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The role of magnetic resonance imaging technique in detection dentofacial pattern among Diyala Governorate population

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Abstract

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Background: Magnetic Resonance Imaging is accepted as the most advanced imaging modality for diagnosis of maxillofacial soft tissue abnormalities. It is noninvasive and has the potential to yield high quality tomographic imaging in any plane with bone as well as soft tissue spatial resolution. Additionally, the patient is not exposed to ionizing radiation or any biological hazards.
Objective: 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).
Patients and Methods: 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 found that the muscle fibers in the extra posterior direction had a steeper angle than the horizontal group, with the vertical fiber orientation having an anterior connection at the angle of the mouth.
Keywords: MRI, growth patterns, masseter muscle.

Introduction

Many research have been conducted to investigate the effect of jaw muscle activity on the development and maturation of the human craniofacial complex. The link between defective jaw muscle function and abnormally vertical skull development patterns has received a lot of attention (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

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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 [1,2,3,4,5,6,7] .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 employed in tests in which the jaw muscles' alignment was surgically altered, and the results were contradictory. Only Hohl observed a considerable increase in the vertical axis growth of the skull after moving the masseter and temporalis muscles in a more oblique orientation, lowering the efficacy of these muscles utilizing biomechanics.

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 methods. [10,11] These findings show that the jaw muscles of people with long faces are oriented slightly obliquely in relation to the Nasion-Sella line and the Frankfort horizontal plane (FH). The ineffectiveness of the muscles that shut the jaw has allegedly been linked to the etiology of long-face morphology. The posterior vertical chain of muscles proposed 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. This skeletal system has been thought to be posteriorly located, directed obliquely, and adjacent 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 new studies have used MRI scans to assess the location of the Jaw muscles in people in vivo by using MRI [14]. MRI was used in this study to investigate the connections between variations in masseter muscle anatomy in people with different facial patterns.

Patients and Methods

Place and duration: orthodontic care in different special centres in Baqubah city by the from June 2021 to October 2022.

Sample size: Thirty participants had lateral cephalograms. The current study excluded anyone with a history of orthognathic surgery or systemic diseases, and the participants' ages ranged from 16 to 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 analyzed in statistical method. Different parameters measurements that obtained like the slandered deviation and the mean by the

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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 analyzed to establish the subject's development trend. The following metrics were obtained using the MRI scan. The considered measurements are: [17]

A. Area between the first molar distal end and anterior fibers of masseter muscle.

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: Depict the angle created by the line drawn parallel to the mid-fibres found in sagittal view and the reference line connecting the lower margin of the zygoma to the external auditory meatus.

Statistical Analysis

SPSS (statistical package for social sciences) version 19 computer software was used to do statistical analysis on measurements, and data analysis was translated into a digital database structure.

Some of the performing aspects (validity) of a test or criterion are positive predictive value, specificity, sensitivities, and negative predictive value. Sensitivity is the conditional possibility that a sick person will have a positive result. Its value could be changed by adjusting the cutoff point for positive test results. Specificity is the conditional probability of a disease-free person receiving a negative test result.

The provisional opportunity that a person with a positive test result is ill is the Positive Predictive Value (PPV). Its value is determined by the positive test result cutoff point and the illness prevalence in the screened population. The provisional opportunity that a individual with a negative test result is clear of the disease is known as the negative predictive value (NPV). The percentage of genuine findings among all test results is called accuracy (per cent agreement) (positive and negative) [18].

Results

The mean distance between anterior fibres distal to the first molar in the vertical (17.30±1.64mm), horizontal (13.30±2.00mm), and average (14.60±1.9mm) groups. A Post Hoc Tukey HSD (Honest Significant Difference) test for multiple comparisons among the three study groups for the distance between the anterior fibres distal to the first molar reveals a statistically significant difference when the vertical group is compared to the horizontal and average groups at 95% confidence level. When the horizontal and average groups were compared, there was no statistically significant differenceTable (1). The mean distance of the posterior fibres distal to the first molar in the vertical (52.701.64mm), horizontal (57.601.71mm), and average groups. When the vertical group was compared to the horizontal and average groups, the Post Hoc Tukey HSD (Honest Significant Difference) test for multiple comparisons revealed a statistically significant difference. When the average and horizontal groups are compared, there is no statistically significant difference Table (2). Mean angulation of masseter fibres in vertical (64.6002.20), horizontal (72.7001.490), and average (68.0001.760) groups. When the vertical group was compared to the average and horizontal groups, there was a statistically significant difference with mean differences of 3.400 and 8.100. There was also a statistically significant difference between the horizontal and average groups, with a significant difference of 4.700 Table (3).

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

Distance between the anterior fibres distal to the 1st molar (mm)	Mean	S.D.	P - value
Vertical group	17.30	1.64	0.000
Horizontal group	13.30	2.00	0.009
Average group	14.60	1.96	0.283

*Statistically significant if P<0.05

Table (2): Distance between fibers of masseter muscle (anterior) placed distal to first molar (mm) measured statistically in three clusters using Mean, Standard deviation, and Post Hoc Tukey test

Distance between fibers of masseter muscle (posterior) placed distal to first molar (mm)	Mean	S.D.	P - value
Vertical group	52.70	1.64	0.000
Horizontal group	57.60	1.71	0.000
Average group	56.60	1.71	0.394

* Statistically significant if P<0.05

Table (3): Statistical measurements assessing the orientation of masseter muscle fibers (degrees) in three clusters using Mean, Standard Deviation, and Post Hoc Tukey test

Orientation of the muscle fibre (degrees)	Mean	S.D.	P - value
Vertical group	64.60	2.22	0.000
Horizontal group	72.70	1.49	0.068
Average group	68.00	1.76	0.001

*Statistically significant if P<0.05

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 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 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.56, 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.'s 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 direction inclination and at a dolicofacial sample has a substantially the angle toward occlusal plane more acute occlusal plane. than in a brachyfacial sample [16]. 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 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].

Conclusions

The study found that the muscle fibers in the extra posterior direction had a steeper angle than the horizontal group, with the vertical fiber orientation having an anterior connection at the angle of the mouth.

Recommendations

Evaluating the same variable with sample size larger than used in this study also doing comparison of the variable used in this study in varied races.

Source of funding: The current study was funded by our charges with no any other funding sources elsewhere.

Ethical clearance: Ethical approval was obtained from the College of Medicine / University of Diyala ethical committee for this study.

Conflict of interest: Nil

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دور تقنية التصوير بالرنين المغناطيسي في الكشف عن اشكال الوجه والفكين في سكان محافظة ديالى

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الملخص

خلفية الدراسة: تعتبر طريقةالتصوير بالرنين المغناطيسي الطريقة الأكثر تقدمًا لتشخيص تشوهات الأنسجة الرخوة في الوجه والفكين. اذ انها طريقة غير جراحية ولديها القدرة على إنتاج تصوير مقطعي عالي الجودة في أي مستوى يحتوي على العظام بالإضافة إلى الدقة المكانية للأنسجة الرخوة. بالإضافة إلى ذلك، لا يتعرض المريض للإشعاعات المؤينة أو أي مخاطر بايولوجية.

اهداف الدراسة: لتحديد عمق العضلة الماضغة في مختلف أشكال الوجه السني العمودية وربط عمق العضلة الماضغة مع الأشكال القحفية الوجهية باستخدام تقنية التصوير بالرنين المغناطيسي.

المرضى والطرائق: تم اختيار ثلاثين شاباً سليماً تتراوح أعمارهم بين ١٦ و ٤٠ عاماً وقسموا إلى ثلاث مجموعات كل منها عشرة، باستخدام (التصوير بالرنين المغناطيسي)، وصنف كل منهم إلى عمودي ومتوسط وأفقي. كان لمفاهيم العضلات الماضغة أبعادها التشريحية المختلفة (الاتجاهات السهمية والمحورية والإكليلية) باستخدام منظورات التصوير بالرنين المغناطيسي.

النتائج: وجدت دراستنا أن الفرق كبير عند المقارنة بين أنماط النمو في كلا الاتجاهين (الأفقي والعمودي)، كما كان اتجاه الألياف العضلية للعضلة الماضغة (الأمامية والخلفية) بعيدا عن الرحى الأولى إلى القوس الوجني.. وعلى عكس القائمة الأفقية، عندما تكون الألياف متصلة بشكل أمامي وعمودي بزاوية الفك، اكتشفنا في بحثنا أن اتجاه الألياف العضلية يكون نحو الجانب الخلفي أكثر من الجانب الأمامي وبزاوية أكثر حدة.

الاستنتاجات: وجدت الدراسة أن الألياف العضلية في الاتجاه الخلفي الإضافي لها زاوية أكثر انحدارًا من المجموعة الأفقية، مع وجود اتصال أمامي في اتجاه الألياف العمودي عند زاوية الفم.

الكلمات المفتاحية: التصوير بالرنين المغناطيسي ،أنماط النمو ،العضلات الماضغة.

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