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New technique to determine maxillary anterior teeth dimensions in Kashmiri population

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Abstract
Introduction: Several methods have been used to determine the anterior teeth dimensions in edentulous patients. However, this remains debatable when preextraction records are not available. Therefore, the purpose of this study was to determine anterior dimensions in Kashmiri population.
Materials and methods: Total 154 subjects were taken. Pearson's correlation tests were performed. combined anterior teeth width (CATW) and interalar width (IAW), intercommisural width (ICoW) was evaluated. central incisor length (CIL) with facial height (FH) and CIW with bizygomatic width (BZW) was also performed.
Results: Significant correlation was found between the CATW and ICoW and IAW (p-values <0.0001), no correlation was found between the FH and right CIL and BZW and right CIW.
Conclusion: It was concluded that the ICoW and IAW measurements are only predictable methods to determine reference value for CATW.

Keywords: Central incisor dimensions, Kashmiri population, teeth dimensions

Introduction
The selection of artificial teeth for an edentulous patient requires artistic skills, knowledge and experience [1]. The selection of artificial teeth should meet the individual esthetic and functional needs of a patient [2]. According to McArthur [3], patients own natural teeth are the best guide, and records of these should be obtained whenever possible. These records should include the size, shape and shade of the teeth and any special characteristics, or arrangement.
Many anthropometeric measurements have been proposed in the past for the selection of anterior tooth dimension. Berry's [4] "biometric ratio method" presented dimensions of maxillary central incisor as one-sixteenth of the face width and one-twentieth of the face length. Sears [5] put forward "Anthropometric Cephalic Index" method in which maxillary anterior teeth width was determined by dividing either the transverse circumference of the head by 13 or BZW by 3.3. In addition, men usually have larger teeth than women [6]. Nevertheless, it has been found that the maxillary anterior teeth should be in proportion with the size of the face and head to achieve good esthetics [7]. The pro-portion of facial structures and the relationship be-tween facial measurements and natural teeth could also be used as a guide in selecting teeth for den-tures [8-10]. Therefore, the purpose of this study was to determine maxillary anterior teeth dimensions in Kashmiri population.

Materials and methods
Total 154 patients were taken with male (85) and female (69). The subjects were patients who attended government dental college and hospital Srinagar kashmir. The inclusion criteria were patients between 18 and 38 years of age, medically fit, well-aligned maxillary anterior teeth, and healthy periodontium, while subjects who have undergone orthodontic treatment, wear of anterior teeth, crowding or spacing, missing or restored anterior teeth, developmental tooth anomalies and facial deformities were excluded from the study. Ethical clearance was granted. This study was designed to evaluate facial height (FH), BZW, IAW, and ICoW, CIL and CIW are also used. All the measurements were per-formed using a digital vernier caliper. For FH, the measurements were done between two points placed at the hairline and slightly below the chin. Bizygomatic width measurements were done between two points placed posterior to the lateral corner of the eyes.

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The FH and BZW were divided by 16 to estimate the CIL and CIW respectively. For IAW measurements, the sides of the caliper's jaw were placed at the widest dimension of nostrils, while ICoW were measured between the right and left corner of the mouth with the lip at resting position.

Results
High level of examiner reliability was detected. The intraclass and interclass correlation coefficient values were 0.989 and 0.971 respectively. The mean, standard deviation, and range of the width, length, and width/ length ratio of maxillary anterior teeth and combined anterior teeth width (CATW) for male and female subjects are presented in Table 1. Tables 2 show means, standard deviation, and range of measurements for both genders respectively. Significant correlation was found between the CATW and ICoW and IAW (p-values < 0.0001).

Table 1: Mean and Standard deviation of length and width of each individual maxillary anterior tooth (mm) and combined anterior teeth width.

	Gender	N	Width	Length	W/L ratio	
Central Incisor	M	85	8.70 ± 0.59	9.67 ± 0.83	0.90	± 0.08
8			(7 to 10.27)	(7.49 to 11.38)	(0.72 to 1.14)	
	F	69	8.56 ± 0.47	9.22 ± 0.93	0.93	± 0.09
			(7.32 to 9.73)	(7.49 to 11.53)	(0.70 to 1.20)	
	M	85	8.73 ± 0.56	9.66 ± 0.80	0.90	± 0.08
9			(7.19 to 10.27)	(7.50 to 11.37)	(0.72 to 1.14)	
	F	69	8.63 ± 0.52	9.21 ± 0.91	0.94	± 0.09
			(7.25 to 9.75)	(7.12 to 11. 08)	(0.71 to 1.24)	
Lateral Incisor	M	85	6.57 ± 0.53	7.88 ± 0.52	0.84	± 0.10
7			(5.47 to 8)	(5.17 to 10.52)	(0.56 to 0.10)	
	F	69	6.73 ± 0.53	7.72 ± 0.73	0.87	± 0.9
			(5.44 to 8.44)	(5.76 to 9.54)	(0.66 ± 1.16)	
	M	85	6.77 ± 0.78	7.71 ± 0.96	0.89	± 0.17
10			(6.67 to 10.52)	(5.17 to 10.52)	(0.56 to 0.10)	
	F	69	6.87 ± 0.64	7.67 ± 0.74	0.89	± 0.10
			(4.83 to 9.06)	(5.88 to 9.47)	(0.59 to 0.13)	
Canine	M	85	7.77 ± 0.45	8.87 ± 0.86	0.88	± 0.08
6			(6.70 to 9.16)	(6.18 to 10.76)	(0.70 to 1.33)	
	F	69	7.60 ± 0.46	8.28 ± 0.86	0.92	± 0.09
			(6.34 to 9.02)	(5.58 to 10.35)	(0.65 to 1.35)	
11	M	85	7.76 ± 0.48	8.89 ± 0.88	0.88	± 0.13
			(6.53 to 9.85)	(6.73 to 11.31)	(0.70 to 20)	
	F	69	7.55 ± 0.49	8.27 ± 0.94	0.92 ± 0.09	
			(6.36 to 9.25)	(6.60 to 10.51)	(0.70 to 1.17)	
Combined Anterior Teeth Width	M	85	53.16 ± 2.84	-	-	
			(45.85 to 61.53)			
	F	69	51.67 ± 2.51	-	-	
			(45.76 to 59.41)			

Table 2: Mean, Standard deviation and Range of different extra oral technique measurements (mm)

	All (n=154)		Females (n=69)		Males (n=85)	
Variable (mm)	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
FH	178.7 (9.41)	139.14 to 212.45	176.7 (8.31)	155.07 to 194.80	180.4(9.93)	139.14 to 212.45
BW	120.2 (13.96)	79.79 to 184.51	131.5 (8.80)	97.53 to 184.51	111.2 (10.32)	79.79 to 150.35
IAW	35.5 (3.77)	27.64 to 63.76	33.9 (2.77)	27.64 to 40.54	36.8 (3.96)	29.96 to 63.76
ICW	51.7 (6.44)	40.01 to 99.40	47.8 (3.66)	40.01 to 85.03	54.9 (6.49)	41.07 to 99.40

FH: Facial height, BW: Bizygomatic width, IAW: Interalar width, ICW: Intercommisural width

Discussion
In the present study, IAW, ICoW, were measured and compared with overall mesiodistal width of all the anterior teeth. A weak but significant relationship (Pearson's correlation coefficient) was found between CATW and IAW and ICoW. A positive but nonsignificant relationship was found between CIW and CIL when compared with the BZW and facial length respectively. Interalar width has been reported in the past to be related with either the ICTD or distance between the distal surfaces of the canines. In our study population, IAW was found to be 35.5 mm for total sample with a range of 27.64 to 63.76 with males having higher mean IAW (36.8 mm) than females (33.9 mm). Mean IAW was seen higher in males as compared with females and this was in accordance with several populations globally [11-13]. However, for CATW, Abdullah et al. [14] suggested a multiplication factor of 1.26, while Deogade et al and Al-el-Sheikh and Al-Athel suggested multiplication factors of 1.14 for Indian population. However, in our study, this factor was found to be 1.47. In this study, Significant correlation ($r = 0.30$) was found between ICoW and CATW. Width/Length (W/L) ratios of the anterior teeth are related to the anterior esthetics. Magne et al. [15] found a W/L ratio of 0.78 for central incisors, while others found this ratio to be 0.85 [16], 0.72 for Asians [17], and 0.78 for Whites [18]. Furthermore, Ahmad [18] suggested a ratio of 0.75 to 0.8 to be ideal and postulated that any ratio lesser than 0.6 would result in longer crowns whilst ratios above 0.8 would result in a much wider central incisor dimension. Aforementioned ratios, suggesting a slightly shorter and wider central incisor dimension. The W/L ratio for lateral incisors was found to be 0.85 in our studied population.

In our study, the mean right CIW was found to be 8.64 ± 0.55, which is similar to the dimension (8.65 mm) reported by Radia *et al*. Central incisor length has been studied much less as compared with CIW. However, in our study it was found to be 9.45 mm. This variation could be related to different measurement techniques used in the studies and different ethnic backgrounds among studied populations. Central incisor length has been pro- posed to be in ratios of 1:16 and 1:20 as compared with the FH. Maxillary arch forms have been related to the shape of the central incisor. Therefore, the novel technique proposed in this study was based on the fact that the anatomic structures on the hard palate are relatively stable and could be easily measured at any given point of time. These were evaluated in our study knowing that central incisor is the cornerstone of esthetics and knowing its dimensions will help to estimate all other anterior teeth either for fixed or removable rehabilitation. literature has shown so many different extraoral and intraoral techniques for prediction of either the dimensions of all maxillary anterior teeth or individual tooth dimensions but the question still remains the same as which method can be generalized to all populations so that selection of teeth becomes easier for edentulous patients. Many factors might have affected the accuracy of formerly published data. These factors include the type and accuracy of instrument used for measuring specific dimensions, materials used, determination of landmarks, cast measurement, or photographic analysis or whether measurement was done on straight line or curvature. Although the numbers of subjects analyzed in the present study were small, efforts were made to standardize the measurements but still variation cannot be negated. This study is the first and one of its kind to evaluate many extraoral and intraoral dimensions for the given population and quantified a novel method for the estimation of central incisor width and length This will provide clinical and laboratory guidelines that will help Kashmiri clinicians and laboratory technicians in selecting anterior teeth size for their patients.

Conclusion

Within the limitations of this study, it can be concluded that the ICoW and IAW measurements are predictable to estimate the initial reference value for CATW. Additionally, our studied population was found to have relatively shorter and wider anterior teeth in comparison to other populations. A proposed approach was hypothesized based on the data obtained from the Kashmiri population. Further studies to investigate the predictability of this approach to estimate the central incisor dimensions among different populations are needed

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