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Evaluation of Hyoid Bone Position in Different Skeletal Patterns in a Sample of Egyptian Population Using Cone Beam Computed Tomography: A Retrospective Study.

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ABSTRACT

Objective: The current study's objective was to assess Hyoid bone position on Different Skeletal Patterns in a Sample of Egyptians using Cone Beam Computed Tomography.

Materials and methods: This study utilized 90 anonymized cone beam computed tomography (CBCT) scans. Subsequently, analysis of the raw DICOM dataset images was performed using On-Demand software. The study included evaluations of skeletal classes and various measurements such as SNH, SNB, BNH,

Results: A significant difference among classes for various measurements except for a few. Class III showed more anterior position and variation compared to Class I and II based on high F values. Class III had higher means for certain measurements.

Conclusion: The hyoid bone is positioned more anteriorly in class III skeletal patterns.

Keywords: Hyoid Bone, CBCT, Skeletal Patterns, On-Demand software

Introduction:

One of the keystones of orthodontic treatment planning is the positioning of hyoid bone (HB) using cone beam computed tomography (CBCT). The position of the hyoid bone in healthy young adults has shown anatomical variations among the diverse populations of different ethnic groups, The hyoid bone position in normal cephalometric image established due to its clinical significance and needs to be taken into account when establishing treatments for both breathing-related conditions and orthodontics.[1]

Significant correlations were observed between the different facial characteristic parameters and hyoid bone position parameterswhich may serve as a reference for surgeons before orthodontic or orthognathic surgery.[2]

Gender-related differences were also reportedas when comparing boys and girls over the age of ten, measures of airway dimensions and hyoid bone locations revealed discrepancies. When diagnosing and treating orthodontic issues, these findings may be taken into account.[3]

The significance of the location of the hyoid bone is widely investigated because it was suggested to be deterministic of the skeletal pattern and predictive of the airway dimensions more than are soft palate and epiglottis.[45]

The type of the facial growth pattern, whether anteroposterior or vertical, had no impact on the hyoid bone's vertical location in class II cases with hyperdivergent mandibular plane angle was significantly posteriorly positioned in relation to the participants in Class I and Class II norm divergent. [6]

During maxillofacial surgery, it is important to consider how the horizontal jaw relation and the hyoid bone location affect the dimensions of the airway. This is especially true for individuals who have class III malocclusion and require mandibular setback surgery, as this operation might cause the hyoid bone to shift posteriorly and restrict airway passage. The airway state in such patients should be assessed before any surgical operation to avoid unintended complications because of the potential of sleep apnea and airway blockage. [7]

That's why, the morphologies of airway dimensions were found dependent on the progress achieved during the orthodontic and orthognathic interventions asThe Pharyngeal airway Measurements were shown increase following the use of Class II functional appliances for improving a mandible that was positioned backward. There have also been prior reports on the advantages of Herbst therapy, including the jaw prognathism and hyoid bone, anterior tongue traction, and improved posterior airway dimensions.[8]

Bot functional mandibular advancer and herbestappliances cause the hyoid bone and epiglottis to move anteriorly and caudally, widening the posterior airway space. The Herbst appliance has somewhat greater, but not substantially, beneficial impacts.[9]

This study focused on the predictive values of the position of the hyoid bone related to the mandible in a sample of Egyptians who have not started any orthodontic treatment.

Material and method:

Study design:

This study is retrospective study. It has been conducted on unidentified, ninety cone beam computed tomography radiographs was taken from the archives of Oral Radiology Department, Faculty of Dentistry, Suez Canal University after the approval of the ethical committee of Suez Canal University number 386/202.

<u>Sample size calculation:</u>

According to trial cases that have already been performed (8) (angular position of hyoid bone), Using Franz Faul's G power version 3.1 statistical programme at Universität Kiel in Germany, we performed a power analysis. An ANOVA: Fixed effects,the necessary sample size was calculated using one-way analysis, taking into account the effect size, power, and α. The parameters that were entered included a power of 0.95, an effect size (f) of 0.70, a bias chance of 0.05, and three separate groups.

<u>Inclusion criteria:</u>

1. The name of patient is unknown (unidentified film)
2. Normal population included (no pathologic lesions)
3. Both genders will be enrolled.
4. All cases must cover the three skeletal patterns (Class I, II and III).
5. All participants must be (25-15) years.
6. Cone beam computed tomography of high-quality images with an adequate range of view that includes cervical vertebra and hyoid bone.

<u>Exclusion criteria</u>:

1. Images having a narrow field of vision and maxillofacial abnormalities or anomalies.
2. A poor quality that made readings difficult to make.
3. Presence of any orthodontic or prosthodontic appliances.
4. Maxillofacial or plastic surgery.

Methodology:

In this retrospective study, a total of ninety CBCT scans were gathered using the same standard protocol, all CBCT scans were taken using Soredex SCANORA 3D, present in the Radiology department, Suez Canal University (Figure 1). For the DICOM data set, the primary reconstruction time was two minutes. After that, the On-Demand programme (Cybermed, Seoul, Korea) was used for importing the raw DICOM data set image for secondary reconstruction and image analysis.

ASSESSMENT

This study involved assessing skeletal classes through ANB° measurements. Angular measurements for anteroposterior relations using the SN plane included SNH°, SNB°, and BNH°. all detailed in Figure (1).

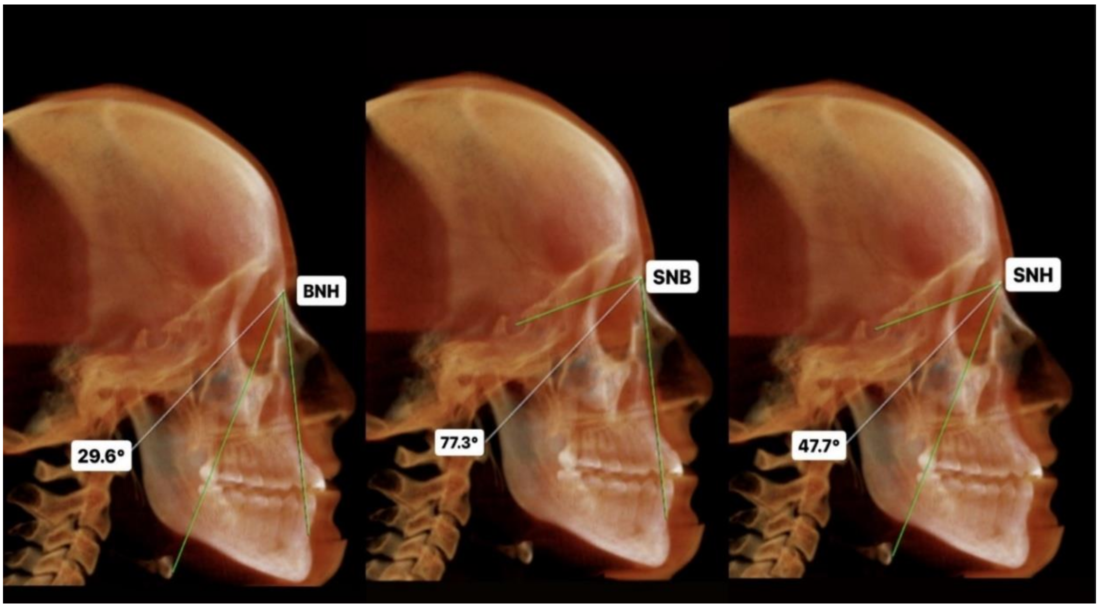

Figure (1) angular measurement (anteroposterior relation)

Statistical analysis:

Data was collected, analyzed, and statistically tested using various tests. A normality test was conducted to ensure sample distribution. Descriptive statistics were calculated as Mean ± Standard deviation. One-way ANOVAs compared different groups, followed by Tukey Test for pairwise comparisons. An independent sample t-test assessed differences between classes. A P value ≤ 0.05 indicated statistical significance. Qualitative data was presented as frequencies and percentages. Pearson correlation coefficient examined correlations. SPSS software version 26.0 was used for all analyses at a significant level of 0.05.

Results:

Significant Differences: using one way ANOVA Variables such as SNB°, BNH°, show significant variations between the classes (Class I, Class II, Class III). These differences suggest variations in skeletal and dental characteristics among the different types of skeletal patterns (Class I, II, III)

Non-Significant Differences: Variables like SNH show no statistically significant differences between the groups, indicating that these measurements may not vary significantly across the different types of malocclusions.

Ratio Interpretation: SNB/SNH° shows that it is notsignificantly different throughout the categories statistically (p = 0.061), suggesting that this ratio may not differ significantly across the different malocclusion classes. Overall, this table provides a comprehensive view of how various dental and skeletal measurements differ across different types of malocclusions, highlighting both significant and non-significant differences among them. Class III had the high means for SNH, SNB, BNH, SNB/SNH.

Table 1. the means and SD of angular measurements

	Class I	**Class II**	**Class III**	**F**	***P***
SNH°	53.7±4.4[a]	53.6±6.4[a]	55.8±4.6[a]	1.59	0.209
SNB°	75.4±7.9[b]	77.5±3.8[b]	81.8±3.6[a]	10.72	0.001**
BNH°	23.6±2.6[b]	23.9±5.9[b]	26.1±2.8[a]	3.36	0.039**

SNB/SNH°	1.40	1.45	1.47	2.88	0.061

[a,b]; Different superscript letters at the same raw means significant difference

Discussion:

Different dentofacial structures in individuals with distinct facial patterns are studied. The hyoid bone in the oropharyngeal complex is vulnerable to damage. A study with 90 samples explores. The correlation with the location of the hyoid bone and facial patterns. Measurements of hyoid bone position were taken using reference structures. Analysis revealed strong connections in Egyptian adults and differences in the locations of the hyoid bones in people with different facial types and dental ages. Where the hyoid bone is in relation to dentofacial patterning has been the subject of extensive questioning. Studies show a relationship between changes in mandible placement and hyoid bone position. The hyoid bone responds to variations in the head position.

Class III (26.29 ± 2.81) was significantly the most anterior, while there was insignificant difference between class I (23.62 ± 2.60) and class II (23.93 ± 6.02). In agreement with Mortazavi et al (2018)[10], Chen et al.(2021)[11] ,Zou et al (2020)[12] , Cheng et al.(2022)[13] , Bilal R (2021)[14] and Adamidis et al (1992)[15] and Alexa V. et al (2022)[16]. In disagreement with Jose et al (2014)[17]Kocakara et al (2020)[18]Daraze A,(2018)[1] Anthropometric data and gender differs among of population also Weight, height, body mass index, and neck circumference There were little statistically significant differences in BMI between the three classes, but measures were significantly higher in masculine than in females. Class III had significantly higher body stature, weight, and NC than classes I and II.

The factors that might play a role in the anteroposterior positioning of the hyoid include the relative lengths of the muscles running from the base of the skull, mandible, and tongue to the hyoid bone and maintenance of the patency of the pharyngeal airway space. This can be attributed to the muscular attachment of the hyoid bone and the mandible. The hyoid follows the mandibular movements in the sagittal plane, so it moves backwards in class II individuals and forward in class III patients.

The main obstacle of the present analysis was the lack of a functional examination of the hyoid bone. Thus, we recommend that future studies look into the position of the hyoid bone during processes including breathing, speaking, and swallowing.

Conclusions:

Hyoid bone was positioned the most anterior in Class III, regarding (anteroposterior relation) angular measurements according to SN plane as a reference.

Conflict of interest:

The authors declare that there is no conflict of interest.

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