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Correlation between Inter Canine Width and Skeletal Patterns in Orthodontic Patients

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Abstract

Dental arches vary among people according to tooth size, tooth position, pattern of craniofacial growth and by many genetic and environmental factors. The relationships between craniofacial morphology and malocclusion have long been of interest to orthodontists. The objective of this study was to assess how skeletal characteristics in orthodontic patients relate to intercanine width. The sample consisted of hundred good qualities lateral cephalogram and dental casts. Obtaining ethical approval from the research committee of Women Medical and Dental College demonstrates a commitment to conducting research in a responsible and ethical manner. This step ensures that the study respects accepted ethical standards and protects the rights and welfare of the participants Pre-treatment lateral cephalogram and manual study model with complete permanent dentition except third molars were used to record the measurements. Test subjects between the ages of 14 to 27 were chosen for conducting this study. The mean age of the participants coming out to be 19.62 ± 4.54 years. After running the correlation analysis, a very insignificant and weak although positive correlation was found between the UICW and N⊥A (p=0.705, ρ=0.038), and also between UICW and N⊥Pog (p=0.946, ρ=0.094). Inferring from the results of the study, it is concluded that the correlation between N⊥A and UICW, N⊥Pog and LICW is not a very significant one.

Keywords Upper Inter-canine Width, Lower Inter-canine Width, Cephalometric Analysis, Dental Cast

1. Introduction

The orthodontic diagnosis and treatment planning (1) of a patient requires thorough records of the patient, which has been implied by the information provided by us. These are multifaceted records containing intraoral and extraoral photos, radiographs such as lateral cephalograms and panoramic radiographs, dental impressions or scans and clinical examinations (2). In order to develop treatment plans befitting the occlusal and skeletal aspects of patient care (3, 4), orthodontists need to synthesize all the above diagnostic information, which shows how integral the patient records prove in such a process. Dental arches continue to alter throughout the growing process of an adult, ultimately becoming less prominent/diminished due to such dynamic nature. A plethora of factors contribute to such a variation in dental arches, which include tooth size, position, craniofacial growth patterns, genetics, and environment (5,6). The relationship between craniofacial morphology and malocclusion has always piqued the interest of orthodontists. Accounting for ethnic variations, the arch form is shown to be influential on outcomes such as functional, aesthetic as well as stables ones (outcomes) (7). As intriguing as it might be, determining the relationship between cephalometric and dental arch factors within a given population 8 has also proved essential. Closely linked to the normal conclusion, during orthodontic diagnosis and treatment planning process, the dental arch width has a significant role to play. Skeletal patterns (9) dictate occlusal development and

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impact incisor movement during treatment (10). Orthodontic alignment often leads to long-term changes in dental arch widths, with maxillary arch expansion ranging from 0.55 to 2.13 mm in non-extraction cases[11]. Preserving each patient's arch form during treatment is vital to minimize post-retention relapse risk (12) .Complete comprehension of factors affecting dental arches is essential for achieving aesthetically pleasing, functional, and stable results (13). From their first use in 1931 by Broadbent in the USA and Hofrath in Germany, techniques for performing the cephalometric analysis of lateral head radiographs in two-dimensional viewing has been developed. Since then cephalometric analysis has been one of the fundamental tools frequently employed in the diagnosis and treatment planning of orthodontics (14). Orthodontic treatment planning heavily depend on cephalometric analysis, particularly in borderline extraction or surgical treatment. Despite the rise of CBCT imaging, 2D lateral cephalograms still hold primary importance due to their extensive scientific validation and the necessity for patient radiological protection (15).

This study set out to assess the connection between skeletal characteristics and intercanine width in patients undergoing orthodontic treatment.

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2. Material and Method

The sample consisted of a hundred good qualities lateral cephalogram and dental casts. Ethical approval was sought from the research committee of Women Medical and Dental College, Abbottabad (EC Ref No: 2021-04-064). The inclusion criterion was a full dentition except third molars, patients of either gender, any skeletal class, good quality casts and lateral cephalogram of high clarity. Exclusion criteria included previous orthodontic treatment, crowding, history of bad oral habits, supernumerary teeth, deformed arch, ectopic canine, previous maxillofacial or orthognathic surgery and history of trauma.

Two examiners (AW and KS) working independently recorded inter-canine width on plaster casts and cephalometric measurements on lateral cephalogram of the same patient. Inter canine region width was taken as the perpendicular distance from the center of palatal vault to a line drawn along the cusp tips of permanent maxillary canines with the help of digital vernier caliper. (Fig 1).

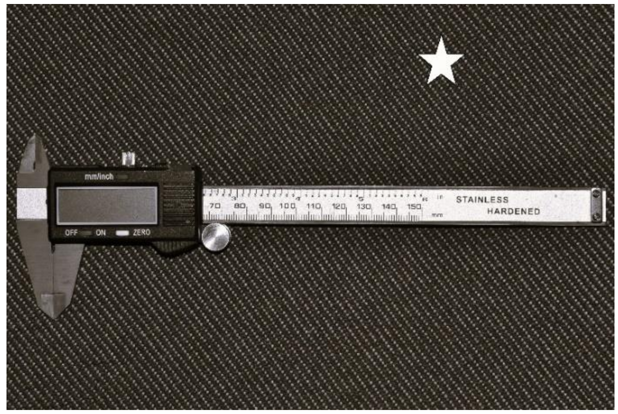

Figure 1: Digital caliper for manual measurements

For the continuous variables, means and standard deviations were calculated. The normality of the data distribution was examined using the Shapiro-Wilk test. Pearson Correlation test was applied to compare the measurements of inter-canine width and cephalometric landmarks. Intra observer reliability was assessed with Pearson correlation coefficient with r > 0.85 indicating excellent reliability.

3. Results

With participants ranging in age from 14 to 27 years old, and a mean age of 19.62 ± 4.54 years, a total of 100 dental casts and cephalograms were evaluated. The number of men and women in the sample was equal. Table I the upper inter-canine width (UICW) and lower inter-canine width (LICW), as well as the inter-canine width's mean, maximum, minimum, and standard deviation as well as skeletal sagittal parameters such as N⊥A and N⊥Pog. The UICW ranged from 24mm to 50mm, with a mean value of 35.06±3.97mm, while the LICW ranged from 21mm to 40mm, with a mean value of 29.09±4 Pearson correlation values revealed a strong relationship between inter-canine width 12mm. For N⊥A, the ranging -13mm to 8mm, with a mean value of -0.03±3.32 mm, and for N⊥Pog, the range was from -17mm to 22mm, with a mean value of -4.90±6.92 mm Peason correlation values revealed a strong relation between intercanine width and both N⊥A and N⊥Pog. Table II demonstrates the correlation between inter-canine width and sagittal skeletal parameters. Good inter and intra reliability was observer (R value >0.8). Additionally, non-significant weak positive correlations were found between UICW and N⊥A (p=0.705, ρ=0.038) and between UICW and N⊥Pog (p = 0.946, ρ = 0.094), as shown in Table II.

Table 1: Inter-canine width and skeletal parameters

	N	Min	Max	Mean	Std. Deviation
Age	100	14	37	19.62	4.54
N⊥A	100	-13	8	-0.03	3.32
N⊥Pog	100	-17	22	-4.90	6.92
MMA	100	2	38	21.87	5.66
UICW	100	24	50	35.06	3.97
LICW	100	21	40	29.09	4.12

Table 2: Correlation

		N⊥A	N⊥Pog	MMA
UICW	Correlation	0.038	0.070	-0.096
	P	0.705	0.490	0.342
LICW	Correlation	0.007	0.094	0.115
	P	0.946	0.352	0.257
			UICW	**N⊥Pog**
UICW	Correlation		1	0.07
	P			0.490
N⊥ Pog	Correlation		0.07	1
	P		0.490	
			MMA	**LICW**
MMA	Correlation		1	0.115
	P			0.257
LICW	Correlation		0.115	1
	P		0.257	

4. Discussion

The purpose of our study was to look for any correlation between the skeletal patterns and intercanine width in orthodontic patients. The skeletal patterns and intercanine width did not differ in a way that was statistically significant.

Widths between the mandible and maxilla intercanine are related to SNA and SNB angulations, respectively. With Increase in SNA angle, maxillary inter-canine width decreases, while with increase in SNB angle, mandibular inter-canine width increases (16,7). Saffarshahroudi et al suggested that wider dental arches in canine area is linked to increased angle between SNA and SNB [18]. We considered maxillary and mandibular plane angle for relationship of cephalometric analysis and inter-canine widths (19). The SN and FH lines serve as standard reference planes in cephalometrics for assessing growth and quantifying changes related to orthodontic treatment. Research indicates that the anterior cranial base completes its growth by around 6 to 7 years of age. Literature suggests that cranial base length and inclination significantly influence the sagittal growth of the maxilla and mandible.

The present study's findings indicate that there was no significant correlation between certain cephalometric measurements like N⊥A and UICW, and N⊥Pog and LICW. This suggests that factors such as lower incisor width and pogonion position may be independent of each other. Additionally, the study suggests that patients with maxillary prognathism and a low angle tend to have increased upper inter-canine width. These results provide valuable insights into the complex relationships between cephalometric measurements and dental arch dimensions.

According to proposal in some studies, Uysal T et al., the SN plane for evaluating jaw growth can be effectively substituted by the mandibular plane angle (MMA) [20].

Whereas regarding the relationship between cephalometric measurements and dental arch dimensions, conflicting findings have been reported [21]. While some studies have reported no correlation between the maxillary dental arch and patients with higher angles, one study has been reported suggesting a narrow maxillary dental arch in patients with higher angles, while others draw a different correlation. Similarly, the correlation between certain cephalometric measurements like SN-MP and UICW has also been convoluted as of yet due to various studies reporting different correlations, some even pointing out to a negative one. These discrepancies only emphasize the importance of interpreting results in light of multifaceted factors and considerations for such a complex topic of orthodontic research (22,24).

As of the present study, no significant correlation between certain cephalometric measurements like N⊥A and UICW, and N⊥Pog and LICW could be found or established. It can be inferred that dependency of fatal factors such as lower incisor width and pogonion position on eachother is nil, i.e. both are independent of each other. Moreover, our investigation finds out that patients who have maxillary prognathism and a low angle are more liable to have increased upper inter-canine width. Such results will provide valuable insights into the complex relationships and correlations between cephalometric measurements and dental arch dimensions

5. Conclusion

From this study we concluded that a higher N⊥A measurement was associated with a narrower maxillary dental arch in canine area. In mandible, a higher N⊥Pog measurement was associated with a wider dental arch in canine area.

Conflict of interest The authors declared that they have no competing or conflict of interest.

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