Ultrasonographic observation of anterior temporalis and masseter muscle in open bite patients: A comparative study

Davis T Danny[1,*], Anjana S Nair[2], Hrudya Balachandran[3]

[1-3]Senior Lecturer, [1-3]Dept. of Orthodontics, [1,2]Sree Mookambika Institute of Dental Sciences, Kulasekharam, Tamil Nadu, [3]PSM Dental College, Kerala, India

***Corresponding Author:**
Email: davisthomasdanny@gmail.com

Abstract

Aim: The present study was done to compare the muscle thickness of the masseter and anterior temporalis muscle in adults with normal occlusion and anterior open bite using ultrasonography, in rest position and maximum intercuspation.

Material and Methods: Ultrasonographic recording of masseter and anterior temporalis thickness of both sides of nine subjects with anterior open bite and normal occlusion was done. Unpaired t test was used for the intergroup comparison of muscle thickness.

Results: A significant correlation between the thicknesses of both the muscles in contracted state was found to be more in anterior open bite. There was no statistically significant correlation between thicknesses of both muscles in relaxed state.

Conclusion: Since no detailed investigation was done, it will be premature to give a final verdict on the correlation between the masticatory muscle thickness and facial morphology. A long term follow up will provide a new insight for future clinical purpose.

Keywords: Ultrasonography, Temporalis muscle, Masseter, Open bite.

Introduction

The relationship between the form and function of the stomatognathic system has been studied, but it's not clear whether it's Genetics or the strength of the masticatory muscles that play the decisive role.[1,2,3] The field of medical imaging, stimulated by advances in digital and communication technologies has grown tremendously. New imaging techniques that reveal greater anatomical details are available in most of the diagnostic department.[4]

Previous studies have determined the increased muscle activity of masticatory muscle using electromyography.[5] Ultrasonography was found to be a highly reliable and accurate method for imaging and measuring masticatory muscle thickness.[6]

Masticatory muscle function correlates with the morphological feature of craniomandibular apparatus to which they are geometrically related.[7] Answering the question as to whether the activity of masticatory muscle has any effect on facial morphology is important for understanding of normal growth and development and also the occurrences of morphological abnormalities. If this is held true, then the abnormal muscle structure can explain extreme abnormalities of facial morphology and certain forms of malocclusion.[8]

Ultrasound being an accurate, easy and convenient method, the growth of masticatory muscle and its inherent structure could be studied to decode the entire activity and the influence it exerts on the facial form. Increased muscle thickness directly substantiates for the increased muscle activity.[9]

Therefore this present study was undertaken with the aim of

1. Evaluating ultrasonographically as a method for imaging and measuring various facial muscle and here in masseter and anterior temporalis muscle.
2. Quantitating the range of thickness of these muscles in cases with different facial morphology.

Materials and Methods

The study comprised of 18 subjects between 18- 25 years of age. They were grouped into two groups- the test group comprised of 9 subjects having anterior open bite and the control group comprised of 9 subjects with Angle's Class I molar relationship.

Ultrasonographic recordings of the masseter and anterior temporalis muscle were made with the subjects in supine position. The recordings site for masseter muscle was central portion (the area of greatest lateral distention) and for anterior temporalis muscle was in front of the anterior border of the hairline (the area of greatest lateral distention).

A real time ultrasound system (PHILIPS HD 11XE) equipped with a 7.5 MHz sector scan transducer with a sectoring angle of 100˚ was used. Air tight gel was applied on the skin surface, then transducer was placed and transverse sector scan was done.

The measurements were recorded immediately both in rest position of the mandible and maximal intercuspation of the teeth. Data of muscle thickness in millimetres was collected and statistically computed for

1. The mean and standard deviation.
2. Intergroup comparison of muscle thickness using unpaired t test.

Results

Table 1 & 2 shows muscle thickness of masseter and anterior temporalis muscle in relaxed and contracted state of Test subjects. Table 3 & 4 shows muscle thickness of masseter and anterior temporalis muscle in relaxed and contracted state of Control subjects. Table 5 shows the overall comparison of muscle thickness of Test and Control subjects. Table 6 shows the comparison between right and left muscles in Test subjects. Table 7 shows the comparison between right and left muscles in Control subjects.

On comparing the two groups, the masseter muscle thickness was more in the control group than the test group in relaxed as well as contracted state and this was found to be statistically significant.

On comparing the two groups, the anterior temporalis muscle thickness was more in test group than the control group in contracted state and this was found to be significant.

On comparing the two groups, the anterior temporalis muscle thickness was more in test group than the control group in relaxed state but it was not found to be statistically significant.

On comparing the right and left side muscles of test and control group, it was found to be insignificant.

Table 1: Masseter muscle measurement in test group-readings in millimeters

Sl No.	Age	Relaxed-right	Relaxed-left	Contracted-right	Contracted-left
1	19yrs	7.8181	7.86	8.39	8.30
2	20yrs	7.80	8.10	8.20	8.50
3	20 yrs	9.60	9.50	10.50	10.20
4	21 yrs	8.00	8.20	8.50	8.60
5	25 yrs	7.33	7.40	7.90	7.85
6	25 yrs	9.10	8.70	10.30	9.80
7	22 yrs	8.60	8.80	9.20	9.50
8	23 yrs	7.90	7.80	8.30	8.40
9	21 yrs	8.00	8.10	9.20	9.10

Table 2: Anterior temporalis muscle measurement in test group-readings in millimeters

Sl No.	Age	Relaxed-right	Relaxed-left	Contracted-right	Contracted-left
1	9yrs	11.30	11.20	12.50	12.70
2	20yrs	8.40	8.00	9.50	8.80
3	20yrs	10.30	10.90	11.30	11.50
4	21yrs	9.90	9.60	10.80	10.70
5	25yrs	7.60	7.60	8.20	8.80
6	25yrs	10.60	10.40	11.80	11.70
7	22yrs	9.40	9.08	10.80	10.90
8	23yrs	11.40	11.30	12.70	12.70
9	21yrs	11.10	10.80	12.40	12.10

Table 3: Masseter muscle measurement in control group readings in millimeters

Sl No.	Age	Relaxed-right	Relaxed-left	Contracted-right	Contracted-left
1	18yrs	9.30	9.00	9.70	9.70
2	21yrs	10.50	10.30	12.20	11.80
3	21yrs	9.40	9.80	10.20	10.40
4	21yrs	10.50	10.80	11.00	11.30
5	21yrs	9.30	8.90	9.90	9.40
6	19yrs	9.40	9.70	10.00	10.20
7	19yrs	9.50	9.60	10.10	9.90
8	19yrs	9.40	9.60	9.90	10.00
9	21yrs	9.20	9.30	9.70	9.75

Table 4: Anterior temporalis muscle measurement in control group-readings in millimeters

S. No.	Age	Relaxed-right	Relaxed-left	Contracted-right	Contracted-left
1	18yrs	8.50	8.00	9.10	8.60
2	21yrs	9.90	9.20	10.20	9.90
3	21yrs	9.90	9.60	10.20	10.10
4	21yrs	10.30	10.00	10.80	10.50
5	21yrs	8.90	9.10	9.40	9.60
6	19yrs	9.70	9.50	9.90	9.90
7	19yrs	9.70	9.75	10.00	10.10
8	19yrs	9.60	9.50	10.10	10.00
9	21yrs	9.20	9.10	9.60	9.55

Table 5: Overall comparison of muscle between test group and control group

	Test group	Control Group	Mean difference	95 % CI	t-value	p-value
Masseter muscle relaxed	8.33 ± 0.84	9.67 ± 0.77	1.33	0.78 – 1.88	4.97	P<0.0001
Masseter muscle contracted	8.94 ± 0.94	10.28 ± 0.75	1.33	0.76 – 1.91	4.71	P<0.0001
Anterior temporalis muscle relaxed	9.89 ± 1.23	9.55 ± 0.62	0.33	0.33 – 0.99	1.03	P=0.31
Anterior temporalis muscle contracted	11.27 ± 1.48	9.94 ± 0.54	1.33	0.57 – 2.09	3.57	P=0.001

Table 6: Comparison between right and left muscles in test group

	Right	Left	Mean difference	95 % CI	T-value	P-value
Masseter muscle relaxed	8.33 ± 0.86	8.33 ± 0.86	0.00	-0.86 – 0.86	0.00	P=0.99
Masseter muscle contracted	8.88 ± 1.05	9 ± 0.86	0.11	-0.85 – 1.07	0.24	P=0.81
Anterior temporalis muscle relaxed	9.88 ± 1.27	9.88 ± 1.27	0.00	-1.27 – 1.27	0.00	P=0.99
Anterior temporalis muscle contracted	11.22 ± 1.56	11.33 ± 1.5	0.11	-1.42 – 1.64	0.15	P=0.88

Table 7: Comparison between right and left muscles in control group

	Right	Left	Mean difference	95 % ci	T-value	P-value
Masseter muscle relaxed	9.55 ± 0.88	9.77 ± 0.67	0.22	-0.55 – 1	0.6	0.55
Masseter muscle contracted	10.33 ± 0.7	10.22 ± 0.83	0.11	-0.88 – 0.66	0.3	0.76
Anterior temporalis muscle relaxed	9.67 ± 0.5	9.44 ± 0.73	0.22	-0.84 – 0.4	0.75	P=0.46
Anterior temporalis muscle contracted	9.88 ± 0.6	10 ± 0.5	0.11	-0.44 – 0.66	0.43	P=0.67

Discussion

The orofacial muscle activity has been studied in detail using electromyographic techniques, but of late, ultrasonography is providing an uncomplicated and reproducible access to parameters of jaw muscle function and its interaction with craniomandibular system.[10]

In recent years development of ultrasound has spread throughout different fields of medicine, being an accurate, easy and convenient method in determining the thickness of masticatory muscle.

It has been proved evidently about the relationship between skeletal morphology and masticatory muscle amplitude with greater amplitudes in subjects having anterior open bite than normal subjects.[11]

A previous study on ultrasonographic measurement of masseter and anterior temporalis muscle in normal and open bite subjects between 8-12years showed no

significant difference in thickness between two groups.[12]

In the present study, a significant correlation between the thickness of masseter muscle in both relaxed and contracted state was observed in normal than anterior open bite subjects. While anterior temporalis muscle in contracted state was significant in anterior open bite than normal subjects, but it was found to be insignificant in relaxed state. Due to paucity of data, no comparison can be done in relation to the findings in adults. In this study a significant positive correlation was noted in anterior temporalis muscle of adults in anterior open bite than with normal subjects. This could possibly be due to the dynamic role of the anterior temporalis muscle in maintaining the postural rest position of the mandible.

Conclusion

Ultrasonography is a highly reliable and accurate method for imaging and measuring masticatory muscle thickness. The study provided following results:

1. Masseter and anterior temporalis muscle in contracted state was found to be significantly thicker in open bite than normal subjects.
2. In relaxed state masseter muscle showed increased thickness in normal subjects, while anterior temporalis showed increased thickness in open bite subjects.
3. There is no statistical significance between right and left side muscles in both open bite and normal subjects.

Anterior temporalis being a powerful muscle among facial muscles, its increased thickness might possibly be due to its dynamic role in maintaining the postural rest position of the mandible in anterior open bite subjects. Since this is a pioneering study, it is too premature to give a final verdict on the correlation between masticatory muscle thickness and facial morphology for the recorded cases. A long term follow up will provide a new insight for future clinical purpose.

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