

## Relationship between width and length ratios of upper anterior teeth in young Chilean population.

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**Abstract:** Introduction: Knowledge about the size and proportion of upper anterior teeth allows dental rehabilitation taking into consideration the local parameters of a population. The aim of this research is to determine the width, length and the relationship between width and length of central incisor, lateral incisor and canine teeth in both sexes in young Chilean population. Methodology: A cross-sectional study was performed. Study subjects included 187 dentistry students from two Chilean cities (mean age 21.35±2.7 years, 52.9% men). The teeth width and height were measured and the width/height ratio was calculated. Differences in measurements according to sex was analyzed ( $p<0.05$ ; STATA v.10.0). Results: The width and height of the teeth were statistically and proportionally larger in men ( $p<0.05$ ). The width/height ratio of lateral and canine incisors was significantly higher in women ( $p<0.05$ ). Conclusion: In a sample of young Chileans, upper anterior teeth were longer and wider in men. However, the width/height ratio of teeth was found to be significantly higher in women.

*Keywords:* incisor, canine, aesthetics, dentures, anthropometry, Chile.

### INTRODUCTION.

One of the main parameters to consider in dentofacial aesthetics is the use of measurements and proportions of upper anterior teeth. Application based on the golden ratio of the frontal view of the six upper anterior teeth constitutes a strict measure for the clinician in oral rehabilitation.<sup>1</sup> However, there are contradictory reports indicating that this mathematical proportion does not apply when defining a beautiful smile, where the width and the height of teeth are much more important. The height, width and the width/height ratio of teeth directly influence the perception of symmetry together with the proportion of the configuration of the upper anterior teeth. This allows an optimal dentolabial relation in harmony with the overall facial appearance.<sup>2</sup>

Different authors have reported on the differences in the mean width and height dimensions of the upper anterior teeth in European<sup>3</sup> and Caucasian<sup>4</sup> populations. However, standard proportions have been characterized mainly in Caucasian populations, causing an external lack of validity for Hispanic American populations.<sup>3-5</sup> Due to its geographical location and historical context, this population

presents a unique dental morphological pattern caused by the different migrations and high levels of gene flow, which are very common in the region.<sup>6</sup>

Previous reports in Chile<sup>5</sup> and Peru<sup>7</sup> have shown that the width/height proportion of upper anterior teeth is approximately 0.8:1. Nonetheless, this measure does not account for differences according to sex. Considering this background, the aim of this study is to determine the width, the length, and the width/height ratio of central incisor, lateral incisor and canine teeth in young Chilean population.

## MATERIALS AND METHODS.

### Design and sample

A cross-sectional study was performed. Both the study protocol and informed consent were evaluated and approved by the Ethics and Research Committee of the School of Medicine of Universidad Austral de Chile and written according to the STROBE guidelines.

Students from the School of Dentistry of Universidad Austral de Chile (Valdivia, Chile) and of Universidad San Sebastián (Santiago, Chile) participated in the study between July and October of 2016. Subjects with six healthy upper anterior teeth were selected, who presented no cavities, restoration nor dental attrition.

Those with a history of orthodontic treatment, fixed dentures, any kind of congenital anomaly or dentoalveolar trauma in the anterior region were excluded from the study. Subjects with gingival alteration or those who had undergone periodontal surgery<sup>4</sup> or had foreign ancestry of at least three previous generations were also excluded from the study.

The size of the sample was established with the measurements of the width of the upper incisors proposed by Orozco-Varo<sup>3</sup> ( $8.6 \pm 0.5$ mm), postulating the hypothesis that the mean width of the central incisors presents a difference of  $\pm 1$ mm. Considering the participation of students from two Chilean cities and establishing a confidence level of 95%, a statistical power of 90% and a margin of data loss of 25%, a sample size of at least 55 subjects was estimated.

### Dental Measures

All measurements and records of study models were performed according to the study protocol of Troncoso-

Pazos *et al.*<sup>8</sup> Prior to dental measurements, a researcher performed a test-retest with 15 study models in two periods a week apart, observing a Pearson correlation of  $r=0.98$  between the measured points.

The procedure was explained to the subjects who agreed to participate by signing an informed consent form. Upper dental arch models were made to record mesiodistal width and height of the six upper anterior teeth in millimeters based on the protocol designed by Sterret *et al.*<sup>4</sup> Once plaster models were obtained, a previously calibrated researcher measured central incisor teeth, lateral incisors and canine teeth on the right side of the subject's mouth using the Mitutoyo<sup>®</sup> digital caliper (Japan, 0.01mm accuracy).

The height or vertical length of teeth corresponded to the distance between the clinical cervix and the incisal edge, parallel to the major axis of the crown.

The width corresponded to the horizontal distance, perpendicular to the axial axis of the clinical crown measured between the wider mesiodistal portion in relation to the point of contact of each tooth. All these measurements were tabulated on an electronic database designed for this study (Google Drive, Google, CA, USA).

### Statistical analysis

A third researcher performed descriptive statistical analysis and obtained frequency measurements, dispersion and the mean with a standard deviation ( $\pm$ ) of subjects' age and sex, facial index and dental indexes of the upper anterior teeth. The presence of parametric variables was calculated using the Shapiro-Wilk test. ( $p < 0.05$ ). Differences in the dental proportions according to sex were analyzed using the t-test ( $p < 0.05$ ). The statistical package STATA 10.0 (StataCorp. Texas, USA) was used in all cases.

## RESULTS.

A total of 187 study subjects were selected (mean age  $21.35 \pm 2.7$  years, range 18-29 years) of which 99 were men (52.94%).

Table 1 shows the comparison in width, height and the proportion of the size of upper anterior teeth between both sexes. Table 2 shows the width/size ratio of upper anterior teeth of both sexes separately.

**Table 1.** Comparison of width measurements and size proportions of upper anterior teeth between both sexes.

	Tooth	Total (N=187)			Women (N=88)			Men (N=99)			Proportion	
		Mean±SD	min	max	Mean ±SD	min	max	Mean ±SD	min	max	W:M	p
Central Incisor	Width	8.65 ±0.52	7.35	10.1	8.05 ±0.45	7.53	9.61	8.79 ±0.56	7.35	10.1	1.03	0.0001
	Height	10.24 ±0.84	8.2	12.61	9.97 ±0.61	8.52	11.22	10.49 ±0.96	8.2	12.61	1.05	<0.001
Lateral Incisor	Width	7.06 ±0.54	5.29	8.82	6.94 ±0.53	5.29	8.82	7.17 ±0.53	5.29	8.82	1.03	0.004
	Height	8.94 ±0.93	6.55	12.81	8.64 ±0.75	6.75	10.22	9.22 ±1.0	6.55	12.81	1.07	<0.001
Canine	Width	8.24 ±0.54	6.96	9.23	7.93 ±0.43	7.12	8.88	8.26 ±0.54	6.96	9.23	1.04	<0.001
	Height	10.3 ±0.97	7.89	13.52	9.92 ±0.78	7.89	11.8	10.64 ±1.01	7.89	13.52	1.07	<0.001

SD: Standard Deviation. min.: minimum; max: maximum

**Table 2.** Comparison of width measurements and size proportions of upper anterior teeth between both sexes.

Tooth	Total (N=187)		Women (N=88)		Men (N=99)		p
	Mean±SD	min-max	Mean±SD	min-max	Mean±SD	min-max	
Central Incisor	0.84±0.06	0.55-0.92	0.85±0.06	0.57-0.92	0.83 ±0.07	0.55-0.9	0.24
Lateral Incisor	0.79±0.07	0.59-1.15	0.8±0.08	0.64-1.15	0.78±0.08	0.59-1	0.04
Canine	0.79±0.06	0.62-1	0.8±0.06	0.68-0.96	0.78±0.07	0.62-1	0.03

SD: Standard Deviation. min.: minimum; max: maximum

## DISCUSSION.

The width and the length of the upper anterior teeth of this young Chilean population were significantly larger in men. On the other hand, the width/height ratio was higher in women, showing statistically significant differences in lateral and canine incisors; however this was not the case for central incisors.

In general, the results of this study were similar to those previously reported. Larger teeth had higher incidence in men than in women, suggesting a difference of 0.5mm and 1mm<sup>1,2-4</sup> in width and height. Unlike the difference in length, the width/height ratio of upper anterior teeth was higher in women, with a statistically significant difference in the case of lateral and canine incisors.

The importance of considering the relation between the width and length for each tooth is clinically relevant since it allows for the calculation of length loss based on the existing width, which usually remains stable.<sup>3</sup> However, it has been reported that a width/height ratio of 0.82 is considered attractive by patients,<sup>9</sup> when considering the aesthetic perception

of a smile. In spite of this, the sample in this study has similar proportions to studies performed in oral rehabilitation in the United States,<sup>4</sup> Peru<sup>7</sup> and in other Chilean dentistry students,<sup>5</sup> but slightly below dental proportions in studies performed with subjects from Turkey.<sup>2</sup> Europe<sup>3</sup> and India.<sup>10</sup> This situation represents a shift of the standards of beauty commonly used in the teaching of dental aesthetics applied to a population of Caucasian origin, which does not coincide with the morphological aspects of the population living in South America, due to the high population variability in this region caused by migratory influx.<sup>6</sup>

The increase in the relationship between width/height in the upper anterior teeth seems to have an effect on aging, associated with gingival recession, with the central incisor being the most affected tooth in this group.<sup>1</sup>

Ethnicity and gender should be considered in the treatment of the anterior maxillary zone. Knowledge of racial norms can help to specify certain aesthetic and functional modifications to suit the multiple population groups within modern societies.<sup>2</sup>

Among the limitations of the study, the possibility of randomization bias and the selection of Chilean subjects in terms of recognition of belonging to the Chilean population or the anatomical variability of their dental arches can be highlighted.

Despite this, researchers have cautioned the control of selection bias using clear criteria, and measurement biases through the calibration of measurements and

the use of dental materials based on the manufacturer's instructions.

## CONCLUSION.

The width and height of upper anterior teeth in young Chilean subjects was larger in men than in women. However, the width/height ratio of the teeth was found to be significantly higher in women.

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