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ORIGINAL ARTICLE

The Relation between Dentofacial Shapes and Depth of Masseter Muscle Using Magnetic Resonance Imaging Technique

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ABSTRACT

Aim: To determine the depth of masseter muscle in various vertical dentofacial shapes and to relate masseter muscle depth with craniofacial shapes using magnetic resonance imaging technique (MRI).
Study design: The participants were split into three teams, each with ten. The chosen participants had lateral cephalograms. Everyone with a history of orthognathic surgery or systemic disorders was not included in the current investigation.
Place and duration: Study performed in orthodontic care in different special centres in Baqubah city from October 2021 to June 2022.
Methodology: Thirty youthful, healthy people overall between the ages of 16 and 40were chosen and divided into three groups of ten,using(MRI), categorize each as a vertical, average, and horizontal grower. The concepts masseter muscles had their different anatomical dimensions sagittal, axial, and coronal directions utilizing MRI perspectives.
Results: Our study found the difference is significant when comparing between the growth patterns in both direction (horizontal and vertical) ($p<0.05$), also the direction of muscle fibers of masseter muscle (anterior and posterior) away from first molar to the zygomatic arch was saved. In contrast to the horizontal list, when the fibers are attached anteriorly and vertically at the jaw angle, we discovered in our research that the directionof the muscle fibers is toward the posterior side more than anterior side and at a sharper angle.
Conclusion: The study show that the muscle fibers located in extra posterior direction and the angle was sharper than the horizontal group, where the vertical fiber orientation having an anterior connection at the angle of the mouth's.
Keywords: MRI, growth patterns, and masseter muscle.

INTRODUCTION

The effect of jaw muscle activity on the development and maturation of the human craniofacial complex has been the subject of several studies. Much focus has been placed on the relationship between abnormal jaw muscle function and abnormally vertical skull development patterns (long-face morphology).

However, none of these studies could reveal anything about how the function of the jaw muscles affects growth or how growth affects the function of the jaw muscles. Only methods research on the effects of caused aberrant muscular movement on the skull development can give the answers. When the muscle of jaw activity impacts craniofacial development, the force vector's spatial direction and the magnitude of muscle force probably play a role in mediating this impact[1-6] level and kind of muscular activation and other potential contributing elements, such the inherent characteristics of muscles are not considered in this study.

It is evident that the stress pattern created in growing bones and cartilage is determined by muscular forces' direction and that this stress pattern directly affects the development process.

The young dogs aged[8,9] were used in tests where the jaw muscles' alignment was surgically changed, and the findings conflicted. Only Hohl saw a noticeable rise in the skull's vertical axis development after repositioning the masseter and temporalis muscles in a more oblique position, reducing byusing biomechanics efficacy of these muscles.

Currently, correlational information on the relationships between human craniofacial shape and the way the jaw muscle is oriented is unusual. and are acquired mainly by cephalometricmethods[10,11]. These results demonstrated that the jaw muscles of people with long faces are orientated somewhat obliquely concerning the Nasion-Sella line and the Frankfort horizontal plane (FH).The ineffectiveness of the muscles that close the jaw has purportedly been connected to long-face morphology's etiology. The posterior vertical chain of muscles postulated by Sassouni et al. to control the vertical development of the skull consists of the temporalis, masseter, and medial pterygoid muscles in individuals with long faces, it was believed that this skeletal system was posteriorly located, oriented obliquely, and neighbouring to the TMJ joint[12,13]. The development of non-invasive imaging methods similar to using (MRI) and computer tomography has substantially enhanced about the muscles of human jaws when the study done in vivo. Many of newstudies have used MRI scans to assessthe location of the Jaw muscles in people in vivo by using MRI[14].

Purpose of this research was to investigate the links between the variances in anatomy of the masseter muscle in people with various facial patterns using MRI.

METHODOLOGY

Place and duration:orthodontic care in different special centres in Baqubah city by the Department of Surgery, College of Medicine, University of Diyala from oct.2021 to jun. 2022
Sample size: Thirty patients with had lateral cephalograms. Everyone with a history of orthognathic surgery or systemic disorders was not included in the current investigation their age ranged from 16-40 years
Inclusion criteria:
- Patient aged ranged 16-40 years old
- Signed a written permission form.
- participants had lateral cephalograms

Exclusion criteria:
- age less than 16 years
- age over 40 years
- rejection of writing a permission
- history of orthognathic surgery or systemic disorders

Data collection and Statistical analysis:they were split into three teams, each with ten.Total standards gotten were charted and analysed in statistical method. Different parameters measurements that obtained like the slandered deviation and the mean by the using of ANOVA test (one-way) in order to detect the significant value in the groups.

The pattern of vertical growth in Group one, the pattern of average growth for Group two, and the pattern of horizontal growth in Group three. The cephalogram was drawn on four angles, one proportional, and acetate paper was analysed to establish the subject's development trend. The following metrics were obtained using the MRI scan. The considered measurements are:
A. Area between the first molar distal end and anterior fibers of masseter muscle.

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B. Area between the first molar distal end and posterior fibers of masseter muscle
C. Direction of the fibers of masseter muscle.
Area between the first molar distal end and fibers of masseter muscle: The area measured from first molar distal aspect and both anterior and posterior fibers of masseter muscle detected in axial view.
Direction of the fibers of masseter muscle: Represent the angle that is formed between reference line joining the lower edge of the zygoma to the external auditory meatus and the line drawn parallel to the mid-fibres detected in sagittal view.

RESULTS

The average measurements for the vertical, horizontal, and average groups of separated from the anterior fibers proximal to the first tooth are each (17.301.64) millimeters. According to a Honest Significant Difference (HSD) Post Hoc Tukey test for various evaluations across the (3) research groups,The difference was significant between the (3) groups include ,vertical and the average groups when comparing the distance from the first tooth's anterior fibers to that tooth. There is a 95% degree of confidence in this finding.The difference was not significant statistically, thoughbetween the average and horizontal groupings after being contrasted (Figure 1).

Figure 1: Statistical measurements assessing the Distance between the anterior fibres of masseter muscle distal to the 1st molar (mm) in 3clusters using Mean, Standard deviation, and Post Hoc Tukey test.

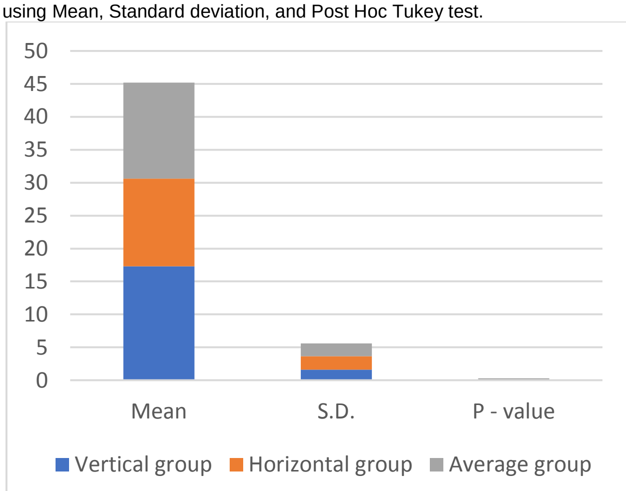
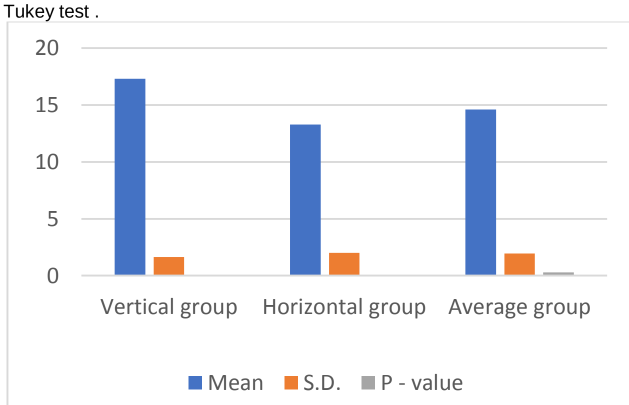
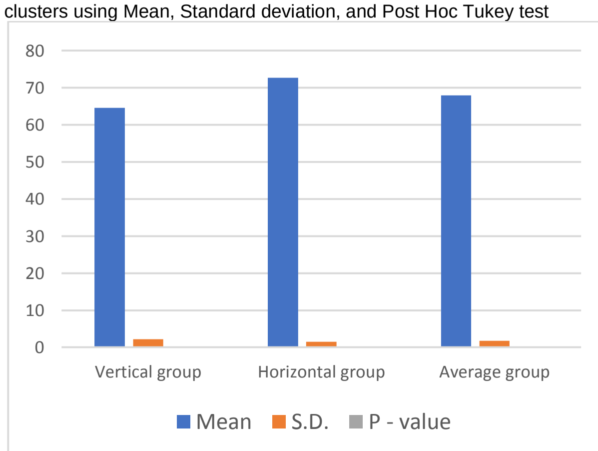


Figure 2: Measurements that statistically analysed for evaluating the Distance between fibers of masseter muscle (anterior) located distal to first molar (mm) in 3 clusters using Mean, Standard deviation, and Post Hoc Tukey test .



The average separation in between the front molar and the posterior fibres was examined between the straight (52.70 mm), horizontal (57.60 mm), and average groups (56.60 mm). Honest Significant Difference (HSD) Post Hoc Tukey test for multiple comparisons across the three study teams found a difference that is statically important when the average and horizontal groupings are contrasted with the vertical group. as shown. There isn't a statistically difference, though when the contrast the average and horizontal classes. Figure 2 shows the average angle of the masseter's fibers in three groups: vertical (64,6002.20), horizontal (72,7001.490), and average (68,0001.760). A statistically noteworthy disparity exists between the average, vertical, and horizontal classes, with a mean variation between 3.400 and 8.100. The difference was also statistically noteworthy between the horizontal and average classes (Figure 3).

Figure 3: Measurements that statistically analysed forevaluating the direction of the fibers of the masseter muscle (degrees) of masseter muscle in 3 clusters using Mean, Standard deviation, and Post Hoc Tukey test



DISCUSSION

The literature only contains a small number of assessments of the space between the fibers and the first molar antero-posteriorly. This has practical implications for a natural anchoring notion made available by the muscle tissue above the rear teethin this article, the spacing between the backward section of the fibers is far to the first teethand the distal portion of the anterior fibers of the first molar is measured from an axial perspective.This sheds light on where the masseter muscle fibres are located furthest from the back teeth and may illustrate why the vertical growth patterns show more anchoring loss than the horizontal and average development formations.

The frontal fibers in the vertical team are farther from the first molar on the posterior side than those in the horizontal and average groups. Therefore, their impact on the tooth's ability to serve as a muscle anchoring is less significant. These results are likewise consistent with and provide evidence for the notion advanced by Haas et al., who hypothesized that the molars were placed more anteriorly to the masseter in hypodivergent over closed face patterns than in hyperdivergent vertical facial patterns. These findings support a hypothesis put out in a study According to Sassouni and Nanda, a dolicocephalic person's muscle fibres are directed more posteriorly because of where they unite at the angle of the jaw.Due to the masseter muscle's wider size at the location of insert, the anterior fibres of the masseter are more near the first molar in the horizontal group, while the posterior fibres are further away[12].

These results support Bench et al. muscular anchoring theory, which proposed that the position and shape of the strong muscles involved would enable the teeth to be governed by natural anchorage in a brachyfacial pattern. As a result, while employing retraction mechanics, anchoring loss of the posterior teeth in a brachycephalic individual is reduced or insignificant compared to people with dolicocephaly or mesocephaly[15]. The outcomes of this experiment agree with earlier investigations that measured the fibre orientation using the occlusal plane as a reference plane.Haskell et al. the superficial masseter was shown to be anterior directioninclination and at a dolicofacial sample has a substantially the angle toward occlusal plane more acuteocclusal plane than in a brachyfacialsample[16].

The ability to control the perpendicularconstituent of craniofacial growth was found to be lower in individuals with larger vertical craniofacial dimensions and jaw muscles with a slightly oblique orientation, according to Van Spronsen et al 6's explanation of the link between the skull's growth patterns and the direction of the subject's muscle fibers[17].

CONCLUSION

The study show that the muscle fiberslocated in extra posterior direction and the angle was sharperthan the horizontal group, where the vertical fiber orientation having an anterior connection at the angle of the mouth's.

Recommendation: Studying the same variable with large sample size, comparison the same variable between different races.

Conflicts of interest: The authors have no conflict of interest.

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Ethical Approval: This study was approved by the Department of Surgery, College of Medicine, University of Diyala. Before the treatment started, each participant signed a written permission form.

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