Original Article

Association of Anterior Alveolar Dimensions with Different Sagittal Jaw Relationships

Abdul Jabbar[1], Muhammad Nazir[2], Maryam Mushtaq[3], Romesa Khero[4], Permanand[5], Muzaffar Qayum Khan Ghouri[6]

[1]Associate Professor, LUMHS/Jamshoro, [2,4]Lecturer. Bhittai Dental and Medical College Mirpurkhas
[3]Senior registrar, orthodontic department of CIMS Dental College Multan
[4]Associate Professor. Bhittai Dental and Medical College Mirpurkhas
[5,6]Assistant Professor. Bhittai Dental and Medical College Mirpurkhas

Author`s Contribution

[1,5]Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work, [2,3,6]Drafting the work or revising it critically for important intellectual content, [4]Final approval of the version to be published

Funding Source: None
Conflict of Interest: None

Received: Mar 09, 2022
Accepted: Aug 30, 2022

Address of Correspondent
Dr. Muhammad Nazir
Lecturer. Bhittai Dental and Medical College Mirpurkhas
mnazir20dec@gmail.com

ABSTRACT

Objective: To determine the association between anterior alveolar dimensions and sagittal jaw relationship.

Methodology: The Orthodontic Department, Institute of Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro, conducted this cross-sectional study from August 2018 to January 2019. Patients of both genders ranging in age from 18 to 30 years were included. All the subjects, as per ANB angle, were grouped into three categories as (Class I = value between 1° and 4° for ANB angle), (Class II = value > 5° for ANB angle) and (Class III= value <1° for ANB angle). All the data was recorded in the Performa for the purpose of analysis.

Results: A total of 90 patients were studied; their average age was 21.12+3.47 years and 52.2% were females. Mean upper posterior alveolus width was significantly higher in sagittal class II as 12.69 ± 5.52 than in sagittal class I and III p-value 0.058. The mean upper anterior alveolus height was found to be significantly greater in class I and III in contrast to class II p-value 0.028. Mean lower anterior alveolus width was insignificantly related with sagittal classification, p-value 0.343. Mean upper anterior alveolus width and lower posterior alveolus width were insignificantly related to sagittal classification, and the p-value were quite insignificant. Sagittal class II and III were significantly associated with female gender 0.021, while class I was linked to male gender p-value 0.021.

Conclusion: There was a significant association between dimensions of anterior alveolar among different vertical and sagittal jaw association.

Keywords: Anterior alveolar dimensions, Sagittal classification.

Cite this article as: Jabbar A, Nazir M, Mushtaq M, Khero R, Permanand, Ghouri MQK. Association of Anterior Alveolar Dimensions with Different Sagittal Jaw Relationships. Ann Pak Inst Med Sci. 2022; 18(3):252-256. doi. 10.48036/apims.v18i3.693

Introduction

Orthodontic movement of the tooth is accomplished by altering the alveolar process's bone remodeling. The determination of any potential restrictions to orthodontic dental movements in the form of hard and soft tissues is necessary for achieving an orthodontically appropriate position for the teeth that is also aesthetically appealing and long-lasting.[1] The inferior side of the palate (particularly in cases with a deep bite), regions of sclerosed bone, and the labial and lingual cortical plates at the level of the root apex are all examples of limits that can be found in the hard tissue.[1] Orthodontic subjects have a variety of sagittal and vertical skeletal disparities, as well as dentoalveolar compensations to various degrees.[2] There is typically a correlation between skeletal malocclusion and dental malocclusion as well. Consequently, a subject may have a confluence of sagittal and vertical dysplasia in addition to dental features of malocclusion at the time of examination.[2-4] An elevated face convexity is one of the most prevalent

doi. 10.48036/apims.v18i3.693

reasons for extraction treatment, which necessitates the retraction of the anterior teeth during the orthodontic procedure. Whenever the lower and upper incisors are situated so that they are vertical in relation to their apical bone bases, this typically results in optimal aesthetics and the optimal stability being obtained. Anteroposterior relocation of the lower and/or upper incisors to reestablish proper sagittal relationship can frequently serve as a viable option for the camouflage treatment of malocclusions of Class II and III. Improving the stability around the roots of the teeth and leading to better periodontal situations can be accomplished by locating the incisors such that they are in the middle of the alveolar process between the labial and lingual/palatal cortical plates.[6] The biological measurements of the previous alvéol are defined by sound orthodontic activity of anterior teeth. Enhanced facial divergence is an important predictor of extraction care that allows anterior teeth to withdraw throughout orthodontic treatment.[6] When surgery is an option, one of the most common goals of presurgical orthodontic treatment is to decompensate the inclination of a lower incisor so that the underlying skeletal disease can be concealed or, at the very least, made less obvious. As a consequence of this, it simplifies the process of achieving post-operative outcomes that are more favourable much simpler. No such studies have been conducted on the association of anterior alveolar dimensions classification of sagittal jaw at local level. Therefore, the study has been done to assess the correlation between anterior alveolar dimensions among different classification of sagittal jaw.

Methodology

This cross-sectional study was conducted in the Orthodontic Department, Institute of Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro, from August 2018 to January 2019. The consecutive sampling technique was used.

The study included patients of both genders ranging in age from 18 to 30 years. Individuals with congenital abnormalities, Individuals who have had previous orthodontic treatment or growth modification therapy and a previous history of trauma to the head and/or neck were excluded from the study.

The research was carried out following approval by the Ethical Committee of the hospital. The study included all the patients who meet inclusion criteria. Every patient received an informed written consent. All the subjects, as per ANB angle, were grouped into three categories as (Class I = value between 1° and 4° for ANB angle), (Class II = value > 5° for ANB angle) and (Class III= value <1° for ANB angle). The vertical face pattern was calculated from TFH i.e., the LAFH and TAFH sratio, as per the criteria given below:

Obtaining Lateral Cephalogram

Radiographs of the lateral cephalometric view taken digitally before treatment are included in this investigation. The lateral cephalometric radiograph of the patients was obtained with the participant's Frankfort horizontal plane parallel to the floor, with the lips in a relaxed position and the mandible in a centric occlusion. The film plane is 15 centimeters away from the object, and the X-rayed source is 150 centimeters away from the object. Each x 10-inch standard radiography documentation had been traced on a standard 8 × 10-inch acetate plot paper using a 0.5 plumb. Additionally, a transparent metric length box had been included on the plot paper. The following dimensions were used in various vertical and sagittal jaw connections to determine the width and height of the anterior alveolus.

Upper posterior alveolus width (UP): Distance between palatal cortex in a line defined along apex parallel to the palatal plane (ANS–PNS), and central incisor apex.

Upper anterior alveolus width (UA): gap between central maxillary incisor apex and labial cortex boundary in a line marked parallelly to palatal plane across the apex.

Upper anterior alveolus height (UH): The minimum distance between palatal plane and apex of central maxillary incisor.

Lower posterior alveolus width (LP): the gap from the upper edge of the central mandible incisor across a field marked parallel to occlusal plane, to the edge of lingual cortex.

Lower anterior alveolus width (LA): the gap between mandibular central incisor apex and labial cortex dividing mark parallel to apex of occlusal plane

Lower anterior alveolus height (LH): The minimum distance between apex of mandibular central incisor and lowest level of the symphysis transected in a line parallel to occlusal plane. All the data was recorded in the Performa for the purpose of analysis. Data was entered into SPSS 26.0 version and analyzed by using the same software.

Results

The selection process resulted in 90 patients, whose average age was 21.12 + 3.47 years. Females were 52.2% and males were 47.8%. Mean upper posterior alveolus width was 11.31+4.59, upper anterior alveolus width mean was 9.26+6.19, mean upper anterior alveolus height 6.72+3.65, lower posterior alveolus width 4.85+1.87, lower anterior alveolus width mean was 6.16+2.40 and mean of lower anterior alveolus height was 22.44+4.88. According to sagittal classification, class III was most common among 43.3%, class II in 40.0% and class I was 16.7%. Table I

Table I. Average age and gender distribution of the patients (n=90)

Variables		Statistics
Age		21.12±3.47 years
Gender	Males	43(47.8%)
	Females	47(52.2%)
Dimensions of anterior alveolus (mean)	Upper posterior width	11.31±4.59
	Upper height	6.72±3.65
	Lower Anterior width	6.16±2.40
	Upper Anterior width	9.26±6.19
	Lower posterior width	4.85±1.87
	Lower height	22.44±4.88
Sagittal classification	Class I	15(16.7%)
	Class II	36(40.0%)
	Class III	39(43.3%)

Mean upper posterior alveolus width was significantly higher in sagittal class II as 12.69 ± 5.52 as compared to sagittal class I and III p-value 0.058. Mean upper anterior alveolus height was significantly higher in class I and III in contrast to class II p-value 0.028. Mean lower anterior alveolus width was insignificantly related with sagittal classification, p-value 0.343. Mean upper anterior alveolus width and lower posterior alveolus width were insignificantly related to sagittal classification, p-value were quite insignificant. Table II

Sagittal class II and III were significantly associated with female gender 0.021, while class I was linked to male gender p-value 0.021. Table III

Table III: Sagittal classifications according to gender (n=90)

Sagittal classification	Gender		Total	p-value
	Male	Female		
Class I	12	3	15	0.021
Class II	16	20	36	
Class III	15	24	39	
Total	43	47	90	

Discussion

A major indicator of the need for extractions in orthodontic tooth retraction is increasing facial convexity. Optimal stability and appearance are often attained when the upper and lower incisors remain positioned upright in comparison to their apical cup foundation.[7] Numerous studies have demonstrated a strong correlation between the morphology of the dental region of the jaws and facial morphology. In people having hypo- and hyper-divergent growth patterns, basal and alveolar incisor height alterations were primarily responsible for dentoalveolar adjustment. In this study mean upper posterior alveolus width was significantly higher in sagittal class II as 12.69 ± 5.52 as compared to sagittal class I and III p-value 0.058. Because class II Pattern grows downwards and forward so as in compensatory mechanism the dentoalveolar compensation takes place in which the vertical height of the alveolus increases with time. Mean upper anterior alveolus height was statistically significantly higher within class I and III in contrast to class II p-value 0.028. Since major growth center is head of the condyle so excess growth of the condyle leads to forward growth of the mandible that is why mandible ahead of maxilla thickens and vertical height of maxilla increases in class III as a compensatory mechanism. Mean lower anterior alveolus width was insignificantly related with sagittal classification, p-value 0.343. Mean upper anterior alveolus width and lower posterior alveolus width were insignificantly related to sagittal classification, p-value were quite insignificant. Timock et al.[8] reported that CBCT may be used for a quantitative

Table II: Mean dimensions of anterior alveolus according to sagittal Classification (n=90)

Dimensions of anterior alveolus	Sagittal classification			P-Value
	Class I (n=15)	Class II (n=36)	Class III (n=39)	
Upper posterior width	9.93 ± 4.55	12.69 ± 5.52	10.56 ± 3.23	0.058
Upper height	7.6 ± 4.32	5.47 ± 3.04	7.53 ± 3.66	0.028
Lower Anterior width	6.4 ± 2.19	6.53 ± 2.3	5.74 ± 2.56	0.343
Upper Anterior width	8.93 ± 1.7	8.72 ± 3.16	9.89 ± 8.88	0.701
Lower posterior width	5.13 ± 1.98	4.77 ± 1.83	4.82 ± 1.91	0.821
Lower height	21.33 ± 3.77	21.05 ± 2.6	24.15 ± 6.24	0.013

assessment of high accuracy and precision of the thickness and height of buccal bone. Moreover, it was found that head alignment during scan doesn't really affect the precision or trustworthiness of linear craniofacial complex dimensions.[9,10] Kuitert et al[11] stated that In both mandible and maxilla, the previous dental alveolar height among long-face individuals was significantly greater than in shorts. Other studies have also confirmed this.[12-14] Therefore, the procedure for compensating dentialveolars may be deduced by increasing the vertical diameters of the height of front dentoalveolar in patients with long sides and decreasing them in individuals with short sides. In a study, the face evaluation, which would be the first strategy of diagnosing hierarchy, provides a more appropriate perception of investigating and qualitating a long face, the malformation that is a 3-D expression, even after its vertical portion. This is the case despite the fact that the long face has a vertical portion.[11] In a few of the examinations, the lateral cephalograms, alveolar height and the zone dimensions have been applied for the purpose of observing the anterior alveolar-basal-mixillar cross-section as well as the mandible.[11,15-17] Only a small number of research have employed 3-D data to assess the alveolar bone morphology, and the majority of these investigations have focused on the front part of the mandible or the maxilla.[18-20]

In this study, mean age was 21.12$\pm$3.47 years, with minimum and maximum age range of 18 to 30 years. In a study with similar findings, Jeelani W. et al.21 found that the average age as 22.52 4.36 years. In accordance with the vertical pattern, this study found that 37.8% of participants had long faces, 37.8% had short faces, and 24.4% had average faces. According to Bastos DR et al[22], the frequency of the pattern of short face was 3.15 percent. According to sagittal classification, class III was most common among 43.3%, class II in 40.0% and class one was 16.7%.

In this study sagittal class II and III were significantly associated with female gender 0.021, while class I was linked to male gender p-value 0.021. Al Hadlaq A et al[7] stated that there was Standard individuals in Class III and Class I vary among men and women between the respective anterior alveolar measurements. In all previous alveolar proportions, excluding the front and back width of lower front alveolus and males of Class III, the woman specimen was substantially different from the woman specimen of Class I, whereas the male respondent of Class III varied substantially from the male respondent of Class I, excluding the anterior and posterior width of upper alveolus. Male participants have shown a higher value of anterior alveolar measurements as compared to females as per all sagittal jaw classifications.[7] This result is consistent with previous research that have set cephalometric standards for Saudi men and women.

Conclusion

There was a significant association between anterior alveolar dimensions among different vertical and sagittal jaw relationship.

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