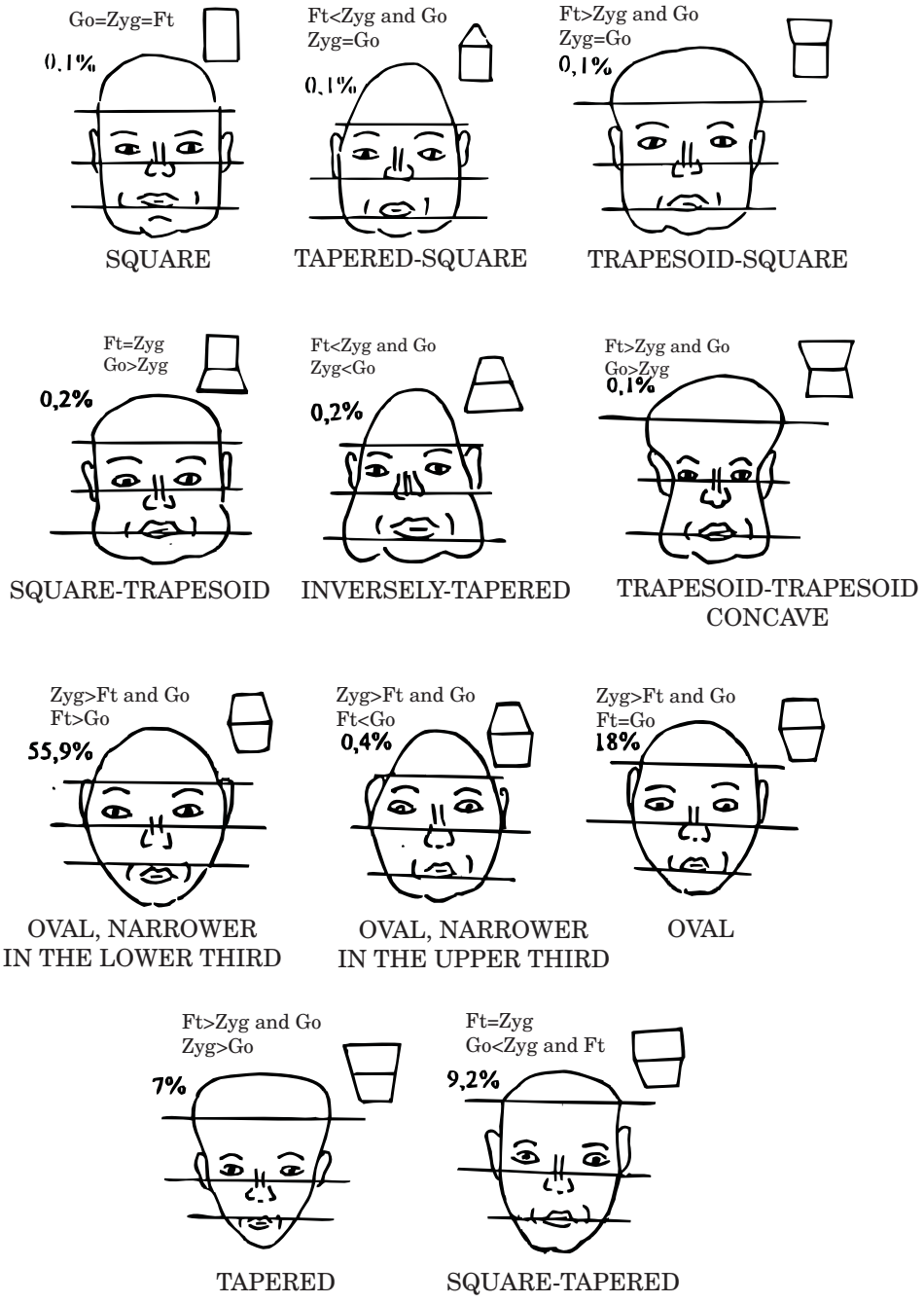


*Fig 1. Forms of the face derived from the relation between Ft-Ft, Zyg-Zyg and Go-Go.*

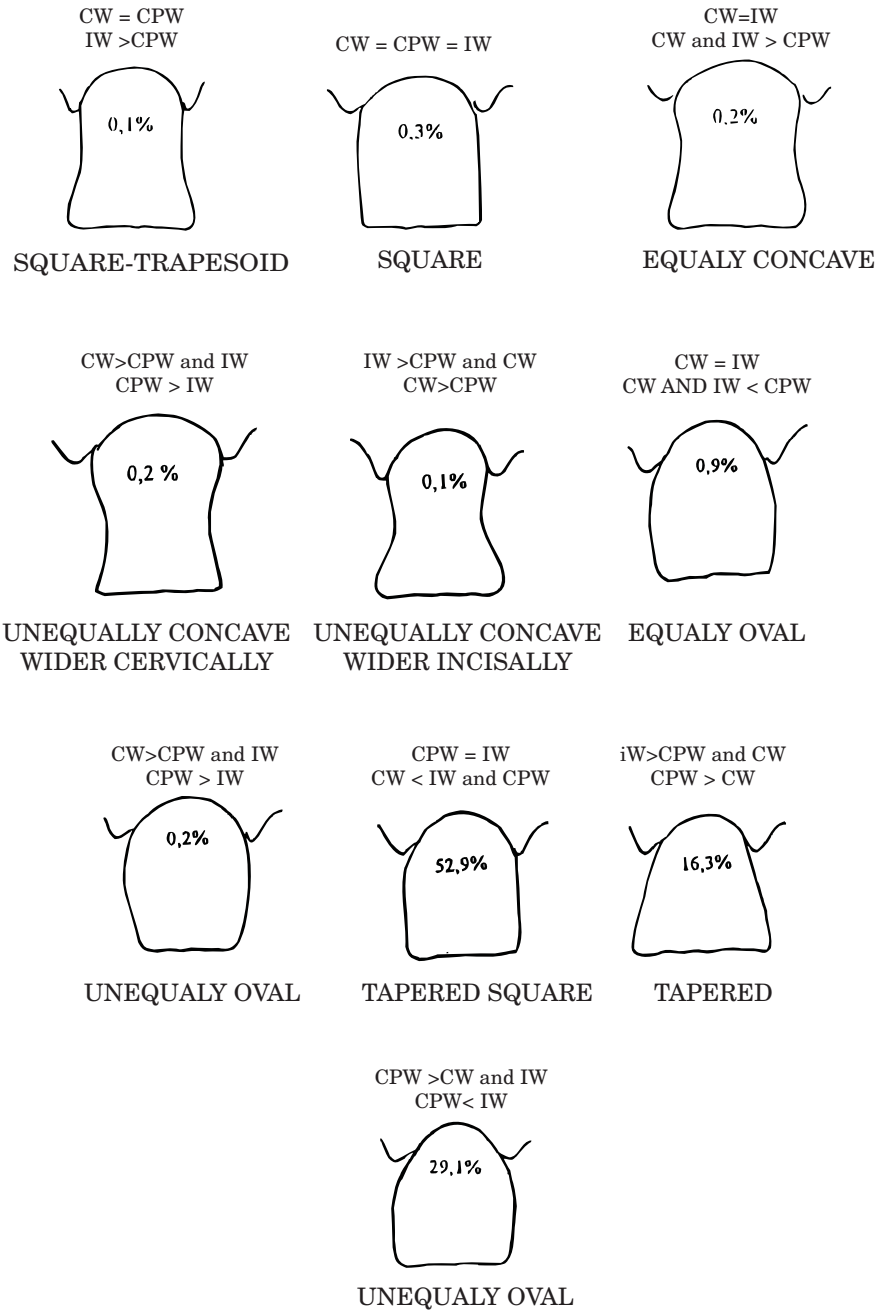


*Fig 2. Forms of maxillary central incisors derived upon relation between CW, CPW and IW; IW = incisal width; CW = cervical width; CPW = contact point width.*

4.3%, and tapered square tooth corresponded to oval face in 44.7%, which is, as mentioned above, the most common combination in the study population.

Long time ago, Leon Williams had categorised all the people to have the three basic face forms which were matching to the same, but smaller and inverse central maxillary incisor's forms (oval, square, tapered)[12,18–20].

The results of this study, in more than 98% of the examined population, also revealed three forms of the face and three forms of the upper central incisor, which is similar to Leon Williams postulation. Although the forms of the upper central incisors and the face could be categorised into same invades forms, as first described by Williams, the matching of the outline of the face, when inverted and the form of upper central incisor has not proved to be good for the choice of artificial teeth upon the results of the present study. The matching of the outline of the face, when inverted and the form of upper central incisor was present in only 30% of the study population. The most common combination that appeared in this study group was the oval face shape which correspond to the tapered-square tooth form in more than 45% of the population. The findings that the central upper incisor form and the face form do not correspond in the majority of our population is in agreement with some other studies on Caucasian population[13,21–24].

In conclusion, men had significantly larger dimensions for all facial and tooth dimensions ($p < 0.05$) than women, except for the cervical tooth width ($p > 0.05$); the left and the right central incisors were of identical dimensions and forms ($p > 0.05$). The width of upper central incisors were smaller approximately 1.5 mm than in west Europeans. Upon the relation between the 3 horizontal dimensions measured on the face and upper maxillary incisor, 11 facial forms and 10 upper central tooth forms could be recognised in the study population, but 98% of the population had only 3 tooth and face forms: Face shapes: oval face – 83.3%, square-tapered face – 9.2% and tapered face – 7%; tooth forms: tapered-square incisor – 53%, oval incisor – 30%, tappered incisor – 16%. Reversed and enlarged tooth form was identical with the facial form in only 30%, while the most common combination was of the oval face form and the tapered- square central incisor (45%). These results disapprove William's theory and may be helpful for the choice of artificial teeth in complete denture construction and the dental industry.

## REFERENCES

1. BALDWIN, D. C., Community Dent. Oral Epidemiol., 8 (1980) 224. — 2. VALLITTU, P. K., A. S. VALLITTU, V. P. LASSILA, J. Dent., 24 (1996) 335. — 3 KNEZOVIĆ-ZLATARIĆ, D., A. ČELEBIĆ, M. VALENTIĆ-PERUZOVIĆ, R. ĆELIĆ, I. FILIPOVIĆ, M. BAUČIĆ, Coll. Antropol., 24 (2000) 485. — 4. ČELEBIĆ, A., M. VALENTIĆ-PERUZOVIĆ, J. STIPETIĆ, Z. DELIĆ, T. STANIČIĆ, L. IBRAHIMAGIĆ, Coll. Antropol., 24 Suppl. (2000) 71. — 5. STIPETIĆ, J., A. ČELEBIĆ, V. JEROLIMOV, I. WINTER, S. KRALJEVIĆ, Z. RAJIĆ, Coll. Antropol., 24 Suppl. (2000) 25. — 6. NELSON, A. A., National Dent. Assoc J., 9 (1992) 392. — 7. SCHLOSSER, R. O., D. H. GEHL: Complete denture prosthesis. (W. B. Saunders, London, 1953). — 8. FRENCH, F. A., J. Prosthet. Dent., 1 (1951) 587. — 9. KRAJICEK, D., J. Prosthet. Dent., 21 (1969) 654. — 10. LOWERY, P. C., Dental. Cosmos., 63 (1921) 1223. — 11. BOUCHER, C. O.: Swensons complete dentures. (C. V. Mosby, St. Louis, 1970). — 12. WILLIAMS, J. L., Dental Digest., 20 (1914) 63. — 13. BRODBELT, R. H., G. F. WALKER, D. NELSON, L. W. SELUK, J. Prosthet. Dent., 52 (1984) 588. — 14. FRUSH, J. P., R. D. FISHER, J. Prosthet. Dent., 5 (1955) 586. — 15. FRUSH, J. P., R. D. FISHER, J. Prosthet. Dent., 6 (1956) 160. — 16. FRUSH, J. P., R. D. FISHER, J. Prosthet. Dent., 6 (1956) 441. — 17. FRUSH, J. P., R. D. FISHER, J. Prosthet. Dent., 7 (1957) 5. — 18. WILLIAMS, J. L., Dental Cosmos., 56 (1914) 627. — 19. WILLIAMS, J. L., Dent. Diggest., 26 (1920) 264. — 20. WILLIAMS,

J. L., Dent. Diggest., 26 (1920) 400. — 21. SELLEN, P. N., D. C. JAGGER, B. D. S. HARRISON, J. Prosthet. Dent., 80 (1998) 163. — 22. SELUK. L. W., P. W. BRODBELT, G. H. WALKER, J. Oral Rehabil., 14 (1987) 139. — 23. BELL, R. A., J.A.D.A., 97 (1978) 637. — 24. MAVROSKOUFIS, F., G. M. RITCHIE, J. Prosth. Dent., 43 (1980) 501. — 25. WRIGHT, W. H., J.A.D.A., 23 (1936) 229. — 26. KENG, S. B., K. W. C. FOONG, Dent. Journal Singapure, 46 (1996) 103. — 27. MACK, P. J., J. Dent., 9 (1981) 67. — 28. GARN, S. M., H. B. LEWIS, H. J. WALENGA, Arch. Oral Biol., 13 (1968) 841. — 29. LAVELLE, C. L. B., Am. J. Orthod., 61 (1972) 29. — 30. SANIN, C., B. S. SAVARA, Am. J. Orthod., 59 (1971) 488. — 31. Mc ARTHUR, D. R., J. Prosthet. Dent., 53 (1985) 540. — 32. CHOLIA, P., P. G. CANNAVINA, In: Conference Programme and Abstracts of 46th Annual Conference. (BSSPD, Liverpool, 1999).

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## ODNOS IZMEĐU OBLIKA LICA I OBLIKA ZUBA

## S A Ž E T A K

Svrha rada bila je utvrditi primjenjivost geometrijske teorije Leona Williamsa i ustanoviti stupanj podudarnosti između oblika lica i oblika centralnog gornjeg inciziva u populaciji Zenice, Bosna i Hercegovina. Dvije tisuće ispitanika sa intaktnim prednjim zubima sudjelovalo je u istraživanju, u dobi od 17 do 24 godine, a mjerene su 3 horizontalne udaljenosti na licu: temporalna širina (Ft-Ft), zygomatična širina (Zyg-Zyg) i širina između goniona (Go-Go) i 3 horizontalne udaljenosti na gornjim središnjim incizivima: širina vrata zuba (CW), širina u razini kontaktnih točaka (CPW) i širina incizalnog brida (IW). Također su izmjereni visina lica (Tr-Gn) i visina zuba. Rezultati su pokazali: 1. Muškarci su imali značajno veće dimenzije zuba i lica od žena ($p < 0,05$), osim cervikalne širine zuba (0,05); lijevi i desni središnji incizivi bili su identičnih dimenzija i oblika na lijevoj i desnoj strani zubnog luka ($p > 0,05$). 2. Širine središnjih gornjih sjekutića bile su prosječno oko 1.5 mm manje od zapadnih Europljana. 3. Pomoću relacije između 3 horizontalne dimenzije izmjerene na licu i središnjem sjekutiću, bilo je moguće izdvojiti 11 oblika lica i 10 oblika gornjeg središnjeg sjekutića, ali je 98% populacije imalo 3 oblika zuba i 3 oblika lica. Oblici lica: ovalno – 83,3%; četvrtasto-trokutasto – 9,2% i trokutasto – 7%; oblici inciziva: trokutasto-četvrtasti – 53%; ovalni – 30%; trokutasti – 16%. 4. Obrnuti i povećani oblici zuba poklapali su se sa oblikom lica u samo 30% slučajeva, a najčešća kombinacija bila je ovalno lice i trokutasto-četvrtasti incizivi – 45%. 5. Ovi rezultati ne potvrđuju da se Williamsova teorija može upotrebljavati prilikom izbora oblika zuba, a rezultati mogu biti korisni dentalnoj industriji i zubnim ambulantama.