

Applicability of the Existence of Golden Standard and Golden Percentage in the Population of Jaipur, Rajasthan, India: A Comparative Study

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ABSTRACT

Aim: An evaluation for the existence of the golden percentage and golden standard in Jaipur population: a comparative study.

Materials and methods: Sample includes a total of 300 dentulous casts of participants including 150 males and 150 females. The cast belongs to the students, patients, and their attendants of Jaipur origin by birth who visited the Jaipur Dental College and Hospital. The width and height of maxillary teeth were measured by using a digital caliper. A grid was used to measure apparent widths of teeth. Student's *t* test was used to analyze the data using SPSS for Windows software (version 21) at the level of significance $p < 0.05$.

Results: The mean and standard deviation (SD) for the golden percentage of right and left central incisors, right and left lateral incisors, and for right and left canines was found to be statistically significant from the ideal golden percentage ($p < 0.05$). The difference between mean and SD of the golden standard for right and left central incisors from the standard (80%) was statistically significant ($p < 0.05$).

Conclusion: The golden percentage and golden standard did not exist in Jaipur population.

Clinical significance: The result of this study shows deviation from the ideal golden percentage and golden standard for Jaipur population which can be used clinically as a guideline for esthetic results.

Keywords: Digital caliper, Golden percentage, Golden standard, Grid, Perceived width.

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INTRODUCTION

During the last few decades, it was noticed that both the patients and dentists show a rapid increase in interest for dental esthetics.¹ During a comprehensive treatment planning, dentists should have in-depth knowledge and understanding in esthetics, harmony, and proportion, as anticipated by people.²

At present, the concept of beauty or esthetics is highly determined by media. They influenced our life that brings facial "standards" that describe perceptions of esthetics, well-being, and fitness, mixed with feelings of social achievement, intelligence, prosperity, and happiness. Nowadays, an esthetic face considers the vital to success.³⁻⁵ Hence, dental professionals should have a thorough knowledge of facial characteristics that considered "attractive" by the people.⁶⁻⁹ The most important dental aspect within the esthetic factors which can be easily controlled is the relative dimension of teeth. Proximal/incisal tooth wear and the individual tooth size variations cause difficult to define ideal tooth dimensions. The "golden percentage" and "golden standard" were proposed to determine the apparent size of teeth as examined from the front.¹⁰⁻¹⁴

The golden percentage and golden standard provide a guideline to achieve esthetic results after dental treatment. The ideal values for golden percentage and golden standard were given by study on a specific population. Snow¹⁰ proposed a bilateral analysis of perceived individual tooth width as a percentage of the total perceived width of the maxillary anterior teeth. He introduced the golden percentage to achieve an esthetically pleasing smile, in which the proportional width of right central incisor, lateral incisor, canine, left canine, lateral incisor, and central incisor is 25%, 15%, 10%, 10%, 15%, and 25%, respectively, of the total distance across

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the anterior segment. However, the results of previous studies showed that golden percentage and the golden standard are not applicable to different ethnic populations.¹⁵⁻¹⁸

The aims of our study were to evaluate the existence and applicability of golden percentage and golden standard in Jaipur population and to compare the golden percentage and golden standard between male and female.

MATERIALS AND METHODS

The sample for this study comprised of study models of 300 subjects including 150 males and 150 females. The subjects were the students, patients, and their attendants who visited the Jaipur dental college and hospital. All subjects belonged to Jaipur by birth. The ancestor origin was established after enquiring with concerned subjects.

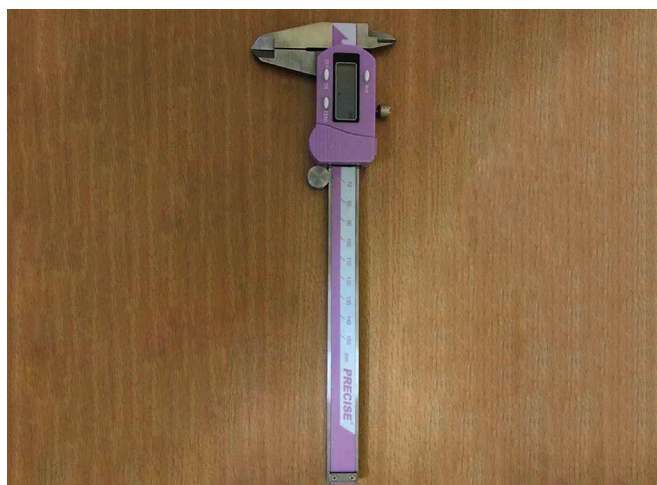


Fig. 1: Caliper

The inclusion criteria were the following:

- Jaipur individuals.
- Completely erupted upper anterior teeth.
- Absence of periodontal disease.
- No previous orthodontic treatment.
- Absence of prosthesis on upper anteriors.
- Absence of morphological variations.

Following are the exclusion criteria:

- Gross restoration.
- Any gingival alteration.
- Loss of tooth structure.

The instruments and dental materials used were the perforated metal stock trays, rubber bowls, curved metal spatula, straight metal spatula, alginate impression material, dental stone, dental plaster, base formers, and sandpaper.

A digital caliper (Fig. 1) with precision reading to the nearest 0.01 mm was used to measure the size of teeth. The mesiodistal (MD) width was measured between the contact points of the tooth. A single researcher measured tooth size twice, from right canine to left canine. If the difference between two measurements was more than 0.2 mm, then the tooth was measured again and only the new measure was registered.

Method to Determine the Golden Percentage from the Casts

The perceived width of teeth was measured by using a grid (Fig. 2). The golden percentage was calculated by dividing the perceived width of central incisor, lateral incisor, and canine by the total width of maxillary anterior teeth and multiplying it by 100. The ideal golden percentage was 10%, 15%, 25%, 25%, 15%, and 10%, from canine to canine.¹⁰

Method to Determine the Golden Standard

The MD width and height of maxillary central incisor were measured by digital caliper as explained above. The width-to-height ratio was calculated by dividing MD width by height of tooth and multiplying the result by 100. The ideal width-to-height ratio of upper central incisor should be approximately 80%. A higher width-to-height ratio means a squarer tooth, and a lower ratio indicates a long tooth.^{19–21}

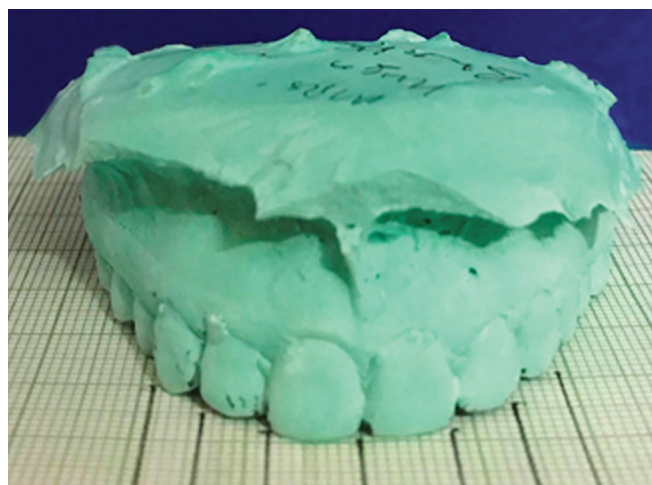


Fig. 2: Grid

Table 1: Comparison between the present study result and the standard golden percentage

Teeth	Mean (%)	SD (%)	p value
Right central incisor	24.931	0.450	0.008
Standard golden percentage	25		
Right lateral incisor	15.465	0.296	0.000
Standard golden percentage	15		
Right canine	9.592	0.275	0.000
Standard golden percentage	10		
Left central incisor	24.931	0.449	0.008
Standard golden percentage	25		
Left lateral incisor	15.476	0.350	0.000
Standard golden percentage	15		
Left canine	9.604	0.268	0.000
Standard golden percentage	10		

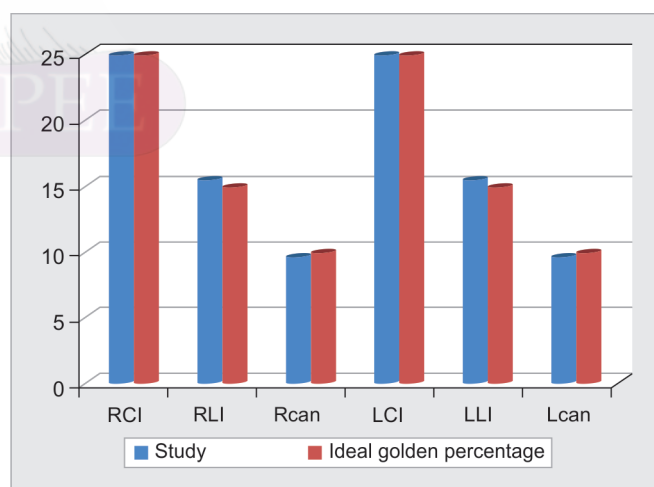


Fig. 3: Comparison between the present study result and the standard golden percentage. RCI, right central incisor; RLI, right lateral incisor; Rcan, right canine; LCI, left central incisor; LLI, left lateral incisor; Lcan, left canine

The data obtained were tabulated and analyzed using Student's *t* test at the level of significance $p < 0.05$. Statistical analysis was done using SPSS for Windows software (version 21).

RESULTS

Golden Percentage

Table 1 and Figure 3 showed the mean golden percentage and SD for maxillary anterior teeth and it revealed that the upper anterior teeth were not in golden percentage. The mean and SD for the golden percentage of right central incisor was 24.931 ± 0.450 , for right lateral incisor was 15.465 ± 0.296 , and for right canine was 9.592 ± 0.275 . The mean and SD for the golden percentage of left central incisor was 24.931 ± 0.449 , for left lateral incisor was 15.476 ± 0.350 , and for left canine was 9.604 ± 0.268 . The difference between the standard golden percentage and our study was found to be

Table 2: Comparison of the tooth width/height ratio for the upper central incisor with ideal golden standard (80%)

Central incisor	Mean (%)	SD (%)	p value
Right central incisor	80.309	1.649	0.001
Ideal golden standard	80		
Left central incisor	80.283	1.664	0.003
Ideal golden standard	80		

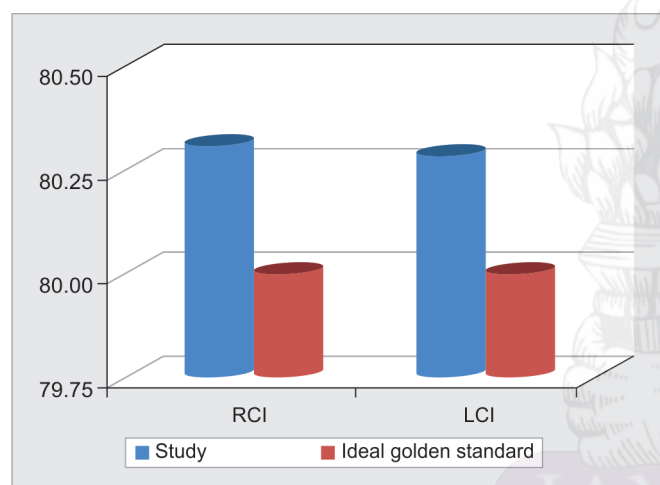


Fig. 4: Comparison of the tooth width/height ratio for the upper central incisor with ideal golden standard (80%). RCI, right central incisor; LLI, left lateral incisor

statistically significant for all six anterior teeth ($p < 0.05$) (Table 1 and Fig. 3).

Golden Standard

The mean and SD of width/height ratio for right central incisor was $80.309\% \pm 1.649$ and for left central incisor was $80.283\% \pm 1.664$. When compared from standard (80%), the difference was found to be significant ($p 0.001, 0.003$) for both right and left central incisors (Table 2, Fig. 4).

Golden Percentage between Males and Females

Both male and female groups were compared for the golden percentage and results are shown in Table 3. The mean and SD for golden percentage of right central incisor for males was 24.919 ± 0.386 and for females was 24.944 ± 0.506 . For right lateral incisor in males, it was 15.479 ± 0.237 and for females was 15.452 ± 0.345 . For right canine in males, it was 9.597 ± 0.214 and for females was 9.586 ± 0.325 . The mean and SD for the golden percentage of left central incisor for males was 24.919 ± 0.386 and for females was 24.944 ± 0.505 ; left lateral incisor for males was 15.488 ± 0.236 and for females was 15.465 ± 0.435 ; and for left canine in males was 9.600 ± 0.216 and in females was 9.609 ± 0.312 . The difference

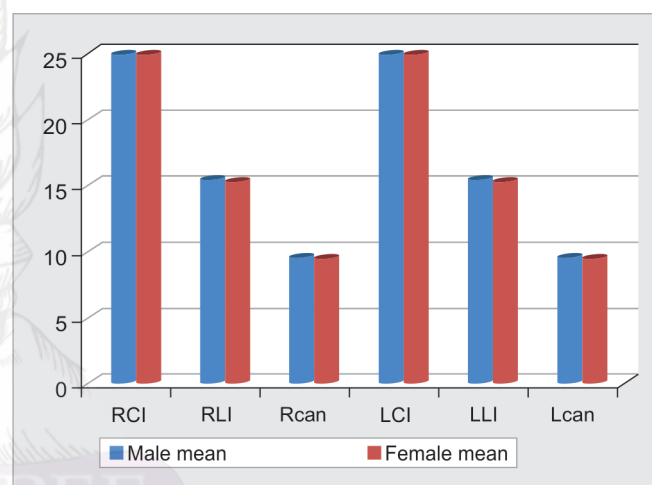


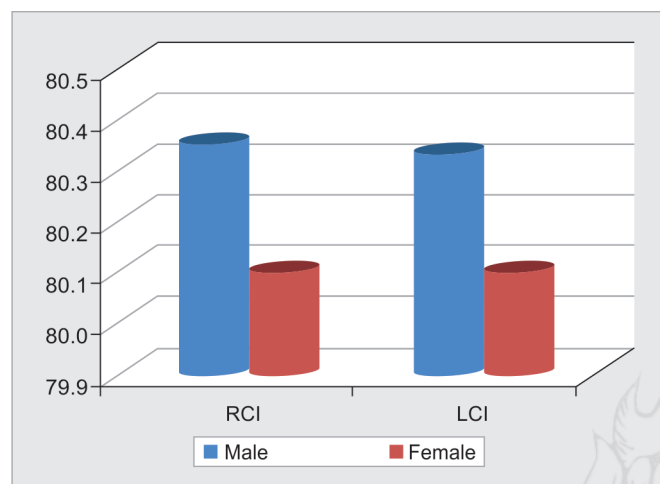
Fig. 5: Golden percentage in males and females. RCI, right central incisor; RLI, right lateral incisor; Rcan, right canine; LCI, left central incisor; LLI, left lateral incisor; Lcan, left canine

Table 3: Golden percentage in males and females

Teeth	Males		Females		p value
	Mean	SD	Mean	SD	
Right central incisor	24.919	0.386	24.944	0.506	0.121
Standard golden percentage	25				
Right lateral incisor	15.479	0.237	15.452	0.345	0.214
Standard golden percentage	15				
Right canine	9.597	0.214	9.586	0.325	0.020
Standard golden percentage	10				
Left central incisor	24.919	0.386	24.944	0.505	0.120
Standard golden percentage	25				
Left lateral incisor	15.488	0.236	15.465	0.435	0.099
Standard golden percentage	15				
Left canine	9.600	0.216	9.609	0.312	0.032
Standard golden percentage	10				

Table 4: Golden standard in males and females

	Male		Female		<i>p</i> value
	Mean (%)	SD (%)	Mean (%)	SD (%)	
Central incisor					
Right central incisor	80.461	1.568	80.157	1.717	0.342
Ideal golden standard	80				
Left central incisor	80.422	1.561	80.144	1.754	0.173
Ideal golden standard	80				

**Fig. 6:** Golden standard in males and females. RCI, right central incisor; LLI, left lateral incisor

between the male and female group was statistically nonsignificant ($p > 0.05$) for right and left central and lateral incisors, whereas for right and left canine, the difference between the groups was found statistically significant ($p < 0.05$) (Table 3 and Fig. 5).

Golden Standard between Males and Females

The mean and SD of width-to-height ratio for right central incisor in males was $80.461\% \pm 1.568$ and in females was $80.157\% \pm 1.717$. For left central incisor in males, it was $80.422\% \pm 1.561$ and in females was $80.144\% \pm 1.754$. The difference between the groups was found to be statistically nonsignificant ($p > 0.05$) (Table 4 and Fig. 6).

DISCUSSION

The upper front teeth size, morphology, and arrangement are the most influential factor for harmonious appearance, especially when viewed from the front. In our study; with respect to the golden percentage, the mean and SD for the golden percentage of right central incisor and right canine is less than the standard golden percentage, but the width of the lateral incisor is slightly greater than the standard golden percentage. The difference in width of the right central incisor (24.931 ± 0.450), lateral incisor (15.465 ± 0.296), and canine (9.592 ± 0.275) to the standard golden percentage as suggested by Snow (25, 15, 10) is statistically significant ($p < 0.05$) (Table 1 and Fig. 3).¹⁰

The mean and SD for the golden percentage of left central incisor and left canine is also less than the standard golden percentage, and the width of the lateral incisor is marginally greater than the standard golden percentage. The difference in width of left central incisor (24.931 ± 0.449), left lateral incisor (15.476 ± 0.350), and left canine (9.604 ± 0.268) to the standard golden percentage

as recommended by Snow¹⁰ (25, 15, 10) is found to be statistically significant ($p < 0.05$) (Table 1 and Fig. 3).

In general, the value for central incisor and canine is slightly lesser and the value of lateral incisor is marginally greater than those recommended by the standard golden percentage (Table 1 and Fig. 3). This shows that the standard golden percentage (25, 15, and 10) is not applicable to Jaipur population. Similar results were found by Snow who proposed that golden percentage theory is applicable if percentages are adjusted according to the ethnicity of the population.¹⁰

Our results are in agreement with Fayyad et al.¹⁵ who also suggested that the golden percentage was not applicable on the subjects of their study. However, a slight modification of these percentages can be adopted taking into consideration the ethnicity differences of the subjects. In their study, the values obtained were 12%, 15%, 23%, 23%, 15%, and 12%. Similarly in Jaipur population also golden percentage can be adjusted to 9%, 15%, 24%, 24%, 15%, and 9%.

The upper anterior teeth are closely related to the jaw and facial appearance, which are important for esthetics and physical anthropology. The maxillary anterior teeth should be put in optimal dentolabial relations, in harmony with the overall facial appearance. The size and form of the maxillary anterior teeth are important for both dental and facial esthetics. The harmonious anterior dentition is influenced by many factors like morphology and arrangement of the maxillary anterior teeth, specifically the upper central incisors in anterior view.^{13,22-24}

Data related to the natural tooth dimensions are available through various tooth morphology sources.²³⁻²⁵ The mesiocervical and incisocervical dimensions of teeth were available since 1902 and it is only recently that the crown width/length ratios have been considered.¹¹

Sterrett et al. used the caliper to measure the dimensions on the casts and he found a homogenous ratio (81%) for the three anterior maxillary tooth groups.¹¹ Magne et al. did the measurements on extracted teeth using imaging software. He measured the width/length ratios and provides data for worn and unworn teeth. The ranking for width/length ratio for the specimens studied emphasizes the difference between unworn teeth, with average ratios between 73% and 78%, and worn teeth, with average ratios between 79% and 87% teeth.²⁶ However, in the present study, the measurements were done on the stone casts using a digital caliper (read up to 0.01 mm) (Fig. 1).

Peixoto et al. concluded that the ideal width-to-height ratio for the central incisor should lie between 75% and 80%. However, an esthetically acceptable ratio appearance is in the 65–85% range.²¹ The results of our study showed width-to-height ratio greater than previous studies conducted by Hasanresioğlu et al.,¹⁸ and Parnia et al.,¹⁹ Wolfart et al.,²⁰ and these studies concluded that there is no golden standard in the nature. Another study conducted in Korea showed similar results for the noncelebrities group.²³

The difference between ideal width-to-height ratio (80%) and our result (right central incisor 80.309% and left central incisor 80.283%) was found to be statistically significant ($p < 0.05$). These results are because of differences in racial characteristics (Table 2 and Fig. 4). Our results are in disagreement with Ku et al. who concluded that after analyzing maxillary anterior teeth of Korean adults, their results were in accordance with the general Western standards of esthetics.²⁷

The golden percentage was compared for the male and female groups, and the difference between right and left central incisors, right and left lateral incisors is statistically nonsignificant ($p > 0.05$), whereas the difference between right and left male and female canine widths is statistically significant ($p < 0.05$). Our results are in agreement with previous studies which concluded that gender has no statistically significant effect when the golden percentage was compared between male and female groups (Table 3 and Fig. 5).^{15,28}

There was no statistically significant ($p > 0.05$) difference in the width/height ratio of maxillary central incisors between the male and female groups. Our results are in agreement with Nalla et al. (Table 4 and Fig. 6).²⁹

CONCLUSION

- The golden percentage and golden standard show ethnic variation as it does not exist in the Jaipur population as described by Snow. Hence, the population-specific golden standard and golden proportion should be used for proper diagnosis and treatment planning.
- The difference between male and female for the golden percentage and golden standard is statistically nonsignificant except the golden percentage for right and left canines.

CLINICAL SIGNIFICANCE

The result of this study shows deviation from ideal golden percentage and golden standard for Jaipur population which can be used clinically as a guideline for esthetic results.

REFERENCES

1. Carlsson GE, Johansson A, Johansson AK, et al. Attitudes toward dental appearance in 50- and 60-year old subjects living in Sweden. *J Esthet Restor Dent* 2008;20(1):46–55. DOI: 10.1111/j.1708-8240.2008.00148.x.
2. Park DJ, Yang JH, Lee JB, et al. Esthetic improvement in the patient with one missing maxillary central incisor restored with porcelain laminate veneers. *J Adv Prosthodont* 2010;2(3):77–80. DOI: 10.4047/jap.2010.2.3.77.
3. Johnson N, Sandy J. An aesthetic index for evaluation of cleft repair. *Eur J Orthod* 2003;25(3):243–249. DOI: 10.1093/ejo/25.3.243.
4. Kokich VO, Kokich VG, Kiyak HA. Perceptions of dental professionals and laypersons to altered dental esthetics: asymmetric and symmetric situations. *Am J Orthod Dentofac Orthop* 2006;130(2):141–151. DOI: 10.1016/j.ajodo.2006.04.017.
5. Shaw WC. The influence of children's dentofacial appearance on their social attractiveness as judged by peers and lay adults. *Am J Orthod* 1981;79(4):399–415. DOI: 10.1016/0002-9416(81)90382-1.
6. Bashour M. An objective system for measuring facial attractiveness. *Plast Reconstr Surg* 2006;118(3):757–774. DOI: 10.1097/01.prs.0000207382.60636.1c.
7. Naini FB, Moss JP, Gill DS. The enigma of facial beauty: esthetics, proportions, deformity, and controversy. *Am J Orthod Dentofac Orthop* 2006;130:277–282. DOI: 10.1016/j.ajodo.2005.09.027.
8. Scott CR, Goonewardene MS, Murray K. Influence of lips on the perception of malocclusion. *Am J Orthod Dentofac Orthop* 2006;130(2):152–162. DOI: 10.1016/j.ajodo.2004.11.036.
9. Sforza C, Laino A, D'Alessio R, et al. Three-dimensional facial morphometry of attractive children and normal children in the deciduous and early mixed dentition. *Angle Orthod* 2007;77(6):1025–1033. DOI: 10.2319/100206-400.1.
10. Snow SR. Esthetic smile analysis of maxillary anterior tooth width: the golden percentage. *J Esthet Dent* 1999;11(4):177–184. DOI: 10.1111/j.1708-8240.1999.tb00397.x.
11. Sterrett JD, Oliver T, Robinson F, et al. Width/length ratios of normal clinical crowns of the maxillary anterior dentition in man. *J Clin Periodontol* 1999;26(3):153–157. DOI: 10.1034/j.1600-051X.1999.260304.x.
12. Qualtrough AJ, Burke FJ. A look at dental aesthetics. *Quintessence Int* 1994;25(1):7–14.
13. Brisman AS. Esthetics: a comparison of dentists' and patients' concepts. *J Am Dent Assoc* 1980;100(3):345–352. DOI: 10.14219/jada.archive.1980.0093.
14. Gillen RJ, Schwartz RS, Hilton TJ, et al. An analysis of selected normative tooth proportions. *Int J Prosthodont* 1994;7(5):410–417.
15. Fayyad MA, Jaman KD, Aqrabawi J. Geometric and mathematical proportions and their relations to maxillary anterior teeth. *J Contemp Dent Pract* 2006;7(5):1–10. DOI: 10.5005/jcdp-7-5-62.
16. Murthy BV, Ramani S. Evaluation of natural smile: golden proportion, RED or golden percentage. *J Conserv Dent* 2008;11(1):16–21. DOI: 10.4103/0972-0707.43413.
17. Rita ME, Kinga J, Carmen B, et al. Aesthetic Principles of the upper front teeth: application of golden proportion (lewin) and golden percentage (snow). *Acta Medica Marisensis* 2013;59(1):25–27. DOI: 10.2478/amma-2013-0005.
18. Hasanresioğlu U, Berksun S, Arus K, et al. An analysis of maxillary anterior teeth: facial and dental proportion. *J Prosthet Dent* 2005;94(6):530–538. DOI: 10.1016/j.prosdent.2005.10.007.
19. Parnia F, Hafezeqoran A, Mahboub F, et al. Proportions of maxillary anterior teeth relative to each other and to the golden standard in tabriz dental faculty students. *JODDD* 2010;4(3):83–86. DOI: 10.5681/joddd.2010.021.
20. Wolfart S, Quass AC, Freitag S, et al. Subjective and objective perception of upper incisors. *J Oral Rehabil* 2006;33(7):489–495. DOI: 10.1111/j.1365-2842.2005.01581.x.
21. Peixoto LM, Louro RL, Gomes AA, et al. Photographic analysis of esthetic dental proportions. *Rev Gaucha Odontol* 2012;60(1):13–17.
22. Marquardt SR. Dr. Stephen R. Marquardt on the golden decagon and human facial beauty. Interview by dr. Gottlieb. *J Clin Orthod* 2002;36(6):339–347.
23. Lee SL, Kim HJ, Son MK, et al. Anthropometric analysis of maxillary anterior buccal bone of Korean adults using conebeam CT. *J Adv Prosthodont* 2010;2(3):92–96. DOI: 10.4047/jap.2010.2.3.92.
24. Gürel G. Predictable, precise, and repeatable tooth preparation for porcelain laminate veneers. *Pract Proced Aesthet Dent* 2003;15(1):17–24.
25. Black GV. Descriptive anatomy of the human teeth. Philadelphia: The S.S. White Dental Manufacturing; 1902.
26. Magne P, Gallucci GO, Belser UC. Anatomic crown width/length ratios of unworn and worn maxillary teeth in white subjects. *J Prosthet Dent* 2003;89(5):453–461. DOI: 10.1016/S0022-3913(03)00125-2.
27. Ku JE, Yang HS, Yun KD. A morphometric analysis of maxillary central incisor on the basis of facial appearance in Korea. *J Adv Prosthodont* 2012;4(1):13–17. DOI: 10.4047/jap.2012.4.1.13.
28. Mahajan V, Nagpal A, Gupta R, et al. Comparative evaluation of golden proportion, recurring esthetic dental proportion and golden percentage in Himachal demographic. *J Adv Med Res* 2019;29(10):1–7. DOI: 10.9734/jamr/2019/v29i1030133.
29. Nalla S, Parth S, Siva S, et al. An analysis of maxillary anterior teeth dimensions for the existence of golden proportion: clinical study. *J Int Oral Health* 2015;7(9):18–21.