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Research Article

Regression Formula to Correlate the Relationship between Facial Measurements in the Selection of Anterior Teeth to Cephalometric Analysis of Soft and Hard Tissues of Nose-A Pilot Study

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Received: November 25, 2019; **Published:** December 23, 2019

DOI: 10.31080/ecde.2020.19.regression-formula-to-correlate-the-relationship-between-facial-measurements-in-the-selection-of-anterior-teeth-to-cephalometric-analysis-of-soft-and-hard-tissues-of-nose-a-pilot-study

Abstract

Aims and Objectives: To evaluate the soft and hard tissue dimensions of nose and to determine the relation with size of anterior teeth; to derive a formula from the analysis of clinical and cephalometric parameters.

Materials and Methodology: Twenty full dentate subjects (10 males, 10 females) with age in between 18 - 25 yrs were selected. Bizygomatic width of all the subjects were measured clinically and based on sear's formula/pounds concept, predicted width of upper central incisor (PWCI) and predicted width of all the upper anteriors (PTWU) were calculated. Similarly, actual widths of central incisor (AWCI) and total width of all upper anteriors (ATWU)were evaluated through study models by using digital vernier calipers. In the meanwhile, cephalometric parameters of nose such as Nasal depth (ND), N' to SN, N to ANS, Nasal length (NL) Columella convexity (CC) were identified in the lateral cephalograms and the distance between them were measured and the values were tabulated to *FIT* in regression model and regression formula was obtained to calculate the actual width of upper central incisor and total width of all upper anteriors.

Results: The results of all measurements were subjected to statistical analysis (paired 't' test) and the correlation is very high and significant. AWCI - All Nasal Parameters = 'P'-value < 0.05 (0.00), ATWU-All Nasal Parameters = 'P'-value < 0.05 (0.00) (except for NL). Similarly, values obtained through regression equation by using cephalometric parameters were found in similarity to other modalities of measurements.

Conclusion: In this study an attempt has been made, to evaluate the cephalometric nasal dimensions and their relation to the size of upper anterior teeth, statistically significant results were obtained and a regression formula was derived. Cephalometric Nasal parameters can also be used as a guide in the selection of upper anterior teeth.

Keywords: *Regression Formula; Nasal Parameters; Bizygomatic Width*

Introduction

Esthetic tooth placement and physiological tooth arrangement are biologically compatible and desirable for patients seeking prosthetic treatment. It is apparent that beauty, harmony, naturalness and individuality are major qualities'' of esthetics. The face excels in beauty when compared with other anatomic divisions of the human being and maxillary anterior teeth contribute a lot to the beauty of the face [1,2]. The size, form, position and the arrangement of individual maxillary anterior teeth make the most crucial contribution to the facial

appearance. It is very difficult to lay down exact rules for guidance in this phase of prosthetic dentistry. There are no rules of thumb but there are anatomical landmarks and manufactured aids that can be used as guides [3,4]. Almost nine anatomical entities (size of face, size of maxillary arch, nose, etc.) can be used as guides to select the size of anterior teeth [5,6]. As per literature available, many formulae were available in selecting the size of anterior teeth but there is always a questionable validity and no universally accepted parameter in this aspect. Moreover, limited studies were conducted on the relation between nasal Parameters and size of anterior teeth [7,8].

This pilot study was done to compare the clinical and cephalometric evaluation of soft and hard tissues of nose and its correlation with other facial measurements in the selection of anterior teeth.

Materials and Methodology

Twenty full dentate subjects (10 males, 10 females) of age between 18 - 25 yr were selected for this study with inclusion and exclusion criteria (Table 1). Maxillary impressions of all the study participants are made with irreversible hydrocolloid alginate (Zelgan; Dentsply, India) and casts were poured with type 4 gypsum product (die stone). Model evaluation was done with digital vernier calipers to calculate the Actual width (Figure 1) of C.I (AWCI) and Actual width of total 6 anteriors (ATWU). Similarly clinical measurements were done to know the bizygomatic width (Figure 2) in each subject by using sear's formula, H.pound's concept, berry's biometric index and predicted width of CI (PWCI)and predicted width of total 6 anteriors (PTWU) was calculated.

Inclusion criteria	Exclusion Criteria
Angle class I	Interdental spacing
Natural well aligned dentition	Crowding
No restorations	Apparent loss of tooth structure
No tooth loss in maxilla	Congenital nasal defects
No history of orthodontic treatment	

Table 1: *Inclusion and Exclusion criteria.*

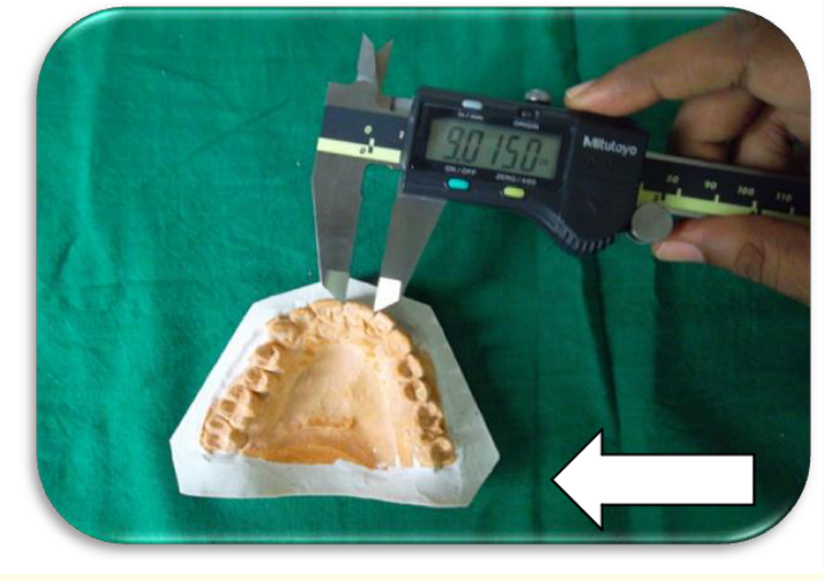


Figure 1: *Measurement of actual width of anterior teeth using digital vernier calipers (DIGIMATIC).*

Figure 2: *Measurement of Bizygomatic width using clinical Facial measurements.*

Furthermore, radiographic evaluation was done by using lateral cephalograms (Figure 3) in order to determine the following parameters Nasal depth (ND), N' to SN, N to ANS, Nasal length (NL), Columella convexity (CC)were calculated. The methodology of the study was briefly explained in table 2.

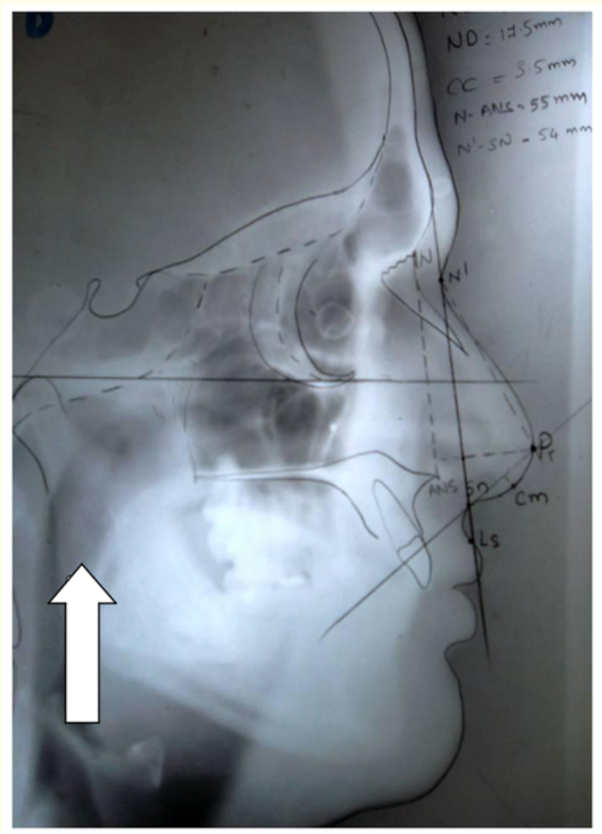


Figure 3: *Cephalometric analysis.*

Clinical Measurements	Study Model Evaluation	Radiographic Evaluation
• Bizygomatic width was measured in each subject Sear's formula, H.pound's concept berry's biometric index • Predicted width of CI • Predicted width of total 6 anteriors	• Maxillary impressions Digital Vernier Calipers • Actual width of C.I (AWCI) • Actual width of total 6 anteriors (ATWU)	Lateral cephalograms Nasal depth (ND) N' to SN N to ANS Nasal length (NL) Columella convexity (CC)

Table 2: *Methodology of the study.*

Results

All the PWCI, PTWU values using clinical facial measurements and AWCI, ATWU by study model measurements and distance between cephalometric landmarks were calculated and tabulated (Table 3). Similarly pictorial representation of values of gender wise comparison were listed in table 4. The values obtained in cephalometric analysis was *FIT* in regression model and regression formula was obtained.

Sex	BZW in mm	PWCI In mm	PTW U In mm	A W CI in mm	A TW U mm	NASAL DEPTH mm	N' to SN In mm	N to ANS In mm	N.L In mm	C.C In mm
		BZW/16	BZW/3.36							
Females										
1.	128	8	38	8.3	44.8	20	62	58.00	55.00	4.50
2.	132	8.25	39.2	8.5	44.8	13	50	50.00	45.00	3.00
3.	120	7.5	35.71	8.4	45.4	13.5	49	54.00	39.00	4.00
4.	122	7.6	36.3	8.2	43	17	53	58.00	47.00	4.00
5.	130	8.12	38.6	8.2	43	19	56	55.00	51.00	4.00
6.	117	7.3	34.8	8	43.2	15	50	53.00	45.00	3.00
7.	126	7.8	37.5	8.4	45	19	56	54.00	44.00	4.00
8.	124	7.7	36.9	8.8	45	16	50	52.00	42.00	3.50
9.	125	7.8	37.2	9.2	47.6	16	52	52.00	50.00	3.00
10.	127	7.9	37.7	9.7	50	16	46	52.00	39.00	3.00
Males										
1.	138	8.625	41.07	7.7	44.2	16	55	60.00	47.50	4.00
2.	130	8.12	38.6	8.8	46.8	19	56.5	55.00	46.00	3.00
3.	130	8.12	38.6	8.1	44.6	17	56	57.00	44.00	3.00
4.	121	7.5	36	8.3	43.8	18	55	55.00	50.00	4.00
5.	130	8.12	38.6	8	45.8	16	54	58.00	46.00	3.00
6.	126	7.8	37.5	8.5	47.2	18	61	56.00	53.00	2.50
7.	131	8.18	39	9.3	50.2	21	55	57.00	49.00	3.00
8.	132	8.2	39.2	9.5	49.6	17.5	54	55.00	46.00	3.50
9.	133	8.3	39.5	8.4	46.2	20	55	52.00	48.00	5.00
10.	124	7.7	36.9	9	46.8	17.5	57	56.00	51.00	3.00

Table 3: *Clinical facial measurements; Study model measurements; cephalometric nasal parameters measurements.*

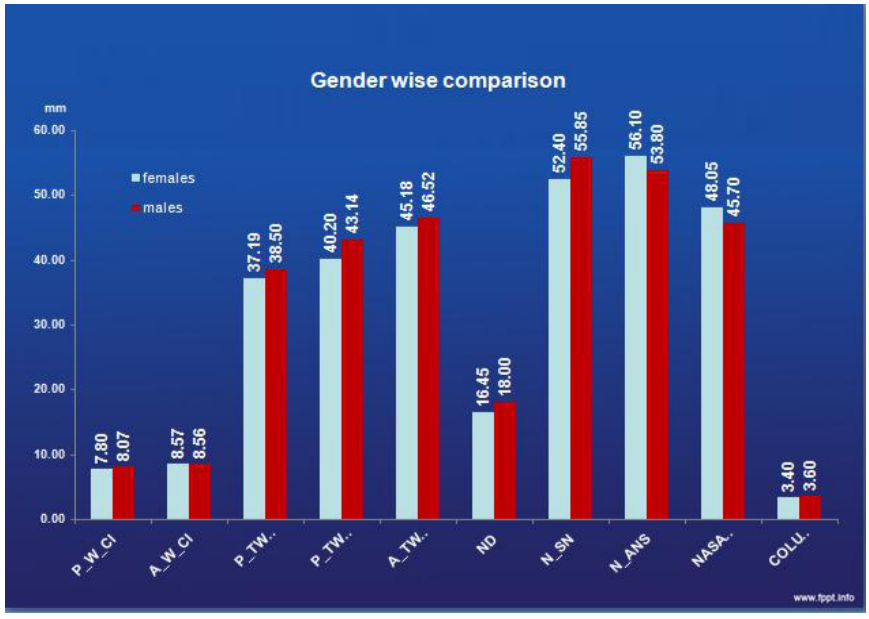


Table 4: *Pictorial representation of Gender wise comparison.*

"Regression equation"

AWCI = 14.07 + (ND x 0.192) - (N'- SN x 0.087) -

(N – ANS x 0.060) + (NL x 0.012) - (CC x 0.387)

"a"

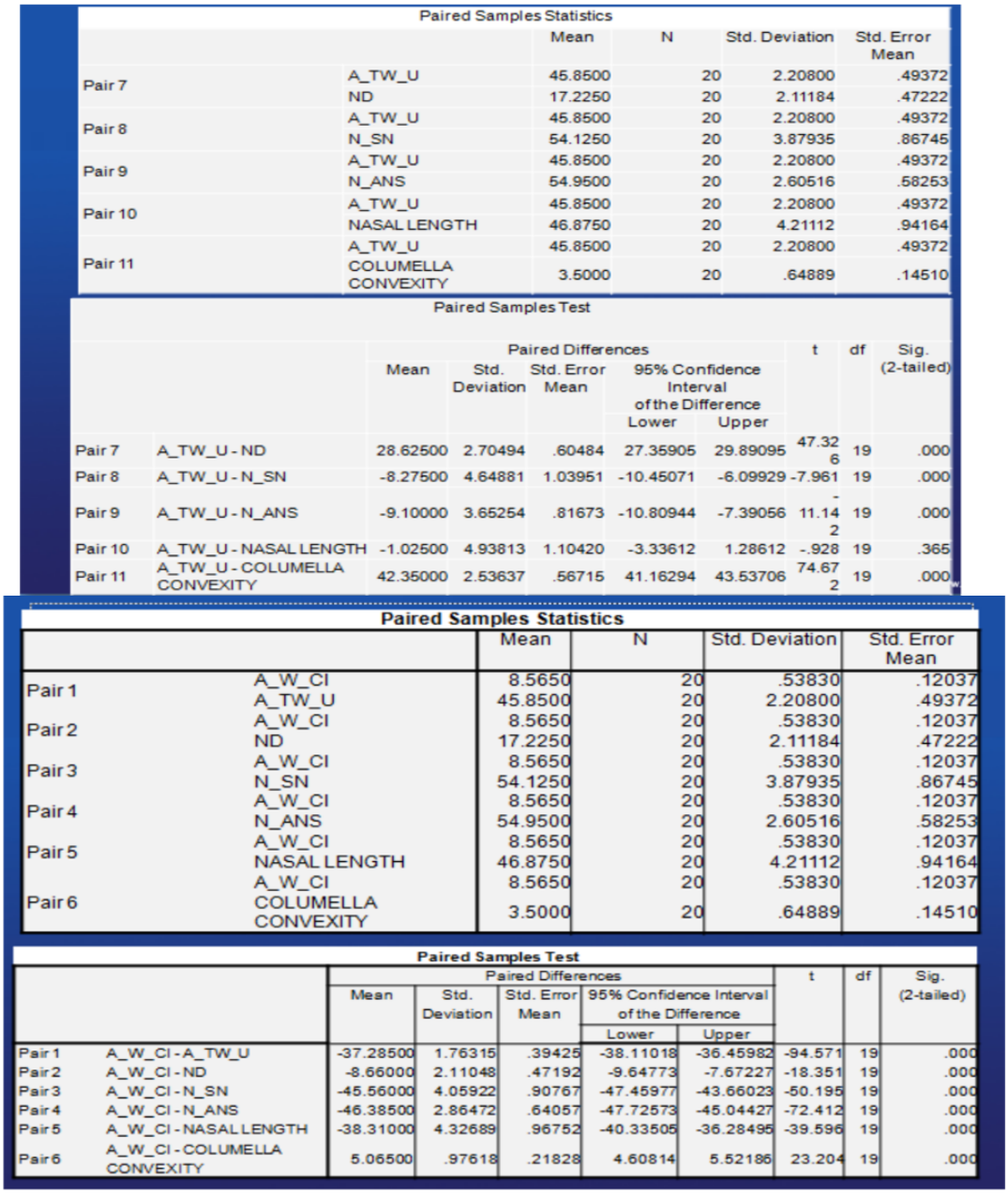
ATWU = a x 5 + (- 4.22 TO 3.33) mm

The results calculated through formula were compared with the clinical facial measurements and study model evaluation (Table 5).

Subject	AWCI	PWCI	Through Formula
Male-1	7.7 mm	8.6 mm	8.4 mm
Female-1	8.3 mm	8 mm	8.5 mm

Table 5: *Comparison of Predicted width, actual width of central incisor and total upper anteriors with the measurements derived through regression formula.*

Then Statistical analysis Paired 't' test was done to compare the parameters used in the study (Table 6):



Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 7	A_TW_U	45.8500	20	2.20800	.49372
	ND	17.2250	20	2.11184	.47222
Pair 8	A_TW_U	45.8500	20	2.20800	.49372
	N_SN	54.1250	20	3.87935	.86745
Pair 9	A_TW_U	45.8500	20	2.20800	.49372
	N_ANS	54.9500	20	2.60516	.58253
Pair 10	A_TW_U	45.8500	20	2.20800	.49372
	NASAL LENGTH	46.8750	20	4.21112	.94164
Pair 11	A_TW_U	45.8500	20	2.20800	.49372
	COLUMELLA CONVEXITY	3.5000	20	.64889	.14510

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 7	A_TW_U - ND	28.62500	2.70494	.60484	27.35905	29.89095	47.326	19	.000
Pair 8	A_TW_U - N_SN	-8.27500	4.64881	1.03951	-10.45071	-6.09929	-7.961	19	.000
Pair 9	A_TW_U - N_ANS	-9.10000	3.65254	.81673	-10.80944	-7.39056	-11.142	19	.000
Pair 10	A_TW_U - NASAL LENGTH	-1.02500	4.93813	1.10420	-3.33612	1.28612	-.928	19	.365
Pair 11	A_TW_U - COLUMELLA CONVEXITY	42.35000	2.53637	.56715	41.16294	43.53706	74.672	19	.000

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	A_W_CI	8.5650	20	.53830	.12037
	A_TW_U	45.8500	20	2.20800	.49372
Pair 2	A_W_CI	8.5650	20	.53830	.12037
	ND	17.2250	20	2.11184	.47222
Pair 3	A_W_CI	8.5650	20	.53830	.12037
	N_SN	54.1250	20	3.87935	.86745
Pair 4	A_W_CI	8.5650	20	.53830	.12037
	N_ANS	54.9500	20	2.60516	.58253
Pair 5	A_W_CI	8.5650	20	.53830	.12037
	NASAL LENGTH	46.8750	20	4.21112	.94164
Pair 6	A_W_CI	8.5650	20	.53830	.12037
	COLUMELLA CONVEXITY	3.5000	20	.64889	.14510

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	A_W_CI - A_TW_U	-37.28500	1.76315	.39425	-38.11018	-36.45982	-94.571	19	.000
Pair 2	A_W_CI - ND	-8.66000	2.11048	.47192	-9.64773	-7.67227	-18.351	19	.000
Pair 3	A_W_CI - N_SN	-45.56000	4.05922	.90767	-47.45977	-43.66023	-50.195	19	.000
Pair 4	A_W_CI - N_ANS	-46.38500	2.86472	.64057	-47.72573	-45.04427	-72.412	19	.000
Pair 5	A_W_CI - NASAL LENGTH	-38.31000	4.32689	.96752	-40.33505	-36.28495	-39.596	19	.000
Pair 6	A_W_CI - COLUMELLA CONVEXITY	5.06500	.97618	.21828	4.60814	5.52186	23.204	19	.000

Table 6: *Statistical Analysis.*

- AWCI - All Nasal Parameters = 'P'-value < 0.05 (0.00)
- ATWU-All Nasal Parameters = 'P'-value < 0.05 (0.00) (except for NL)

- The test is Significant and the correlation is very high

Discussion

Determination of the ideal size and shape of the teeth in harmony with the facial measurements is of paramount importance in establishing good and pleasing esthetics in the prosthetic rehabilitation of complete or partial edentulous patients. Keeping this aspect in point of view, one should relate the possible interrelationship of possible variables in the orofacial complex to the size of the teeth that increases the final outcome of the dental treatment. Several numerous attempts have been put forward to make use of facial measurements for evaluation of the size of artificial teeth for edentulous patients [9-12]. Considering the relationship of width of the alae of nose to the inter canine width of maxillary anteriors, this pilot study was main focused in endowing a particular or specific relationships between facial measurements in the selection of anterior teeth to cephalometric analysis of soft and hard tissues of nose [7,8].

In this study for purpose of selection of anterior teeth, conventional methods such as predicted clinical facial measurements using Sears formula/pounds concept; actual measurements by study model evaluation through digital vernier calipers were explored, interrupted, correlated with the values of regression formula derived by cephalometric analysis of nasal parameters [13]. All the values obtained in the cephalometric measurements were fit into a regression model, applied to the data and the correlations were calculated after deriving the regression model. By using regression equation derived, the total width of upper central incisor and total width of all anteriors was calculated and compared with the predicted width obtained by clinical facial measurements and the measurements obtained by the study model evaluation.

From the results of paired t-test there is statistically significance difference when the P-value is less than (< .05) and therefore it indicates that the width of the central incisor can be determined depending on the cephalometric analysis of soft and hard tissues of nose. It also confirms that the width of central incisor has some relation to the width of the face. But this was contradictory to the results conducted by A Alsaadi., *et al*. [14] whereas studies conducted by Gomes VL [2], Kini AY., *et al*. [12] has positive results in these aspects. In gender comparison of both the males and females; values of predicted widths, actual widths, widths obtained by regression formula; all of them are almost similar and satisfactory. These results are similar to the results of the study groups conducted by Attokaran G., *et al.* [15,16] in two successive years.

The present study confirms that values obtained by regression equation derived using cephalometric analysis of soft and hard tissues of nose can be used for predicting the width of central incisor and total width of maxillary anteriors there by selecting the size of anterior teeth in replacing edentulous situations. Future studies with more number of samples of both genders should be considered for using this regression equation.

Limitations of the Study

- Limited number of samples
- Magnification
- Edentulous state
- Nasal defects
- Cost

Conclusion

From the results of the present pilot study, the following statements can be concluded:

1. Cephalometric nasal parameters can also be used as a guide in the selection of upper anterior teeth.
2. The values obtained for measuring the width of upper central incisor or total width of upper anterior teeth through regression formula derived by using cephalometric analysis of nasal parameters is in similarity with the results derived by conventional methods.
3. There was almost no disparity in the values of the results when gender comparison is done.
4. The Statistical analysis Paired 't' test was done to compare the results used in the study. The test is Significant and the correlation is very high.

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Volume 19 Issue 1 January 2020