

Assessment of Masseter Muscle Thickness in OSMF Patients - A Computed Tomography Study

Choubarga Naik¹, Bimal Krishna Panda², Anisha Avijeeta³, Barnanshu Pattnaik⁴,
Subha Soumya Dany⁵, Sujata Panda⁶, Akriti Agrawal⁷, Alok Ranjan Sasmal⁸

^{1, 3, 7, 8} Department of Dentistry, VIMSAR, Burla, Odisha, India.

²Department of Anaesthesiology and Critical Care, VIMSAR, Burla, Odisha, India. ⁴Department of Dentistry, BB Medical College, Balangir Odisha, India. ⁵HiTech Dental College, Bhubaneswar, Odisha, India. ⁶Department of ENT, VIMSAR, Burla, Sambalpur, Odisha, India.

ABSTRACT

BACKGROUND

Oral submucous fibrosis (OSMF) is the most common precancerous lesion, prevalent mostly in South East Asia. The habit of betel nut or gutkha chewing is the main cause for this. There is a direct association between gutkha chewing habit and development of OSMF, the reason being exaggerated forces on the masseter muscle due to vigorous chewing for prolonged period of time. So, the present study was done to evaluate the thickness of masseter muscle in OSMF patients.

METHODS

A total of 25 subjects were included in the study from January 2015 to December 2017. 25 OSMF patients belonging to the age group of 25-50 years who attended the outpatient department of Veer Surendra Sai Medical College and Hospital, Burla, with masseteric hypertrophy and betelnut or gutkha chewing habit for more than 5 years, were included in the study. The computed tomography (CT) scans were obtained using Siemens Somatom Sensation 4-slice CT scanner. During the scanning period, the patients were asked to keep their mouth gently closed and relaxed. Axial sections of the CT scans were assessed for masseter muscles. The thickness of the muscle was calculated using image-analysing software and the measurements made were in millimeter (mm). Tabulation was done and statistical analysis was done using Mann-Whitney U test.

RESULTS

The thickness of masseter muscle of right side was found to be more than the left side in all patients except for one patient and the outcome was statistically significant with one tailed p value < 0.01.

CONCLUSIONS

The duration and frequency of the habit were found to be directly proportional to masseter muscle thickness and also with the clinical progression of the disease. Similarly, we also concluded from our study that there exists an association of masseter muscle hypertrophy with OSMF, and CT scan measurements of masseter muscle thickness were found to be statistically significant.

KEYWORDS

OSMF, Masseter Muscle, CT Scan

Corresponding Author:

*Dr. Barnanshu Pattnaik,
Department of Dentistry,
BB Medical College,
Balangir-767001,
Odisha, India.*

E-mail: barnanshu.pattnaik@gmail.com

DOI: 10.18410/jebmh/2020/646

How to Cite This Article:

*Naik C, Panda BK, Avijeeta A, et al.
Assessment of masseter muscle
thickness in OSMF patients - a computed
tomography study. J Evid Based Med
Healthc 2020; 7(52), 3176-3179. DOI:
10.18410/jebmh/2020/646*

Submission 01-09-2020,

Peer Review 09-09-2020,

Acceptance 10-11-2020,

Published 28-12-2020.

Copyright © 2020 Choubarga Naik et al. This is an open access article distributed under Creative Commons Attribution License [Attribution 4.0 International (CC BY 4.0)]

BACKGROUND

Sushruta mentioned a condition, "Vidari" under mouth and throat diseases in ancient medicine characterized by narrowing of mouth, depigmentation of oral mucosa, and pain on taking food.¹ Schwartz (1952) first reported a case of "atrophic idiopathic a (tropica) mucosae oris" occurring in Indians in East Africa. In India, this condition was described by Lal and Joshi (1953). Joshi coined the term "oral submucous fibrosis (OSMF).² Pindborg and Sirsat (1966) described histologically, the four consecutive stages of the OSMF. Seedat and Van Wyk (1988) have reported about irreversible nature of the disease, that is, once OSMF induced by the habit of chewing betel nut, the reversal of the disease after cessation of the habit could not occur.³

Oral submucous fibrosis (OSF) is a chronic debilitating disease and a potentially malignant condition of the oral cavity with a malignant potential of 7 % - 13 %.⁴ Worldwide, estimates of OSMF show a confinement to Indians and Southeast Asians, with an overall proportion rate in India of approximately 0.2 – 0.5 %, and a gender proportion of 0.2– 2.3 % in males and 1.2 – 4.57 % in females.⁵

The hallmark of the disease is submucous fibrosis that affects most parts of the oral cavity, pharynx and upper third of the esophagus leading to dysphagia and reduced mouth opening due to fibrosis of lips and cheeks.⁴ The clinical features includes burning sensation and reduced mouth opening in initial stages to loss of hearing and difficulty swallowing in advanced cases. One of the key clinical feature is masseter muscle hypertrophy (MMH), on both right and left sides. The thickness of the masseter muscle increases with prolonged activity. The probable cause of this hypertrophy is increased activity of the muscle due to the habit of gutkha chewing.⁶

To measure muscle thickness, ultrasonography, computed tomography as well as MRI are the documented techniques. A very cost effective and noninvasive method, where the thickness of the muscle both in contraction and in relaxation can be measured is ultrasonography. However, the issue is being technique sensitive. For measuring soft tissue thickness, MRI is the gold standard. In spite of its advantages of superior quality, the demerits of being expensive and not a routine imaging technique for all patients with OSMF cannot be ruled out. Various studies have used CT scans for measurement of masseter muscle thickness and medial pterygoid muscle thickness; hence it is a reliable method.⁷ We chose CT scan for measurement of masseter muscle in our study as CT scan records of OSMF patients were easily available to us. Not much studies have been documented for measuring the thickness of masseter muscle in OSMF. Hence, the aim of the study was to measure and compare the thickness of masseter muscle through CT scans in OSMF patients, who were chronic gutkha chewers.

METHODS

This retrospective study was conducted in the outpatient department of Veer Surendra Sai Medical College and

Hospital, Burla, on a sample size of 25 subjects in a time period between January 2015-December 2017. OSMF patients in the age group of 25 - 50 years with clinically evident masseteric hypertrophy and habit of chewing gutkha for more than 5 years, were included in the study. On basis of history and characteristic clinical features, OSMF was diagnosed based on the presence of blanching of the oral mucosae, burning sensation, stiffening and presence of characteristic fibrous bands. Staging was done according to Haider et al. Stage I, II and stage III patients were included in the present study. Informed consent was taken from all the patients and all patients were explained about the need for undergoing a clinical and radiological examination. The study was approved by the ethical committee of Veer Surendra Sai Medical College and Hospital, Burla. The exclusion criteria prohibited patients who are bruxers and patients having temporomandibular joint disorders.

The CT scans were recorded using Siemens Somatom Sensation 4-slice CT scanner (Siemens AG, Forchheim, Germany), with settings of 140 kVp, 300 mA, 3 mm slice thickness, and no gantry tilt. During the scanning period, the patients were instructed to keep their mouth gently closed and relaxed. Axial sections of the CT scans were assessed for masseter muscles (Fig. 1). As the thickness and cross-sectional area of the muscles vary at different planes, in all the patients, a standard reproducible plane was followed to avoid variations in the measurements.

The reproducible axial plane was standardized in accordance to the section containing the mid ramus level. The thickness of the muscle was calculated using image-analysing software (Image J 1.4q, National Institute of Health, USA) and calibrated according to the scale provided in the CT scan slides. The measurements made were in millimeter (mm). Tabulation was done and to evaluate the difference in masseter muscle thickness between the right and left sides, statistical analysis was done using Mann Whitney U test.

RESULTS

On tabulation, it was found that the mean thickness of masseter muscle on right side was 15.1680 and that on the left side was 12.2920 (Table 2) which interprets the thickness of masseter muscle on right side was more than on the left side.

Patient No.	Right Side (mm)	Left Side (mm)	Patient No.	Right Side (mm)	Left Side (mm)
1	15.4	11.9	15	15.2	11.8
2	14.8	11.6	16	15.4	11.9
3	15.2	11.8	17	15.2	11.8
4	14.7	12.1	18	14.8	11.6
5	15.2	11.8	19	15.4	11.9
6	15.4	11.9	20	14.7	12.1
7	15.3	12.0	21	15.2	11.8
8	15.2	11.8	22	15.2	11.8
9	15.4	11.9	23	14.4	14.7
10	15.2	11.8	24	15.4	11.9
11	15.4	11.9	25	15.3	12.0
12	15.2	11.8			
13	15.4	11.9			
14	15.2	11.8			

Table 1. Patient Data

	Thickness of Masseter Muscle	N	Mean	Std. Deviation	Std. Error Mean
Value	Right side (in mm)	25	15.1680	.27191	.05438
	Left side (in mm)	25	12.2920	1.68793	.33759

Table 2. Comparison of Masseter Muscle Thickness Right vs. Left Side

	Thickness of Masseter Muscle	t	d.f	Sig.(2-Tailed)	Mean Difference	Std. Error Difference
Value	Equal Variances Assumed	8.411	48	0.000	2.876	0.34194

Table 3. T-Test for Equality of Means



Figure 1. Measurement of Masseter Muscle Thickness

Statistical analysis was done using Mann Whitney U test and the mean difference between the thickness of left and right side was found to be 2.876. The critical t value was found out to be 8.4. Therefore, the result was highly significant at $p < 0.01$ (Table 3) indicating that there is a significant difference between the thickness of masseter muscle on right and left side.

DISCUSSION

Masseter muscle is the bulkiest and strongest muscle of the face and maximum force is applied to it during mastication. Muscle thickness has been considered as one of the indicators of jaw muscle function.⁸ Evident changes in the size and composition of the muscle fibre, increasing the muscle strength and the resistance to fatigue is caused by excessive use of any skeletal muscle. Masticatory muscles also apply this property. Prolonged high activity of these muscles resulted in increased thickness of the masseter muscle and increased maximal bite force values.⁹

OSMF is a potentially malignant condition and a topic of interest due to its increased incidence and its malignant potential. Earlier it was seen in south East Asia only but now this disease is found worldwide, may be due to increase in habit of quid chewing, which is the most common aetiological factor for OSMF.¹⁰ Enlarged masseter muscle due to fibrosis of buccal mucosa in OSMF giving the sunken cheek appearance has been well documented in the literature. The differential diagnosis may include other conditions like scleroderma. On basis of history of betel nut

chewers and burning sensation often prevalent in OSMF, OSMF can be ruled out. According to literature search, very few studies have been conducted so far to measure the thickness of masseter muscle in OSMF. The results of the study conducted by Kamla KA et al. coincide with the result of this study.¹¹

To measure muscle thickness, ultrasonography, computed tomography as well as MRI are the documented techniques. A very cost effective and non-invasive method where the thickness of the muscle both in contraction and in relaxation can be measured is ultrasonography. However, the issue is being technique sensitive. For measuring the soft tissue thickness, MRI is considered as the gold standard. In spite of its advantages of superior quality, the demerits of being expensive and not a routine imaging technique for all patients with OSMF cannot be ruled out. We chose CT scan for measurement of masseter muscle in our study as CT scan records of OSMF patients were easily available to us. Slice thickness of 3 mm, although not as accurate as 1-mm slice thickness, has been reported to be sufficient for the evaluation of muscle thickness as measured in this study.⁷ It is a well-established fact that if a muscle can undergo atrophy if not used for a long interval of time. Similarly, increased work load on the muscles may result in hypertrophy. This applies to the muscles of mastication as well. Underdevelopment of masticatory muscles are noted when bite forces are weakened, and when the forces are increased it leads to overdevelopment of the masticatory muscles. In patients with OSMF, prolonged chewing of arecanut and other commercial variants, results in hypertrophy of the masseter muscle.¹²

Egwu et al. used ultrasonography for evaluating masseter muscle and found that at rest stage the thickness was significantly lower than in contracted stage which was in accordance with our study. However, the cause or mechanism of thickening being unclear, there could be two possibilities for explaining this mechanism. The thickening could be due to the muscle fiber filament sliding on each other during contraction thus increasing fiber diameter. Arijj et al. assumed that this changes based on sliding could be observed concomitant with the beginning of contraction. Oedematous change of muscle could be another reason. The thickening of the masseter muscle by the clenching of teeth was also confirmed by an experimental study.

CONCLUSIONS

Duration and frequency of the habit and clinical progression of the disease were found to be directly proportional to masseter muscle thickness. Similarly, our study also showed association of masseter muscle hypertrophy with OSMF, and CT scan measurements of masseter muscle thickness was found to be statistically significant. Muscle atrophy occurs if a muscle is not used for a long interval of time which has been well documented in the literature. In our study we proved the fact that hyperactivity of the masseter muscle resulted in its hypertrophy. Also, we found that the thickness of masseter muscle was more on right side than on the left side.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

Authors thank Dr. Braja Bihari Panda, Professor, Department of Radiology, VIMSAR, Burla, for his support during the study.

REFERENCES

- [1] Srivastava R, Jyoti B, Pradhan D, et al. Proportion of oral submucous fibrosis in patients visiting dental OPD of a dental college in Kanpur. A demographic study. *Journal of Family Medicine and Primary Care* 2019;8(8):2612-2617.
- [2] Murti PR, Bhonsle RB, Gupta PC, et al. Etiology of oral submucous fibrosis with special reference to the role of arecanut chewing. *J Oral Pathol Med* 1995;24(4):145-152.
- [3] Pindborg JJ, Sirsat SM. Oral submucous fibrosis. *Oral Surg Oral Med Oral Pathol* 1966;22(6):764-779.
- [4] Das M, Manjunath C, Srivastava A, et al. Epidemiology of oral submucous fibrosis: a review. *Int J Oral Health Med Res* 2017;3(6):126-129.
- [5] Kumar S. Oral submucous fibrosis: a demographic study. *J Indian Acad Oral Med Radiol* 2016;28(2):124-128.
- [6] Chakarvarty A, Panat SR, Sangamesh NC, et al. Evaluation of masseter muscle hypertrophy in oral submucous fibrosis patient-an ultrasonographic study. *Journal of Clinical and Diagnostic Research* 2014;8(9):ZC45-ZC47.
- [7] Ko EWC, Huang CS, Chen YR, et al. Cephalometric craniofacial characteristics in patients with temporomandibular joint ankylosis. *Chang Gung Med J* 2005;28(7):456-466.
- [8] Rani S, Ravi MS. Masseter muscle thickness in different skeletal morphology: an ultrasonographic study. *Indian J Dent Res.* 2010;21(3):402-407.
- [9] Stavros K, Payam HM, Maarten CR, et al. Ultrasonographic thickness of the masseter muscle in growing individuals with unilateral crossbite. *Angle Orthod* 2007;77(4):607-611.
- [10] Auluck A, Rosin MP, Zhang L, et al. Oral submucous fibrosis-a clinically benign but potentially malignant disease: report of 3 cases and review of the literature. *J Can Dent Assoc* 2008;74(8):735-740.
- [11] Kamala KA, Rajeswari GA, Ashok L. Ultrasonic diagnosis of masseteric hypertrophy in oral submucous fibrosis: a preliminary study. *J Indian Acad Oral Med & Radiol* 2010;22(4):197-200.
- [12] Ramanathan K. Oral submucous fibrosis-an alternative hypothesis as to its causes. *Med J Malaysia* 1981;36(4):243-245.