

Prediction of the mesiodistal width of maxillary anterior teeth from nasal interalar width in peruvian subjects with facial harmony.

Predicción del ancho mesiodistal de dientes anterosuperiores a partir del ancho interalar nasal en individuos peruanos con armonía facial.

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Abstract: **Objective:** To determine regression models to predict the mesiodistal widths of the maxillary anterior teeth from interalar width of the nose in subjects with facial harmony. **Materials and Methods:** A cross-sectional study was carried out in a sample of 75 subjects with facial harmony and ages ranging from 18 to 30 years (21.28 ± 3.75 years). The mesiodistal width of the central (CI), lateral (LI) incisors, and canines (C), as well as the interalar width (IW) of each subject were measured using a digital vernier caliper. Simple linear regression analyses were used to predict the width of the maxillary anterior teeth from the nasal interalar width, from which formulas for predicting the dimensions of each anterior tooth were obtained. **Results:** A statistically significant relationship was found between the nasal interalar width and the mesiodistal widths of the upper central incisor ($p=0.019$, $R^2=5.23\%$), upper lateral incisor ($p=0.019$, $R^2=2.31\%$), and upper canine ($p=0.016$, $R^2=12.04\%$) that allowed to develop simple linear prediction models for each tooth represented by the following formulas: $CI=7.04+0.04(IW)$; $LI=6.01+0.03(IW)$; $C=6.19+0.05(IW)$. **Conclusion:** The nasal interalar width is a good predictor of the mesiodistal widths of the maxillary anterior teeth.

Keywords: Incisor; cuspid; maxilla; nose; face; regression analysis.

Resumen: **Objetivo:** Determinar modelos de regresión para predecir los anchos mesiodistales de los dientes anterosuperiores a partir del ancho interalar de la nariz en individuos con armonía facial. **Materiales and Métodos:** Se realizó un estudio transversal con una muestra de 75 sujetos con armonía facial entre 18 a 30 años (21.28 ± 3.75 años), se midió el ancho mesiodistal de incisivos centrales (IC), laterales (IL) y caninos (C) así como el ancho interalar (AI) de cada sujeto empleando un calibrador vernier digital. Para la predicción del ancho de los dientes anterosuperiores a partir del ancho interalar nasal se emplearon análisis de regresión lineal simple, a partir de los cuales se obtuvieron fórmulas de predicción de las dimensiones de cada pieza dentaria anterior. **Resultados:** Se encontró relación estadísticamente significativa entre el ancho interalar nasal y los anchos mesiodistales del incisivo central superior ($p=0.019$, $R^2=5.23\%$), incisivo lateral superior ($p=0.019$, $R^2=2.31\%$) y canino superior ($p=0.016$, $R^2=12.04\%$) que permitieron generar modelos de predicción lineal simple para cada pieza dentaria representados mediante las siguientes fórmulas: $IC=7.04+0.04(AI)$; $IL=6.01+0.03(AI)$; $C=6.19+0.05(AI)$. **Conclusión:** El ancho interalar nasal es un buen predictor de los anchos mesiodistales de los dientes anterosuperiores.

Palabra Clave: Incisivo; diente canino; maxilar; nariz; cara; análisis de regresión.

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INTRODUCTION.

In dentistry, the maxillary anterior teeth play an important role in providing a pleasant appearance.¹ As their mesiodistal dimension varies according to the pattern of each person, it is necessary to determine it in order to perform an optimal dental treatment.² However, such individual variation may be caused by the influence of various factors, such as the dimensions of some extraoral structures.³

Proper size selection is difficult when seeking to provide good aesthetics for anterior teeth. Anthropometric facial measurements, such as interalar width (IW), could be a referential guide to predict the dimensions of these teeth,⁴ and IW has been reported to directly correlate with the mesiodistal width of some maxillary anterior teeth.⁵⁻⁸ Miranda *et al.*,⁵ found a relationship between the interalar width and the width of the upper canines. Thalib *et al.*,⁶ studied the relationship between the interalar width and the upper central incisor of a Buton tribe, concluding that there is a significant relationship between the measurements.

Patel *et al.*,⁷ found a relationship between the interalar width and the mesiodistal width of the incisors in the Gujarati population. Likewise, Sayed *et al.*,⁸ found that it is possible to predict the dental dimensions of some maxillary anterior teeth from the interalar distance. However, none of these studies have developed any method to predict the individual dimensions of the maxillary anterior teeth.

On the other hand, some authors have reported a lack of relationship between the width of the maxillary anterior teeth and some facial dimensions,^{9,10} causing controversy in the field. Likewise, having an extraoral clinical reference parameter as a predictor would contribute to the rehabilitation of missing, mutilated, or congenital alterations in the size and shape of maxillary anterior teeth, and have a positive impact on orthodontic planning and forensic dentistry.

The aim of the present study was to determine regression models to predict the mesiodistal widths of the maxillary anterior teeth from interalar width of the nose in subjects with facial harmony.

MATERIALS AND METHODS.

Study sample

The present study was carried out on a sample of 75 individuals ranging between 18 to 30 years (21.28±3.75 years), 33 females (21.24±3.23 years)

and 42 males (21.31±4.15 years), living in the cities of Trujillo and Cajamarca, Peru. The minimum sample size was calculated using data from a pilot study ($r=0.463$, confidence level=0.95, statistical power=0.80).

The inclusion criteria were: subjects with six healthy permanent maxillary anterior teeth, with clinical proximity to facial harmony (straight profile, with glabella-subnasal - soft pogonion between 165°C and 175°C and lips in normal position in relation to columella line - soft pogonion, 0mm distance), with a facial midline centered regarding to the anterior teeth and chin, and parallelism between the bipupillary line the commissural plane.

Exclusion criteria included subjects with moderate or severe dental crowding, those who used orthodontic appliances or had background of orthodontic therapy, maxillary or orthopedic surgery, presenting anterior teeth with spacing and alterations, and/or gingival inflammation. This research was approved by the Permanent Committee of Scientific Research of the School of Stomatology of Universidad Privada Antenor Orrego. Each participating subject signed an informed consent.

Measuring interalar distance

In the frontal plane was measured in millimeters, using a digital metal tip caliper from the outermost right lateral point of the nose wing to the outermost left lateral point of the nose (Figure 1A).

Measurement of the mesiodistal dimension of the upper anterior teeth

To measure the mesiodistal dimensions of the upper incisors and canines, an impression of the upper arch was taken with alginate (Tropicalgin-Zhermack, Mapledent Co., Guandong, China) using partial steel trays. Subsequently, casting was performed using type IV extra-hard plaster (Elite Rock Fast-Zhermack, Badia Polesine (RO), Italy).

The largest mesiodistal dimension of each tooth was recorded in millimeters, placing one tip of the caliper at the top of the curvature of the mesial face and the other at the top of the curvature of the distal face, parallel to the incisal surface (Figure 1B).

Method error

The error of the method was evaluated in 15 subjects, making the measurements at two different times two weeks apart. The Intraclass Correlation Coefficient (ICC) was used to evaluate the reliability of measurements of the mesiodistal dimension of maxillary anterior teeth and of the interalar distance, obtaining highly significant reliability ($p<0.01$) with ICC values greater than 0.865.

Statistical analysis

The collected data were processed with the statistical program Stata version 14 (StataCorp LP, Texas, USA).

Simple linear regression analyses were used to predict the mesiodistal dimension of maxillary anterior teeth from the nasal interalar width, from which formulas for predicting the dimensions of each anterior tooth were obtained considering the interalar width as an independent variable. A significance level of 5% was considered.

RESULTS.

Simple linear regression analyses showed a statistically significant relationship between the mesiodistal dimensions of the maxillary anterior teeth and the interalar width. The prediction models found were:

$CI=7.04+0.04 (IW)$; $LI=6.01+0.03 (IW)$; $C=6.19+0.05 (IW)$, where CI, LI, C and IW represent the measurements of the central, lateral incisors, canines, and interalar width, respectively (Table 1).

Figure 1. Schematic representation of the measurement of the nasal interalar width (A) and the mesiodistal dental width (B).

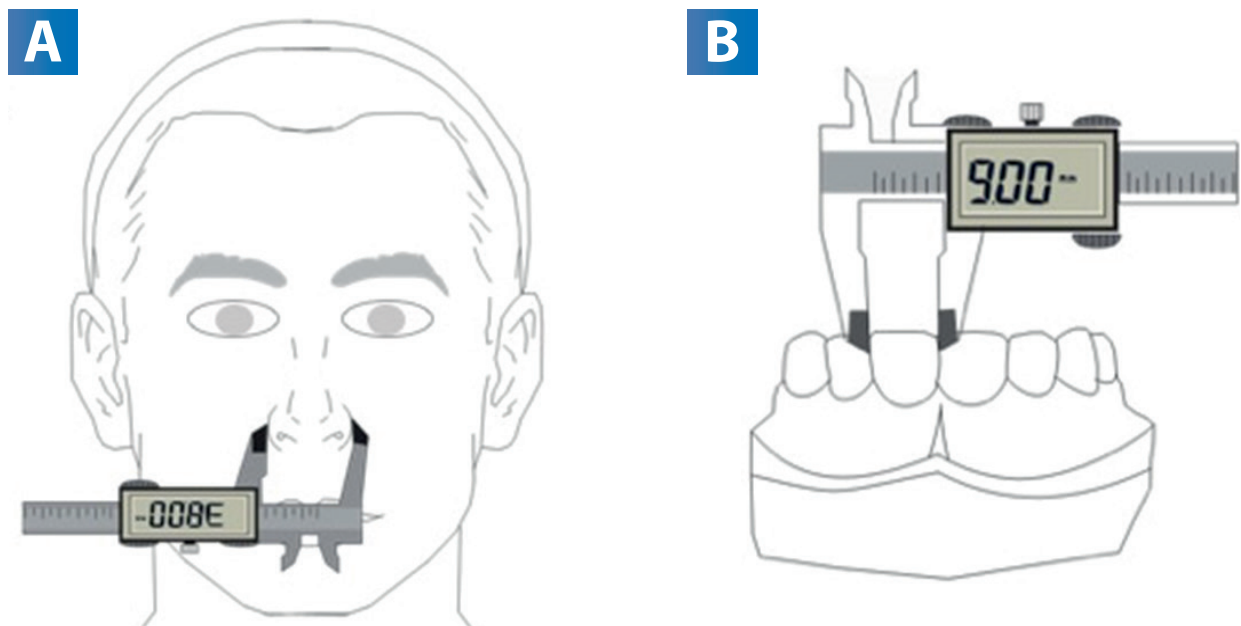


Table 3. Prediction models of the mesiodistal dimension of maxillary anterior teeth from the nasal interalar width in subjects with facial harmony (n=75).

Independent variable	Dependent variable	Characteristic	Value	p-value	95% confidence interval		R2 (%)
Interalar width (IW)	Central incisor (CI)	Coefficient	0.04	0.019	0.00	0.08	5.23
		Constant	7.04	0.737	5.57	8.51	
	Lateral incisor (LI)	Coefficient	0.03	0.019	-0.01	0.06	2.31
		Constant	6.01	0.740	4.53	7.48	
Canine (C)	Coefficient	0.05	0.016	0.02	0.08	12.04	
	Constant	6.19	0.609	4.98	7.41		

Prediction models: $CI:7.04+0.04 (IW)$. $LI: 6.01+0.03 (IW)$. $C:6.19+0.05 (IW)$.

DISCUSSION.

The upper incisors and canines play an important role in facial characterization.¹ Previous prediction of mesiodistal dimensions of these teeth could contribute significantly to individualized dental treatment.² Likewise, a relationship has been reported between some facial anthropometric measurements, such as interalar width,⁵⁻⁸ with some dental dimensions.⁴

IW could be used as a reference for developing prediction formulas of the aforementioned dimensions. In the present study, a relationship was found between the interalar width and the mesiodistal widths of the upper central, lateral incisors and canines. Although some authors^{9,10} disagree on this relationship, most studies⁵⁻⁸ have reported a similar relationship to the one documented in this study. However, in those studies, no individual prediction models have been reported for each anterior tooth from the interalar distance, as it is the case of the present study.

Kurien *et al.*,⁷ reported a linear regression model, but this model allowed to predict the anterior circumference from canine to canine, but not the individual mesiodistal diameters. In this study, it was considered that predicting the individual dimensions of each anterior tooth would indirectly allow dentists to predict the circumference of the six anterior teeth.

The possibility of predicting the dimensions of the maxillary anterior teeth in the results of the present study is probably due to the fact that the nose, mouth and teeth evolve from similar embryonic tissue. In the particular case of the nose, it develops from the frontonasal process, from which the four maxillary anterior teeth develop as well, increasing the probability of showing a relationship between their dimensions.⁷

One limitation of the present study is the inclusion of a univariate analysis, since it is always possible to consider the influence of other variables in a model. Consequently, it is suggested to conduct more studies that take into account the intervention of other variables in said relationship.

The type and size of the sample was another limitation, as it does not allow extrapolation of the results to other populations; consequently, it is suggested to carry out similar studies in other population groups. However, the linear regression analysis performed is valid and reliable, and considering the interalar distance as a determining factor in the reconstructive planning of anterior teeth constitutes an important starting point.

Although there are various guidelines that can be used to select the characteristics of an anterior tooth, such as shape, texture, color, material and others, the size of the anterior teeth is one of the most important factors in aesthetics.

This is especially true in the case of the maxillary anterior teeth, since they are more visible than the lower anterior teeth when the patient is speaking or laughing. In this sense, the models developed in this study could be considered for various applications in dentistry, mainly in prosthetic, orthodontic, cosmetic planning, and even in forensic dentistry.

CONCLUSION.

The interalar width of the nose is a good predictor of the mesiodistal widths of the maxillary anterior teeth using simple linear regression models.

Conflict of interests: Authors have no conflict of interest with this report.

Ethics approval: Research Committee of the Stomatology School at the Antenor Orrego University of Trujillo.

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Authors' contributions: Both authors carried out the entire study, and approved the final manuscript.

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