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EVALUATION OF ESTHETIC DENTAL AND FACIAL MEASUREMENTS OF SAUDI YOUNG ADULT MALE PATIENTS

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Abstract:

Background: *smile is considered as one of the most important facial expressions, in order to obtain a highly esthetic result when restoring a patient's smile, the clinician must consider the effect different tooth forms generate when arranged next to each other. The Golden Proportion (GP) has been considered the most harmonious recurrent tooth-to-tooth ratio and has long been proposed as an aesthetic guideline for restoring maxillary anterior teeth. The aim of the study was to evaluate of esthetic dental and facial measurements of Saudi young adult male patients.*

Methods: *a total of 60 Saudi young adult male patients (20 to 25 years old) with natural smiles. Frontal photographs were captured for all participants while rest position, smiling and close-up anterior with cheek retractors using a digital camera with standardized settings. Photo-editing software was used to measure the perceived mesiodistal width of each anterior maxillary tooth in all digital images. Calculated ratios of the perceived mesiodistal widths of the teeth were compared with their respective GP values using a one sample t-test.*

Results: *for dental measurements, there were no significant differences among the tested groups at ($P< 0.05$) between the calculated ratios and the golden ratios. No significant differences among the tested groups at ($P< 0.05$) were detected for facial measurements.*

Conclusion: *the results of the present study have shown that this GP did not exist between the widths of the maxillary anterior teeth in individuals who have an esthetic smile. While the dento-facial measurements were in accordance to GP.*

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INTRODUCTION:

Smile is considered as one of the most important facial expressions and is essential in expressing emotions. An attractive or pleasing smile enhances the acceptance of an individual in the society by improving the interpersonal relationships [(1)]. The importance of beauty and attractiveness in today society has been well established. Physically attractive people are perceived to be more kind, sensitive, interesting, strong, poised, modest, sociable, outgoing, exciting and responsive.

Webster [(2)] defines the smile as " a change of facial expression involving a brightening of the eyes, an upward curving of the corners of the mouth with no sound and less muscular distortion of the features than in a laugh that may express amusement, pleasure, tender affection, approval, restrained mirth, irony, derision or any of various other emotions.

There are two forms of smiles – the enjoyment or Duchenne smile and the posed or social smile. The Posed smile is voluntary and not elicited by an emotion. In other words it is reliably reproducible and can be sustained. Posed smiles, therefore have importance in cosmetic diagnosis and treatment planning. The enjoyment smile however, is involuntary and is induced by joy or mirth. It is a natural response as it expresses authentic human emotion. Unlike the posed smiles, these smiles are not sustained. It must be understood that there is no universal "ideal" smile. The most important esthetic goal in cosmetic dentistry is to achieve a "balanced" smile, which can best be described as an appropriate positioning of the teeth and gingival scaffold within the dynamic display zone [(3)].

Many investigators [(4-6)] have had been mentioned that, in order to obtain a highly esthetic result when restoring a patient's smile, the clinician must consider not just the individual features of each tooth but also the effect different tooth forms generate when arranged next to each other. In addition, the relationship between teeth, soft tissue, and the patient's facial characteristics must be taken into account. Proper tooth size, tooth shape, tooth-to-tooth proportion, and symmetry are influenced by the gingival architecture. Harmonizing an esthetics smile requires a perfect integration of facial composition and dental composition. The facial composition includes the hard and soft tissues of the face. The dental composition relates more specifically to teeth and their relationship to gingival tissues. A smile design should always include the evaluation and analysis of both facial and dental composition [(7)]. Also facial beauty is based on standard esthetic principles that involve proper alignment, symmetry and proportion of face. Analyzing, evaluating and treatment planning for facial esthetics often involve a multidisciplinary approach which could include orthodontics, orthognathic surgery, periodontal therapy, cosmetic dentistry and plastic surgery. Thus, esthetic approach to patient care produces the best dental and facial beauty [(8)].

Several authors have studied esthetic principles, such as the golden proportion (GP) and the width/height (W/H) ratios of the maxillary anterior teeth [(9-16)]. The GP was described by Pythagoras, an ancient Greek mathematician, as an attempt to correlate science with beauty. It was used to design the Parthenon, and later to label dimensions in da Vinci's classic drawings of human anatomy. The ratio is approximately 0.618 to 1, whereby the height of the shorter object divided by the height of the longer one is identical to the height of the longer object divided by the sum of the shorter plus the longer objects [(14-16)]. Levin recommends the width of the maxillary LI be in GP to the width of the maxillary central incisor (CI) when viewing from the front [(17)]. However, a range of studies [(15,16,18-20)] have not found this proportion to exist in a majority of patients in the general population.

The Digital Smile Design (DSD) is a multi-use conceptual tool that can strengthen diagnostic vision, improve communication and enhance predictability throughout treatment. The DSD allows for careful analysis of the patient's facial and dental characteristics along with any critical factors that may have been overlooked during clinical, photographic, or diagnostic cast-based evaluation procedures. The drawing of reference lines and shapes over extra- and intraoral digital photographs in a predetermined sequence can widen diagnostic visualization and help the restorative team evaluate the limitations and risk factors of a given case, including asymmetries, disharmonies, and violations of aesthetic principles [(21)].

The aim of the study was to determine how some esthetic dental (width/length ratios, Longest apical coronal portion) for upper maxillary anterior teeth and facial measurements (upper lip height, maximal maxillary central incisal, intercommisural width and gingival display at the rest and smile positions relate to the variability of young adult Saudi male patients.

MATERIALS & METHODS:

This study will be consists of 20 Saudi young adult male patients, their age were range from 20 to 25 years old. All the participants had continuous natural

dentitions with natural teeth or fixed restoration on posterior teeth, and with no artificial crowns, porcelain laminate veneers, or composite resin restorations in the anterior maxillary segment. For the maxillary incisors, the exclusion criteria were: evidence of gingival hyperplasia, inflammation, altered passive eruption, attachment loss, gingival recession or periodontal surgery, prior visible composite resin restorations on the facial surfaces of the teeth, prior traumatic injury or occlusal wear into the dentin, dental malocclusion, or prior orthodontic treatment. All the participants included in the study were gave written informed consent to the survey procedures, which was approved by the Ethical Committee of the College of Dentistry, King Khalid University, Kingdom of Saudi Arabia.

Standardization of clinical photographs

Digital camera with 105 mm lens [1] with 1:1 magnification and ring flash [2] , mounted on tripod with fixed distances (50-80 cm) were used during this study. The camera was set to manual control as follows: ISO set to 200, Aperture and depth of field: 5.6 for the smile profile and 11 for the close up photographs. Shutter speed 1/200 sec. Ring flash power was set manually to 1/32 with trigger mounted on the flash housing and synchronized by cord.

Clinical photographs were done with the following standards series as; (a) rest position, (b) smile and (c) close-up anterior with cheek retractors. Photograph calibration procedure was done by taking photographs for two rulers 20 cm in length which mounted horizontally and vertically on white wall with fixed distance (50-80 cm). The photograph was imported to Adobe Photoshop CC 2014 software. Image analysis tool was used to make preset calibration for each photo with different distances (50-80 cm.) respectively Fig. (1), the resulting preset scale was used for measuring of dento-facial composition Fig. (2) and dental composition (Fig.3). Each measurement with preset scale was recorded with the same software.

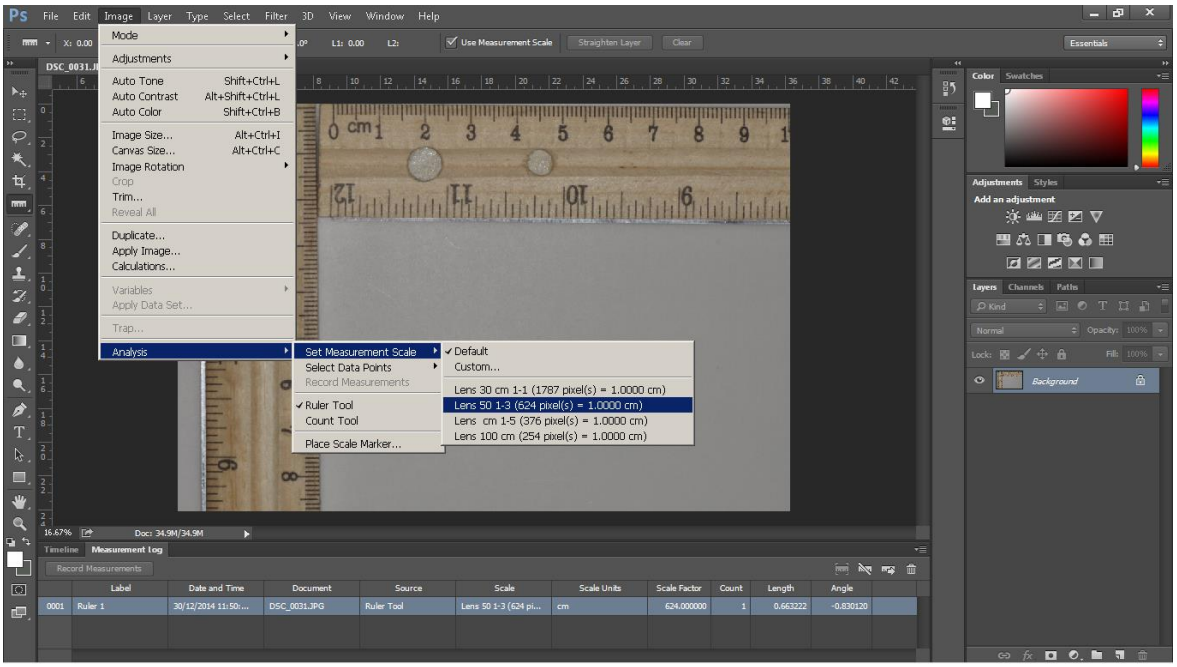

Fig. (1): Settings of Preset calibration with Adobe Photoshop.

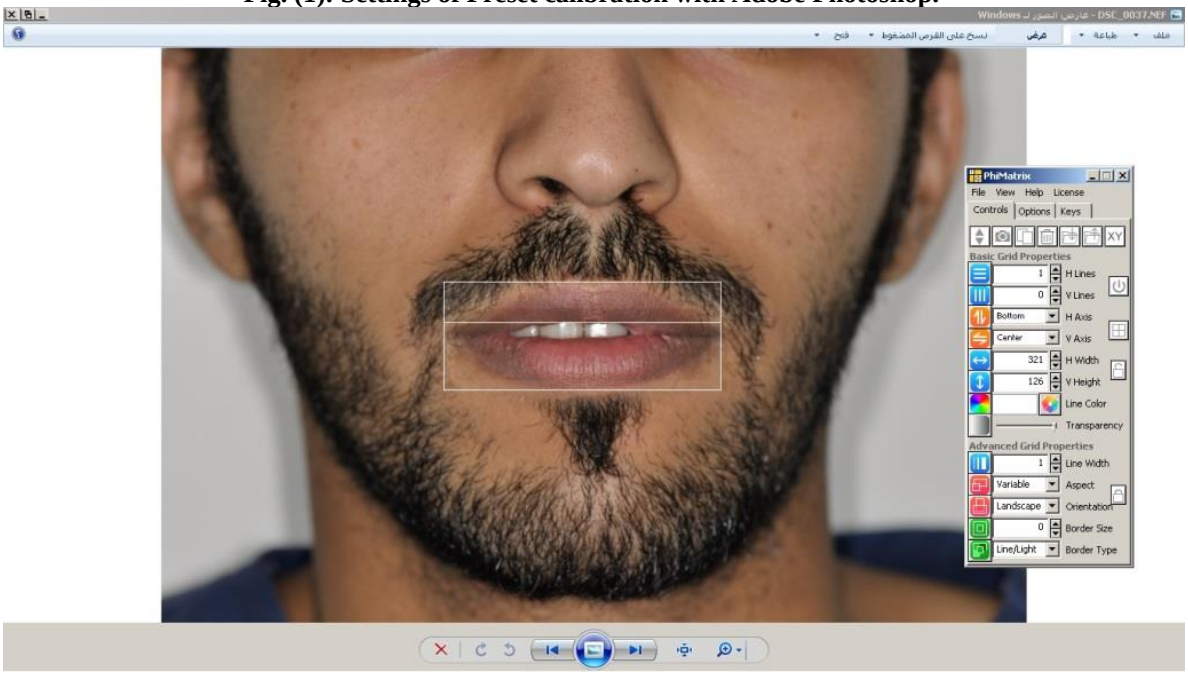

Fig. (2): Dento-labial composition measurement and analysis.

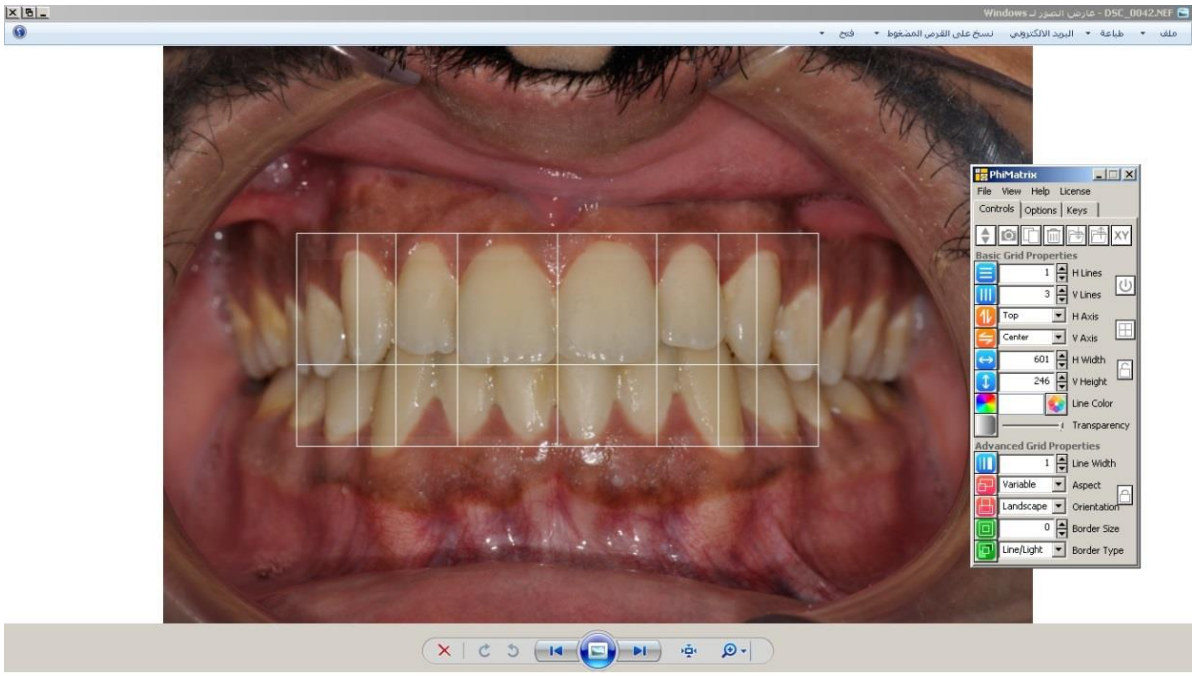

Fig. (3): Dental components measurement and analysis.

Dental Measurements

The distance between the camera and the subject was fixed at a working distance of 50 cm. The camera was stabilized with the help of a tripod. Mesio-distal width and longest apical-coronal portion of maxillary incisor teeth for dental composition were measured. Width/length ratio (WLRs) (%) was calculated. Each parameter was measured three times and the average value was recorded.

Facial Measurements

Standardized frontal images of each participant were taken during rest and during natural smiling using digital camera in the following manner: Subjects were positioned in the natural head position. The camera was positioned and adjusted to obtain a sharp image of the face, from the tip of the nose to the tip of the chin. The distance between the camera and the subject was fixed at a working distance of 80 cm. The camera was stabilized with the help of a tripod, at this fixed distance.

Upper Lip Height , Intercommisural width, Maximum maxillary anterior teeth width and Gingival display in both rest and non-exaggerated smile positions were recorded. Each parameter was measured three times and the average value was recorded.

The images were downloaded to a personal computer. All the measurements were taken with Adobe Photoshop , by one investigator. The facial dimensions were measured between different anthropological points. The upper lip height, the intercommisural width, maximum maxillary anterior teeth, and gingival display were measured in a rest and smile positions. In smile evaluation, the subjects were asked to give a pleasing non-exaggerated smile and the upper lip height, the intercommisural width, maximum maxillary anterior teeth and gingival display were measured again. Each parameter was measured thrice and the average values were recorded. The mean values were calculated and data was statistically analyzed using data analysis in Excel software 2010.

RESULTS:

Dental Measurements;

Table (1) and Fig (4), summarizes the results of dental measurement by millimeters of the tested groups. (Mean, Stander deviation, minimum and maximum). Statistical analysis using 1 way ANOVA using data analysis in Excel software 2010 results revealed no significant differences among the tested groups at P< 0.05 (Tab.2 and 3).

Facial Measurements

Table (4) and Fig. (5) summarizes the results of facial measurement during rest and smile of upper lip height, intercommisural width, maximum maxillary anterior teeth width and gingival display in millimeters of the tested groups. (Mean, Stander deviation, minimum and maximum). Statistical analysis using 1 way ANOVA data analysis in Excel

software 2010 of the recorded results revealed no significant differences among the tested groups at P< 0.05 (Tab.5).

Table 1: Mean of dental measurements (mm), Stander deviations, Minimum and Maximum for tested groups

Groups	Mesio-distal Width				Longest Apical Coronal Portion			
	Mean (mm.)	Std	Min	Max	Mean (N)	Std	Min	Max
Right lateral Incisor	6.37	0.52	5.32	7.20	8.17	1.02	6.87	11.36
Left Lateral Incisor	6.39	0.54	5.32	7.20	8.03	0.87	6.29	9.92
Right Central Incisor	8.48	0.38	7.70	9.09	10.55	2.38	8.30	8.30
Left Central Incisor	8.46	0.40	7.70	9.09	10.54	2.38	19.83	19.38

Table 2: One-way ANOVA test for dental measurements (Mesio-destal width)

	Source of Variation	SS	df	MS	F	P-value
Lateral Incisors	Between Groups	0.00529	1	0.00529	0.018666	0.89205
	Within Groups	10.76931	38	0.283403		
	Total	10.7746	39			
Central Incisors	Between Groups	0.003062	1	0.003062	0.019985	0.888325
	Within Groups	5.823035	38	0.153238		
	Total	5.826098	39			

Table 3: One-way ANOVA test for dental measurements (Longest apical-coronal portion)

	Source of Variation	SS	df	MS	F	P-value
Lateral Incisors	Between Groups	0.20736	1	0.20736	0.230454	0.633939
	Within Groups	34.19199	38	0.899789		
	Total	34.39935	39			
Central Incisors	Between Groups	0.000303	1	0.000303	5.34E-05	0.994209
	Within Groups	215.3672	38	5.667558		
	Total	215.3675	39			

Table 4: Mean of facial measurements (mm), Stander deviations, Minimum and Maximum for tested groups

	Upper Lip Height		Inter-commissural Width		Maximum Maxillary Anterior Teeth Width		Gingival Display	
	Rest	Smile	Rest	Smile	Rest	Smile	Rest	Smile
Mean (mm.)	0.74	0.57	4.88	5.90	1.93	3.72	0.00	0.25
Std	1.18	1.17	0.37	0.72	1.29	0.28	0.00	0.21
Min.	0.32	0.20	4.30	4.67	0.00	3.39	0.00	0.00
Max.	1.00	0.98	5.51	7.21	3.51	4.29	0.00	0.65

Table 5: One-way ANOVA test for dental measurements (upper lip height, inter-commissural width, maximum maxillary anterior teeth width, and gingival display)

	Source of Variation	SS	df	MS	F	P-value
Upper Lip Height	Between Groups	0.276253	1	0.276252632	8.915579881	0.005060327
	Within Groups	1.115474	36	0.03098538		
	Total	1.391726	37			
Inter-commissural width	Between Groups	9.945094737	1	9.945095	30.39702	3.10845E-06
	Within Groups	11.77824211	36	0.327173		
	Total	21.72333684	37			
Maximum Maxillary Anterior Teeth Width	Between Groups	30.70804	1	30.70804211	34.93964132	9.13901E-07
	Within Groups	31.63998	36	0.878888304		
	Total	62.34802	37			
Gingival Display	Between Groups	0.576378947	1	0.576379	27.20044	7.76752E-06
	Within Groups	0.762842105	36	0.02119		
	Total	1.339221053	37			

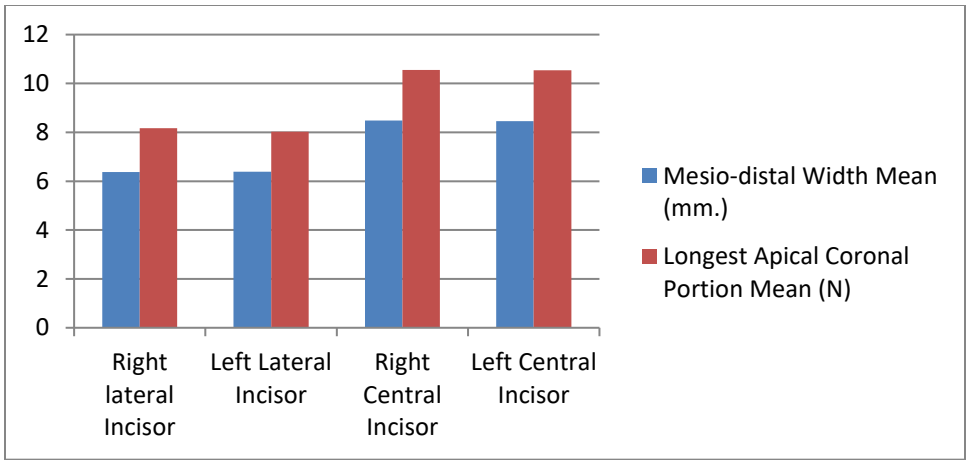

Figure (4): shows the mean dental measurements for maxillary incisors.

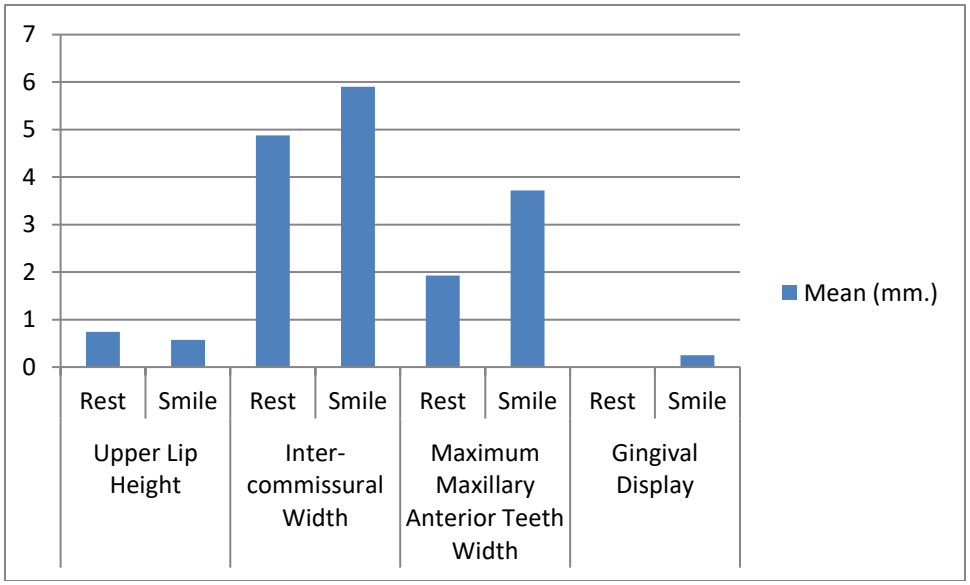

Figure (5): shows the mean dento-facial measurements in rest and smile positions

DISCUSSION:

Smile analysis and smile design have become key elements of cosmetic dentistry either during diagnosis and treatment planning over the last decade. Recent advances in technology now permit the clinician to measure dynamic lip-tooth relationships and incorporate that information into the biomechanical plan. Digital video-graphy is particularly useful in both smile analysis and in doctor/patient communication. Smile design is a multifactorial process, with clinical success determined by an understanding of the patient's soft-tissue treatment limitations and the extent to which multidisciplinary treatment can satisfy the patient's and clinician's esthetic goals.

The results of this study showed that there were no statistical significant differences between the tested variables either for the dental measurements or the facial measurements. However in our study golden proportion results showed lower value than the standard ratio (1.0:1.618) [22]. The results of our study were 1.0:1.327. This may be attributed to the limitation of number of the participants sharing in this study.

Although golden proportion has been proposed in the literatures as a useful application for achieving proportion and esthetics,[22-24] no one has yet evaluated this proportion in esthetically accepted cases. This investigation is therefore considered the first step taken in this regard. The measurements were also made with maximum effort for their validity and reliability.

Several other studies have estimated the esthetic quality of smiles by employing a judgment panel (including nondentist volunteers,[25] or dentists and fine art professors[26]). The differences of opinion between dentist and non-dentist groups suggest that it is wise to seek patients' opinions regarding dental appearance [27]. The present study tried to use defined criteria of the study and the subjects, rather than the judgment of a panel. The aim was to augment the objectivity and reduce the subjectivity of selecting esthetic smiles.

Preston's findings regarding the golden proportion in terms of perceived maxillary anterior teeth width ratios and the mean perceived lateral-to-central incisor and canine to-lateral incisor ratios were similar to findings of this study [28]. Gillen and colleagues found a poor correlation between tooth dimensions and the golden proportion [29]. However, because their measurements were made directly on casts, those findings could not be compared to findings in the current study. Rosenstiel and colleagues found that golden proportion was preferred only with regard to tall teeth [30].This might confirm present findings on the golden proportion. However, our findings corroborated Ward's idea to refuse the use of golden proportion [31], but they do not prove his preference for using the 70% ratio.

CONCLUSION:

Within the limitation of this study, textbooks have suggested that using the golden proportion develops pleasing proportions. The results of the present study have shown that this golden proportion did not exist between the widths of the maxillary anterior teeth in individuals who have an esthetic smile. While the dento-facial measurements were in accordance to golden proportion.

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