

Sonographic evaluation of masseter muscle thickness in bruxist and non-bruxist subjects

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ABSTRACT

Background: Masseter muscle is a jaw closing muscle of the mandible involved in Para functional habits; which include lip and cheek chewing, fingernail biting, and teeth clenching or bruxism which can be classified as awake or sleep bruxism. Patients with sleep bruxism are three to four times more likely to experience jaw pain and limitation of movement than people who do not experience sleep bruxism. The aim of this study is to measure the thickness of the masseter muscle in bruxist subjects and compare it with non-bruxist subjects by using sonography.

Materials and Method: Forty Iraqi subjects with age ranged (20-40) divided into two groups according to the presence of bruxism. Clinical examination was made and masseter muscle thickness measured for both groups using sonography.

Results: For bruxist subjects the mean thickness of masseter muscle in relaxation and clenching were (11.7 ± 1.4 mm) and (16.4 ± 1.3 mm). For non bruxist subjects were (11.2 ± 0.4 mm) and (13 ± 0.3 mm) respectively. There was an extremely high statistical significant difference in masseter muscle thickness under clenching between bruxist and non bruxist subjects (it was higher in bruxist group). Masseter muscle thickness under relaxation was significantly lower than that under clenching for both groups. Also there was a positive correlation between masseter muscle thickness and muscle function in bruxism situation.

Conclusion: Masseter muscle in bruxist subject was thicker when compared to non-bruxist subject. Masseter muscle thickness was found to be positively correlated with increasing muscle function. The findings of this study indicate that the functional capacity of the masseter muscle affected by bruxism and may be considered as one of the factors influencing muscle thickness.

Key words: masseter muscle, sonography, bruxism. (J Bagh Coll Dentistry 2014; 26(3):49-52).

الخلاصة:

العضلة الماضضة هي إحدى العضلات المسؤولة عن غلق الفك السفلي والتي تستخدم في بعض العادات مثل مضغ الشفة والخد، قضم الأظافر وصك أو صريف الأسنان والتي تصنف إلى نوعين عند اليقظة و عند النوم. هدف الدراسة هو قياس سمك العضلة الماضضة لدى مرضى صك الأسنان ومقارنته مع مجموعة سليمة وذلك باستخدام التصوير بالموجات فوق الصوتية. شارك أربعون متبرع في الدراسة تراوحت أعمارهم بين (20-40 سنة) تم فحصهم وتقسيمهم إلى مجموعتين تبعاً لوجود حالة صك الأسنان ومن ثم تم قياس سمك العضلة لدى المجموعتين باستخدام الموجات فوق الصوتية. أظهرت النتائج أن سمك العضلة لدى مرضى صك الأسنان في حالتها استرخاء وانقباض العضلة (11,7 ± 1,4 ملم) و (16,4 ± 1,3 ملم). للمجموعة السليمة كانت القياسات (11,2 ± 0,4 ملم) و (13 ± 0,3 ملم) كذلك سمك العضلة عند الاسترخاء كان أقل بكثير من السمك تحت الانقباض ولدى المجموعتين. الاستنتاج: العضلة الماضضة لدى مرضى صك الأسنان اسماك مقارنة مع الأشخاص الطبيعيين. سمك العضلة يتناسب طردياً مع زيادة وظيفتها. القدرة الادائية للعضلة الماضضة تتأثر بحالة صك الأسنان وتعتبر من إحدى العوامل التي تؤثر على سمك العضلات.

INTRODUCTION

Intensive use of any skeletal muscle may cause changes in the muscle fiber size and composition, which in turn will increase the strength of the muscle and the resistance to fatigue. This is also true for the masticatory muscles. Prolonged high activity of these muscles resulted in increased thickness of the masseter muscle ⁽¹⁾. Masseter muscle is a bulky strong muscle found in the cheek region. It is rectangular in shape and in the frontal view it curves from the inferior boarder of the zygomatic arch to the inferior edge of the ramus ⁽²⁾. Brunel et al. ⁽³⁾ also described the masseter muscle as being multipennate and possessing three layers (superficial, intermediate and deep) that are partially separated by tendinous septa and which overlap one another from the superior to deep and anterior to posterior. ⁽³⁾

Masseter muscle thickness may be measured using MRI, CT, or US, but for clinical examination, sonography is better than MRI and CT because it is a rapid, simple and inexpensive technique, the equipment can be easily handled and transported, and it has no known cumulative biological effects ⁽⁴⁾.

The term bruxism is derived from the French word, "La Bruxomanie", it has been defined as "a nonfunctional, voluntary or involuntary mandibular movement which may occur during the day or night, manifested by the occasional or habitual grinding, clenching or clicking of the teeth" ⁽⁵⁾.

The abnormal force created by bruxism is destructive to teeth, periodontal tissue, temporomandibular joints, masticatory muscles and causes muscle fatigue ⁽⁶⁾. Signs and symptoms of bruxism and parafunctional activity include hypertrophied masseter and temporalis muscles, myocitis of these same muscles, morning jaw stiffness, teeth sensitivity, shiny spot and fractured restoration ^(6,7). Masseter, Temporalis and Pterygoideus medialis muscles are

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continually stimulated by bruxism. Uni- lateral and/or bilateral hypertrophy of masseter are clinically discernable in the case of longstand- ing bruxism, while electromyographic studies show abnormally high tonus in all three muscles⁽⁸⁾. Masseter muscle hypertrophy was first described by Legg⁽⁹⁾ in a 10 years old girl who concurrent idiopathic temporalis muscle hypertrophy. The most commonly quoted etiology in the literatures is grinding in teeth, or habitual clenching of the teeth.⁽¹⁰⁾

A hypertrophied muscle will alter facial symmetry, generating discomfort and negative cosmetic impact in many patients, even though there are several authors claim that emotional stress leading to chronic forceful clenching of the jaws results in hypertrophy of the muscle.⁽¹¹⁾

The aim of the study was to measure the thickness of masseter muscle in individuals with bruxism and compare it with that of normal individuals using Sonography.

MATERIALS AND METHODS

Forty adult male volunteers with age ranged (20-40 y) selected from patients attending Al-Kudher general hospital (Al- Muthana city) for sonographic evaluation of different purposes for period extended from Feb. to April 2014, the entire participants have normal range of body mass index according to WHO system⁽¹²⁾, history had been taken from them and then clinical examination done, including analysis of coincident tooth wear, shiny spots on restorations, fractured restoration, sounds associated with bruxism, jaw muscles discomfort and masseter muscle hypertrophy upon digital palpation, then participants divided into two groups (20 bruxist and 20 non bruxist).

They were seated in supine position then masseter muscle thickness was measured for each participant using ultrasound on a level halfway between the zygomatic arch and gonial angle, under both conditions (relaxation and clenching)⁽¹³⁾, in relaxation the participants asked to maintain slight inter-occlusal contacts, while in clenching they asked to clench maximally in the inter-cuspal position.

Light pressure was applied to the muscle to avoid compression of the soft tissue and muscle, thus avoiding erroneous measurements. The measurements were made directly from the image at the time of scanning (as shown in figure 1).

RESULTS

Descriptive statistics for masseter muscles thickness (MMT) under both conditions were listed in details in table 1. The means and SD of

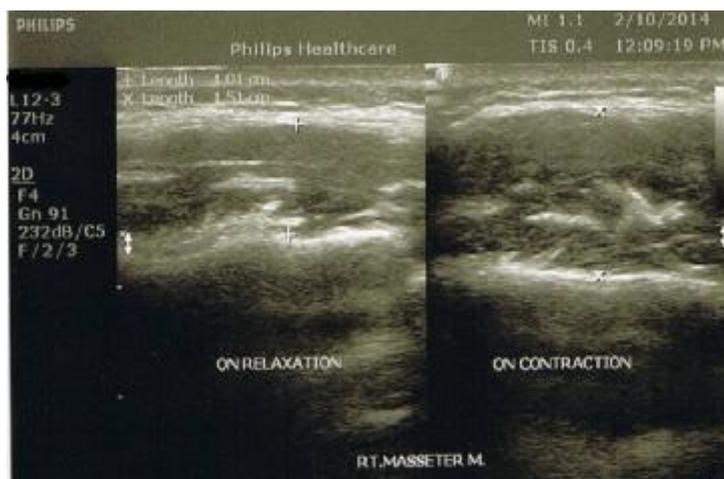


Figure 1: Masseter muscle thickness as measured on Ultrasound in both relaxed and clenched states.

masseter thickness in bruxist subjects under relaxation and clenching were (11.7 ± 1.4 mm) and (16.4 ± 1.3 mm) respectively, while for non bruxist subjects (MMT) under relaxation and clenching were (11.2 ± 0.4 mm) and (13 ± 0.3 mm) respectively.

MMT- relaxed was significantly lower than MMT- clenched ($P < 0.0001$) for both groups. It also shows that MMT –clenched for bruxist subjects was significantly higher than those for non-bruxist subjects ($P < 0.05$). But there was no statistical significant difference in MMT- relaxed between the two groups. Comparison of masseter muscle thickness under both conditions between the two groups was made and listed in table 2.

DISCUSSION

Recently, MMT has been considered as one indicator of jaw muscle function⁽¹⁴⁾. Masseter muscle is a superficial muscle and can be easily recorded on Sonography. It was easily identified as a homogenous structure lying adjacent to the echogenic band of the mandible. Sonography of masseter muscle is reliable, reproducible, simple and rapid method⁽⁴⁾.

The results of the present study show variations in MMT in relaxation and clenching among subjects of both study groups, Bruxist subjects had thicker masseter muscle compared to non-bruxist. Muscle thickness has been considered as an indicator of muscle function and there were many studies concerned with measuring MMT in relation to dentofacial pattern, maxillofacial morphology, dental arch width, different splints thickness in bruxist individuals^(4,6,15,16), or comparing the thickness during different stages of treatment such as treatment of Cl II relationship with twin block appliance or cross bite patients^(13,17), but there

was no study found comparing MMT between bruxist and non-bruxist subjects.

Subjects who participated in this study did not have extreme body mass index because masseter muscle thickness affected by body mass index⁽¹⁸⁾.

Kubota et al.⁽¹⁴⁾ conducted study on 80 adult male and investigated how the thickness of Masseter muscle relates to maxillofacial morphology using US and cephalometric radiograph. The results of MMT- relaxation and clenching were (15.8±3 mm) and (16.7 ± 2.7) mm, respectively. This result was confirmed with the results of the current study.

Kiliaridis et al.⁽¹⁵⁾ examined 60 patients with age ranged 7-18 y and reported MMT under relaxation and clenching for female (11.6 ±1.4mm) and (11.9 ±1.6 mm) respectively, while for male was (12.1 ±2.2 mm) and (12.4± 2.2 mm) respectively. These results were lower than the results of the current study and this due to fact that there was a positive correlation between muscle thickness and age, and the subjects of kiliaridis et al⁽¹⁵⁾ were younger than those of the present study. Satriogolu et al.⁽¹⁶⁾ conducted a study on Turkish population and reported (13.5 ±1.9 mm) and (14.5± 1.8 mm) for MMT- relaxed and clenched respectively. These variations in the thickness of the masseter across different populations may be associated with racial perspectives and the relative indulgence in masticators activities that may have lead to the attendant adaptive increase in size. It may also be associated with the orientation, type, size and composition of the muscle fibres. Also age was described as a factor in the increase in muscle thickness and development. In addition, the genetic and physiological make- up and environmental inclinations of males encourage muscular development and the mastication muscles are not left out.

Kiliaridis et al.⁽¹⁷⁾ measured MMT in examined children wearing twin-block appliance and concluded that muscle thickness was decreased when muscle activity was reduced , the results of the present study agreed with this

conclusion (MMT- relaxation achieved after treatment was lower than MMT- during function).

Rohila et al.⁽⁴⁾ examined 60 patients and reported MMT relaxation (12.5 ±1.2 mm) and MMT- clenching (13.8± 1.3mm). Egwe et al.⁽²⁾ using ultrasonography for evaluation of MMT in an adult Nigerian population with age ranged 19-30 years and reported MMT- relaxation (13.4 ±3.1mm) and MMT- clenching (17.03±3.5 mm). This result is confirmed with the result of the present study.

Many of the previously mentioned studies concluded that MMT was increased with increasing muscle function ,this was absolutely confirmed with the result of the current study and it was possibly due to involuntary low-level continuous contraction of the masticatory muscle associated with muscle pain and fatigue and subsequent hardness of the muscle because bruxism is a parafunctional habit and represent a continuous stimulation not only for masseter muscle but also for medial pterygoid and temporalis muscles and electromyographic studies show abnormally high tonus in all three muscles.

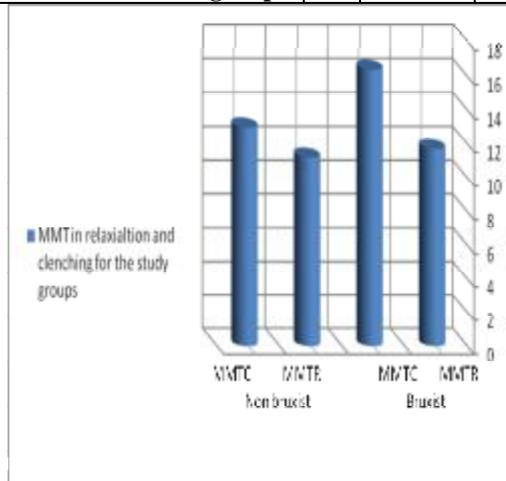
As conclusion; the abnormal force created by bruxism is destructive to teeth, periodontal tissue, masticatory muscles, temporomandibular joints and causes muscle fatigue. The finding of the present study showed a significant positive correlation between masseter muscle thickness and bruxism, the muscle thickness increase as the muscle function increase. Masseter muscle hypertrophy associated with limitation of mouth opening, tension, pain at region of involved muscle in addition to facial asymmetry that cause psychological problem to patient. The familiarity with this condition is important to settle the differential diagnosis with other pathologies such as parotid gland tumors and dental infection. Misdiagnosed cases due to lack of familiarity with this entity may lead to unnecessary biopsies, explorative surgeries and even radiotherapy for suspected parotid tumors.

Table 1: Descriptive statistics for the different states of MMT in millimeters (mm) for bruxist and non bruxist study groups.

	Bruxist		Non bruxist	
	MMT-relaxed	MMT- clenched	MMT-relaxed	MMT- clenched
N	20	20	20	20
Mean	11.7	16.4	11.2	13
SD	1.4	1.3	0.4	0.3
SE	0.3	0.3	0.09	0.08
Low 95% conf. limit	11	14.6	11	12.8
Up 95% conf. limit	12.4	15.9	11.4	13.1
Range	10.1-14.7	13.3-19.5	10.4-11.8	12.4-13.5

Table 2: Comparison of the MMT-relaxed and MMT-clenched between the study groups

Study Groups	N	t- value	d.f	P- value
MMTR and MMTC for all study groups	40	9.02	78	<0.0001, HS
MMTR and MMTC for bruxist group	20	8.1	38	0.0005, HS
MMTR and MMTC for non bruxist group	20	3.6	38	0.02, S
MMTR for Bruxist and Non bruxist groups	40	1.5	38	0.1, NS
MMTC for Bruxist and Non bruxist groups	40	7.4	38	< 0.0001, HS

**Figure 2: Masseter muscle thickness in relaxation and clenching for study groups.**

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