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 40 were 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 direction of 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 impact6-8 level and kind of muscular activation and other potential contributing elements, such as 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 aged6-9 were used in tests where the jaw muscles' alignment was surgically changed, and the findings conflicted. Only Holt saw a noticeable rise in the skull's vertical axis development after repositioning the masseter and temporalis muscles in a more oblique position, reducing by using 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 cephalometric methods10-11. These results demonstrated that the jaw muscles of people with long faces are oriented 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 temporals, masseter, and medial pterygoid muscles in a more long face, it was believed that this skeletal system was posteriorly located, oriented obliquely, and neighbouring to the TMJ joint12,13. 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 assess the location of the Jaw muscles in people in vivo by using MRI14-16.

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. Different 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.
**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, though between the average and horizontal groupings after being contrasted (Figure 1).

**DISCUSSION**

The literature only contains a small number of assessments of the space between the fibers and the first molar anterior-posteriorly. This has practical implications for a natural anchoring notion made available by the muscle tissue above the rear teeth in this article, the spacing between the backward section of the fibers is far to the first teeth and 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 fibers 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.

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\(^6\). The outcomes of this experiment agree with earlier investigations that measured the fiber orientation using the occlusal plane as a reference plane.Haskell et al. The superficial masseter was shown to be anterior direction inclination and at a dolicocephalic sample has a substantially the angle toward occlusal plane more acuteocclusal plane than in a brachyfacial sample\(^6\). The ability to control the perpendicular constituent 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 Sproosn et al 6's explanation of the link between the skull's growth patterns and the direction of the subject's muscle fibers\(^7\).

**CONCLUSION**

The study show that the muscle fibers located in extra posterior direction and the angle was sharper than the horizontal, where the vertical fiber orientation having an anterior connection at the angle of the mouth'

**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.

**Funding:** Self-funded by the author

**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.

**REFERENCES**

6. 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\(^7\).