

Original Article

## Maxillary anterior teeth dimension and relative width proportion in a Saudi subpopulation



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### المخلص

**أهداف البحث:** تحقيق ابتسامة طبيعية أثناء استعادة الأسنان الأمامية يمثل تحدياً. ويعد اختيار البعد المناسب للأسنان أمراً مهماً للحصول على ابتسامة جميلة. الهدف من هذه الدراسة هو قياس وتحليل أبعاد الأسنان الأمامية العلوية، ونسب عرضها النسبي في المجتمع السعودي.

**طرق البحث:** ضم البحث ١٨٠ (ذكور = ١١٢؛ إناث = ٦٨) شخصاً لديهم جميع الأسنان الأمامية للفك العلوي (المدى العمري = ٢٠-٣٠ سنة). تم عمل طبعاات الفك العلوي باستخدام مادة (فينيل-بولي سيلوكسان) وصيها. وتم استخدام الفرجار الرقمي لحساب طول وعرض الأسنان الأمامية العلوية من قوالب الأسنان بالمليمترات (ملم) وتم تصوير القوالب رقمياً لحساب نسب العرض النسبية.

**النتائج:** متوسط عرض القاطعة المركزية كان ٨.٧٤ ملم (ذكر = ٨.٨٩ ملم، أنثى = ٨.٦٠ ملم)، والقواطع الجانبية ٦.٦٤ ملم (ذكر = ٦.٧٩ ملم؛ أنثى = ٦.٤٩ ملم) وكان الناب ٧.٨٢ ملم (ذكر = ٨.٠١ ملم؛ أنثى = ٧.٦٣ ملم). ومتوسط الطول المسجل لهذه الأسنان كان ٩.٨٤ ملم (ذكر = ١٠.٠٤ ملم، أنثى = ٩.٦٤ ملم)، ٨.٠٩ ملم (ذكر = ٨.٣٠ ملم، أنثى = ٧.٨٩ ملم) و ٩.٠٨ ملم (ذكر = ٩.٤٨ ملم، أنثى = ٨.٦٩ ملم)، على التوالي. وكانت القيم المتوسطة لنسبة العرض النسبي التي تم قياسها على صور قوالب الأسنان ٦٣.٦٩ للقواطع الجانبية / القاطعة المركزية و ٣٥.٧٨ للقواطع الناب / الجانبية. ولم توجد فروق ذات دلالة إحصائية بين القيم المتوسطة لنسبة العرض النسبي للجانب الأيمن والأيسر وبين الذكور والإناث.

**الاستنتاجات:** لوحظ عدم وجود تماثل بين الأسنان الأمامية اليسرى واليمنى. وكانت نسبة العرض إلى الطول للقواطع المركزية والجانبية مماثلة لكلا الجنسين مع اختلاف طفيف في الأنثى. وتتخذ الأسنان الأمامية للسكان السعوديين شكلاً أقرب للمربع مع تشابه في الأبعاد مع السكان الأتراك.

**الكلمات المفتاحية:** أسنان الفك العلوي؛ الأسنان الأمامية؛ أبعاد الأسنان الأمامية؛ أبعاد الأسنان؛ تجميل الأسنان.

### Abstract

**Objectives:** Achieving a natural smile while restoring anterior teeth is challenging. Selecting appropriate dimensions of teeth is important for aesthetics. This study aims to measure and analyse the dimensions of the maxillary anterior teeth and their relative width proportions in a Saudi subpopulation.

**Methods:** One hundred and eighty patients (112 men and 68 women) with intact maxillary anterior teeth (age range = 20–30 years) participated in this research. Maxillary impressions (Vinyl Polysiloxane) were created and poured. A digital caliper was used to record the length and width of maxillary anterior teeth in millimetres (mm) from the dental casts, and the casts were digitally photographed to calculate relative width ratios.

**Results:** The mean width for central incisor was 8.74 mm (men = 8.89 mm, women = 8.60 mm), lateral incisor 6.64 mm (men = 6.79 mm, women = 6.49 mm) and canine 7.82 mm (men = 8.01 mm women = 7.63 mm). The recorded mean lengths for these teeth were 9.84 mm (men = 10.04 mm, women = 9.64 mm), 8.09 mm (men = 8.30 mm, women = 7.89 mm) and 9.08 mm

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(men = 9.48 mm, women = 8.69 mm). The mean values of apparent width/width ratio measured on the cast photographs were 63.69 mm for the lateral incisor/central incisor and 78.35 mm for canine/lateral incisor. No statistically significant difference was found between the mean values of the apparent width/width ratio of the right and left sides and between men and women.

**Conclusions:** This study showed a minor asymmetry between left and right side anterior teeth among the participants. The width to length ratio of the central and lateral incisors was similar for both genders, with minor differences in the canines. A squarish form of anterior teeth for the Saudi population with dimensional similarities to the Turkish population was found.

**Keywords:** Anterior teeth; Anterior teeth dimension; Dental aesthetics; Maxillary teeth; Teeth dimension

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## Introduction

The appearance of anterior teeth is a major concern for patients seeking replacement of missing teeth.<sup>1</sup> With the introduction of advanced dental materials and techniques, multiple treatment options with an attractive and aesthetic outcome are available for treating patients with missing anterior teeth.<sup>2</sup> When viewed from the front, the maxillary anterior teeth size, shape, and arrangement are the most important factors for a harmonious and pleasing appearance. Restoration of these anterior teeth is a challenging task for dentists. Patients with missing anterior teeth tend to be more psychologically affected.<sup>3</sup>

The selection of optimal dimensions for the anterior teeth is challenging due to the individuality of each patient.<sup>4</sup> To overcome this challenge and obtain harmonious anterior maxillary teeth dimensions for improving the rehabilitation process, researchers suggest mathematical or geometrical theories.<sup>5</sup> Several maxillary anterior teeth width proportions theories have been suggested to establish guidelines for creating a naturally pleasing smile.<sup>6</sup> The theory of golden proportion states that there is a relation between beauty and mathematics. Levin<sup>7</sup> suggested that the apparent width (visible from front) of the lateral incisor is 0.618 of the apparent width of the central incisor, while the apparent width of the canine should be 0.618 of the apparent lateral incisor width. To obtain a harmonious and pleasing smile, Snow<sup>6</sup> suggested using the golden percentage where the apparent width of the maxillary anterior tooth was calculated as a percentage of canine-to-canine measurement. The central incisor, lateral incisor, and canine widths should be 25%, 15%, and 10%, respectively, of canine-to-canine width. Preston<sup>8</sup> recommended that the lateral incisor width be 66% of the central incisor width, and the canine width should be 84% of the lateral incisor width. Lamboradi<sup>9</sup>

believed to use the known ratios between the widths of anterior teeth in the arrangement of the teeth in removable dentures. Ward<sup>10</sup> proposed using recurring aesthetic dental proportion (RED), in which the width ratio of two adjacent anterior teeth viewed frontally should remain the same as one moves distally. RED is not locked into 62% ratios as in golden proportion; it includes ratios ranging from 60 to 80%, which gives the dentist more flexibility to fit the face form/type of the patient with the body type/form.<sup>10</sup>

In the dental anatomy textbooks, average teeth dimensions are reported. The data in the textbooks are taken from skulls, in which the measurements are recorded from the cemento-enamel junction to the incisal edge. These data lack information on age, gender, and race.<sup>11</sup> Various methodologies are used for the measurement of the dimensions of maxillary anterior teeth. Sterret et al.<sup>12</sup> measured the ratio between width-length of maxillary anterior teeth using stone casts and found the W/L ratio for CI as 85% in men and 86% in women; 76% in men and 79% in women for lateral incisor; and 77% in men and 81% in women for the canine. Another study<sup>13</sup> measured extracted teeth and obtained an average value for W/L ratio of 78%, 73%, and 73% for central incisor, lateral incisor, and canine, respectively. Chu<sup>14</sup> used a measurement gauge to help achieve good aesthetic results for crown lengthening, and he sets the W/L ratio at 78% for all maxillary anterior teeth.

Dental aesthetics related to anterior teeth must be explained from the scientific point of view to establish predictable aesthetic results and to avoid the subjectivity related to the dentists' judgement.<sup>15</sup> Establishing ideal anterior teeth dimensions for all the human races based on the research conducted in a few racial groups is illogical because of significant variations across different populations.<sup>16</sup> Having said that, dental aesthetics should be established by anatomical measurements and rules.<sup>17</sup> However, the selection of teeth dimensions should be based on the research studies conducted in the same population group.<sup>18</sup> The data available for teeth dimensions in the Saudi adult population is scarce. Thus, the current research study's objective was to analyse the dimensions of maxillary anterior teeth and their apparent width ratios in the adult Saudi population. Information obtained from the study results will help the local dentists design and establish the optimal anterior teeth dimensions for their patients.

## Materials and Methods

The current research study was conducted from October 2016 to March 2017. Participants comprised a sample of one hundred and eighty Saudi nationals (One hundred and twelve males and sixty-eight females) with all maxillary anterior teeth present and with an age range of 20–30 years. The participating subjects were students and residents of the College of Dentistry, King Saud University, and were examined by one examiner. Their selection was according to the following criteria: 1. The presence of the entire upper and lower anterior teeth with no missing teeth; 2. No veneered, crowned, fractured, or apparent tooth loss due to attrition; 3. No large restoration on anterior teeth; 4. No tooth rotation or malposition; 5. No interdental spacing or crowding; 6. No signs of gingival alteration (such as recession or

hypertrophy). The participants were not evaluated previously for the presence or absence of an 'aesthetic smile'.

Maxillary impressions were recorded with regular body VPS impression material (Express, 3M ESPE DENTAL PRODUCTS, USA) in disposable PLASTIC impression stock trays (COE SPACER™ TRAY, GC America). All impressions were recorded by one operator and poured with Type IV dental stone (Glastone, Dentsply, USA) with a mixing proportion of 100 g of powder with 22 ml of water. All casts were poured by the same person for three days after impressions.

#### Teeth dimension measurement

A sharp-edged digital caliper with a precision of 0.01 mm (Mitutoyo, 500/196/30 AOS, Absolute-Caliper (0–6), Illinois, USA) was used to measure the teeth dimension on the stone casts. Two previously trained persons recorded all measurements and used an intra-class correlation test to assess the inter-examiner reliability. The maximum mesiodistal width of individual teeth was recorded between contact points mesially and distally, perpendicular to the tooth's long axis. The height of the teeth was obtained by measuring the distance from the most apical points on the gingival margin to the most incisal point of the crown. All measurements were recorded on the labial surface of the teeth in millimetres (mm). The measurements for all the teeth were done three times, and the average of the three measurements was considered the final reading. Width-height ratios were obtained for all maxillary anterior teeth.

#### Measurement of apparent tooth width proportions

The casts were positioned to take digital frontal photographs of the stone casts such that the occlusal and incisal surfaces of the teeth were parallel to the surface. The image's focus was on the central incisors, and effort was made to coincide the midline of the image with the dental midline on the cast. One person photographed all the images using a stand-mounted digital camera (Canon

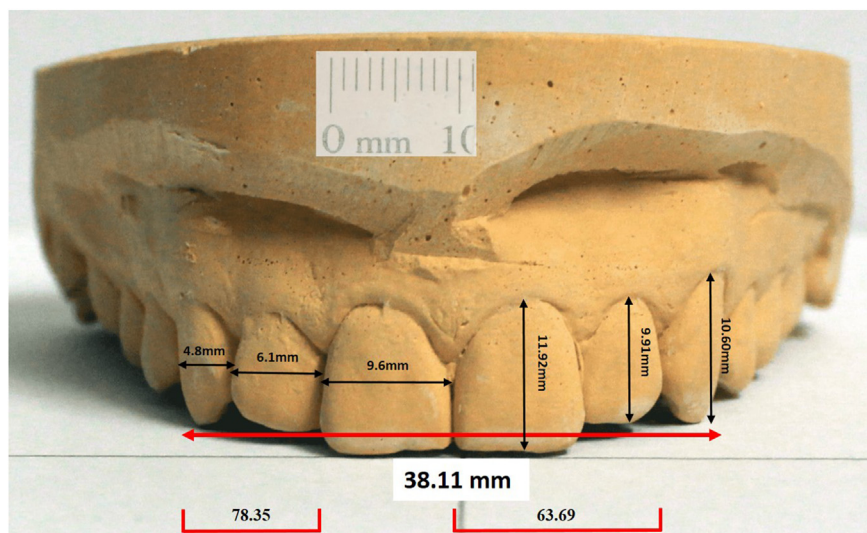
EOS D650, Canon (UK) Ltd, Surrey, RH2 8BF, UK) with a standard lens (Canon, EF-S, 18–55 mm, f/3.5; CANON) and the distance between the camera and cast was fixed for standardised recording of the images. The digital images were saved to a PC and opened in software (Adobe-Photoshop, CC 2015, Adobe-System, UK). For pixel calibration of the images, a printed ruler (10 mm) was placed, and a photoshop ruler (measurement tool of the software) was used for measurements using equation ( $0.9 \text{ pixels} = 1 \text{ mm}$ ) for all the six maxillary anterior teeth (Figure 1). The values were then entered into software (Microsoft-Excel, 2016, Microsoft Corporation, USA), and the relative width ratios were calculated by dividing the lateral-incisor width by the central-incisor width and by dividing the canine width by that of the lateral incisor.

#### Data analysis

The data recorded were analysed using a statistical package for social sciences (SPSS®, Ver. 21.0, Chicago/IL/USA). The data distribution was normal, according to the Kolmogorov–Smirnov test. To determine the exact measurements and to avoid intra-examiner errors, two independent examiners conducted the measurements of the casts individually. An intra-class correlation test was used to assess the inter-examiner reliability for the length and width measurements made on the specimen casts. Paired sample statistics were conducted to compare the measurements, and an independent samples test was used to obtain the gender difference for width, height, the width-length ratio of all the teeth, or apparent width ratios. Further, paired sample statistics were used to determine the significance between right and left side measurements. The significance level was set at  $\alpha < 0.05$  for the analysis.

#### Results

A total of 180 subjects (112 males and 68 females) were included in the study. Overall, there was a high agreement



**Figure 1:** Digital photograph with width and length measurements and apparent width/width ratio of the lateral/central incisor and canine/lateral incisor.

**Table 1: Inter-examiner comparison of the length/width dimensions (mm) of the anterior teeth (N = 160) by paired samples T test ( $p \leq 0.05$ ).**

	*Teeth Number	Examiner	Mean	Std. Deviation	Mean difference	P-Value
*Length	13	1	9.17	1.03	0.01	0.576
		2	9.16	1.01		
	12	1	8.15	0.91	0.06	0.010
		2	8.09	0.94		
	11	1	9.89	0.97	0.02	0.496
		2	9.91	0.95		
	21	1	9.86	0.96	0.04	0.058
		2	9.90	0.96		
	22	1	8.16	0.93	0.02	0.286
		2	8.18	0.90		
	23	1	9.20	0.99	0.01	0.664
		2	9.19	1.03		
*Width	13	1	7.88	0.48	0.01	0.735
		2	7.89	0.46		
	12	1	6.66	0.54	0.03	0.065
		2	6.63	0.55		
	11	1	8.78	0.55	0.03	0.040
		2	8.75	0.55		
	21	1	8.83	0.57	0.07	0.001
		2	8.76	0.55		
	22	1	6.74	0.54	0.09	0.000
		2	6.65	0.55		
	23	1	7.87	0.47	0.05	0.030
		2	7.82	0.46		

\*Length and Width were measured in millimetres (mm).

between the two examiners because of the intra-class coefficient of 0.995.

Inter-examiner measurements and comparison of the length/width dimensions of the anterior teeth are presented in [Table 1](#). Although some of these measurements were statistically significant, these may not be clinically significant as the mean difference between the two examiners was 100th of mm. The minimum (.01 mm) and maximum (.06) mean difference in length was found for teeth number 13, 23 and 12, respectively. Regarding the width, the minimum (.01 mm) and maximum (.09) mean difference was found for teeth number 13 and 22, respectively.

[Table 2](#) summarises the gender-wise comparison of the length/width of maxillary anterior teeth. Mean, standard deviation, and comparison of dimensions of all anterior teeth for male and female participant's revealed significant differences ( $p < 0.05$ ).

The pairwise comparison of the length/width of the left/right side teeth for both gender groups revealed no significance ( $p < 0.05$ ) statistically ([Table 3](#)). The canines' length was found to be of similar dimensions (mean difference = .00) for the males.

[Table 4](#) describes the gender-wise comparison of the width-length ratio of the anterior teeth. The width-length ratio for both genders was similar for central and lateral

**Table 2: Gender-wise comparisons of the length and width (mm) of the anterior teeth (N = 160) with independent sample T test ( $p \leq 0.05$ ).**

	*Teeth	Gender	Mean	Std. Deviation	Std. Error Mean	P-Value
*Length	Canine	Male	9.48	0.96	0.09	0.000
		Female	8.69	0.91	0.11	
	Lateral Incisor	Male	8.30	0.94	0.09	0.003
		Female	7.89	0.82	0.10	
Central Incisor	Male	10.04	0.92	0.09	0.007	
	Female	9.64	0.98	0.12		
*Width	Canine	Male	8.01	0.42	0.04	0.000
		Female	7.63	0.43	0.05	
	Lateral Incisor	Male	6.79	0.51	0.05	0.000
		Female	6.49	0.53	0.06	
	Central Incisor	Male	8.89	0.56	0.05	0.000
		Female	8.60	0.49	0.06	

\*Length and Width were measured in millimetres (mm).

**Table 3: Pairwise comparison of the dimensions of right and left side anterior teeth (N = 160) by paired samples T test ( $p \leq 0.05$ ).**

		Pair	Teeth Number	Mean	Std. Deviation	Mean difference	P-Value
Male	*Length	1	13	9.48	0.94	0.00	0.908
			23	9.48	0.98		
		2	12	8.27	0.93	0.06	0.191
			22	8.33	0.95		
			11	10.03	0.91		
			21	10.04	0.92		
	*Width	4	13	8.02	0.41	0.03	0.218
			23	7.99	0.43		
		5	12	6.76	0.51	0.05	0.128
			22	6.81	0.51		
			11	8.88	0.55		
			21	8.91	0.57		
Female	*Length	1	13	8.65	0.94	0.06	0.282
			23	8.71	0.88		
		2	12	7.86	0.87	0.06	0.315
			22	7.92	0.78		
			11	9.67	1.00		
			21	9.61	0.97		
	*Width	4	13	7.64	0.44	0.04	0.287
			23	7.60	0.42		
		5	12	6.45	0.54	0.06	0.203
			22	6.51	0.52		
			11	8.57	0.50		
			21	8.61	0.48		

\*Length and Width were measured in millimetres (mm).

**Table 4: The average length/width and width to length ratio for the participating Saudi subjects (N = 160).**

Tooth	Gender	Length	Width	Width/length Ratio
Canine	Male	9.48	8.01	85
	Female	8.69	7.63	88
Lateral Incisor	Male	8.30	6.79	83
	Female	7.89	6.49	83
Central Incisor	Male	10.04	8.89	89
	Female	9.64	8.60	89

**Table 5: Comparison of the dimensions of anterior teeth in five racial groups.**

		Saudi Population (N = 160)	<sup>a</sup> European Population (N = 412)	<sup>b</sup> Chinese Population (N = 100)	<sup>c</sup> Turkish Population (N = 100)	<sup>d</sup> Asian population extracted teeth (N = 264)	<sup>e</sup> White population extracted teeth (N = 146)
		Mean (n = 00)	Mean (n = 00)	Mean (n = 00)	Mean (n = 00)	Mean (n = 00)	Mean (n = 00)
*Length	Central Incisor	9.84	10.23	9.39	9.6	11.93	11.69
	Lateral Incisor	8.09	8.59	7.86	8.17	10.52	9.75
	Canine	9.08	9.93	8.90	9.05	11.83	10.83
*Width	Central Incisor	8.74	8.71	8.15	8.6	8.63	9.10
	Lateral Incisor	6.64	6.75	6.64	6.7	6.99	7.07
	Canine	7.82	7.81	7.62	7.7	7.91	7.90
Width/Length Ratio	Central Incisor	89	85	85	89	72	78
	Lateral Incisor	83	79	84	82	67	73
	Canine	86	79	86	85	67	73

\*Length and Width measurements in millimetres (mm).

<sup>a</sup> Hasanreisoglu U et al.

<sup>b</sup> Sah SK et al.

<sup>c</sup> Orozco-Varo A et al.

<sup>d</sup> Marcuschamer E et al.

<sup>e</sup> Magne P et al.

incisors. Although a slight difference between the male (85) and female (88) ratios was observed for the canine teeth, it was statistically non-significant ( $p < 0.05$ ).

The mean values of apparent width/width ratio measured on the cast photographs was 63.69 for lateral incisor/central incisor (63.82 for right side & 63.56 for left side) and 78.35 for canine/lateral incisor (78.31 for right side & 78.39 for left side) (Figure 1). No statistical significance was found between the mean values of the apparent width–width ratio of lateral incisor/central incisor and canine/lateral incisor of right/left sides for both males and females (Figure 1).

Table 5 compares the dimensions of anterior teeth in the current study (Saudi population) with that of European, Chinese, Turkish, Asian, and White populations.

## Discussion

The findings of this analytical/observational research study describe the dimensions/sizes of maxillary anterior teeth in a conveniently selected sample of the Saudi population. The gender-wise comparison of the teeth dimensions/sizes among the central, lateral incisors, and canines was also investigated to utilise the information when rehabilitating the patients with lost maxillary anterior teeth. Variations in the dental and facial features are observed among the Saudi population due to genetic diversity because of its geographical location, historical background, and multicultural society.<sup>25,26</sup> The present study results for the dimensions of the teeth may provide useful information regarding the current tooth norms in this population. They will help the dental clinicians in providing the optimal dental aesthetics to their patients.

In this study, the measurements were made on the stone casts, a method also reported in previous studies.<sup>19–21</sup> The clinical crown dimensions for maxillary anterior teeth were ranked from largest to smallest as central incisor, canine, and lateral incisor, which agrees with the findings of other studies.<sup>22–24,26</sup> As expected, males appeared to have larger anterior teeth dimensions than females. There was a noticeable difference of about 1 mm between length dimensions measured in the current study and reported in previously conducted research studies.<sup>12,13</sup> The length dimensions reported in the previous studies were measured from the cemento-enamel junction to the incisal edge of extracted teeth, contrary to the length measurements of the teeth from the gingival margin to the incisal edge on the stone casts in the present study. The increase in the length also led to a smaller width to height ratio in the studies conducted on extracted teeth.<sup>13</sup>

This study's results for the maxillary anterior teeth length/width were similar to those in studies that used the same measurement method. The results revealed that the length of the anterior teeth for the Saudi population was smaller than the European,<sup>23</sup> Asian,<sup>27</sup> White<sup>13</sup> population, more similar to the Turkish<sup>28</sup> population and larger than the Chinese<sup>24</sup> population. However, the width of the teeth was observed to be similar to European,<sup>23</sup> Turkish<sup>20</sup>, and Asian<sup>27</sup> populations, smaller than the White<sup>13</sup> population and larger than the Chinese<sup>24</sup> population. Regarding the length-width ratio of the anterior teeth, the Saudi population showed more similarity to the Turkish<sup>20</sup> population. The study results also revealed more squarish form of teeth

for the Saudi population as compared to the other populations.<sup>13,20,23,24,27,28</sup>

The comparison of the length and width of the corresponding right and left side teeth showed some minor variations in the current study. The maximum differences found were up to 0.06 of a millimetre and were statistically non-significant. Some previous research studies reported major differences between the dimensions of the corresponding right and left side teeth. Mavroskouvis and Ritchei<sup>29</sup> measured right and left central incisors on 70 students and found that 86–90% of subjects examined did not have identical dimensions for these two teeth. In 60% of the subjects, the difference was quite substantial, with few patients found to have a difference of more than 1 mm. Chu<sup>14</sup> also found asymmetry between right and left side measurements, and it was around 0.5 mm.

According to the researchers, the crown width to length ratio is the most stable reference.<sup>20,23,27,30</sup> In this study, the width to length ratio for the maxillary central incisors (89%) and lateral incisors (83%) were found to be similar for both the male and female participants. A minor difference (3%) was observed for the canine teeth of both genders, but it was not significant. Similar results are reported in a study by Hasanreisoglu U et al.<sup>20</sup> in the Turkish population. However, the width and length ratios found in the current study were found to be different compared to the European, Chinese, Asian, and White populations.<sup>13,20,23,24,27,28,31</sup> These differences might be attributed to the racial characteristics of different populations. The similarity in dimensions of the anterior teeth of the current study findings to the Turkish study can be attributed to the geographical, religious, inter-ethnic marriages, and social closeness of the two populations.

The golden proportion theory proposed by Lombardi<sup>9</sup> in 1973 is still considered the golden standard among many clinicians and researchers globally.<sup>9</sup> According to this theory, the dental and facial aesthetics are best if central-incisor to lateral-incisor width and lateral-incisor to canine width is repeated in proportion from the frontal view of the patient. Based on this theory, the maxillary lateral incisor's visibility is 62% of the central incisor. This study showed that the average apparent width ratio between lateral and central was 63.69%, which is near the golden proportion ratio of 62% as proposed by Lombardi.<sup>9</sup> However, some researchers differed on this golden proportion. Rosenstiel et al.<sup>32</sup> suggested a ratio of 70%, rather than 62% golden proportion. Other authors also advised considering other facial measurements and ratios, rather than focusing only on the golden proportion for restoring the lost aesthetics and improving the patients' appearance with missing anterior teeth.<sup>32–34</sup>

The criteria for an 'aesthetically pleasing smile' vary from dentist to dentist, among cultural and social backgrounds, and are considered more subjective. For this reason, randomly selected samples were chosen for this study. Thus, it is illogical to conclude that there is an absence or presence of golden proportion or other RED proportions within the population studied because the number of participants with the so-called 'aesthetically pleasing smiles' is not known for this current research. The results of the current study are similar to the findings of the study<sup>26</sup> conducted previously in the same population with some minor variations.

Aldegheishem et al.<sup>26</sup> utilised digital photographs for the measurements of the teeth. In contrast, the measurements were recorded from the stone casts in this study. The differences in the findings of these two studies could be due to different methodologies.

Our study's main limitation is the small sample size; obtaining impressions using polyvinyl siloxane and fabricating stone casts for measurement may have introduced minor discrepancies. In addition, minor positional differences that can occur during photography and the measurements recorded using the digital caliper might have also affected the results. However, every attempt was made to standardise the methods. Nevertheless, the study provided some useful information regarding anterior teeth dimensions in a sample of the adult Saudi population.

## Conclusion

Central incisors had the longest and widest (L = 9.84 mm; W = 8.74 mm) crowns, followed by canines (L = 9.08 mm; W = 7.82 mm) and lateral incisors (L = 8.09 mm; W = 6.64 mm). The minor asymmetry between the corresponding left/right sides of anterior teeth showed no statistical difference. The width-length ratios of the central and lateral incisor teeth for both genders were similar, with a minor difference in the canine teeth. The apparent width/width ratio was 63.69 for lateral/central incisor and 78.35 for canine/lateral incisor. A squarish form of anterior teeth for the Saudi population with similar dimensions to the Turkish population was found.

## Recommendations

The information obtained from this research results can be useful for future research studies about the dimensions of teeth in the Saudi adult population. KSA is the 12th largest country globally, with a population of more than 34 million. Therefore, a study incorporating samples from all the regions of the country with a larger sample size selected systematically with similar gender distribution should be considered for future studies to provide more accurate and relevant information on the subject. Comparing the Saudi teeth dimensions with the data from the neighbouring Arab countries will also be helpful.

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## Conflict of interest

The authors have no conflict of interest to declare.

## Ethical approval

The College of Dentistry Research Center (CDRC Registration # IR0206) at the King Saud University, Riyadh,

granted the ethical approval of this research dated 16 October 2016.

## Authors' contributions

ASA conceptualised and designed the study, provided materials, and administered. SRH extracted information for data, conducted the statistical analysis, interpreted data, wrote, reviewed, and submitted the manuscript. MA worked on results and writing. NMA, FAA & ASA worked on data curation, writing, and preparing the original draft. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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