

Masticatory muscles activity in healthy young adults

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Abstract

Objectives: Changes in activity of masticatory muscles can contribute to the development of temporomandibular disorders and myofascial pain syndrome of the head. Masticatory muscle pain, usually found over the temporalis and masseter muscles, is almost 2 times more frequent in women than in men. The aim of the study was to examine bioelectrical activity of the masticatory muscles among healthy young adults in relation to sex.

Material and methods: Forty full dentate, normo-occlusion healthy young adults (20 men, 20 women; mean age 21 ± 2 years) were included into the study. The exclusion criteria were: the presence of signs or symptoms of temporomandibular disorders based on an RDC/TMD examination, and neurological disorders. Electromyographic activity of the anterior temporalis (TA) and masseter muscle (MM) was evaluated in three conditions: during resting mandibular position, during maximum intercuspation clenching, and maximum voluntary clenching with cotton rolls between teeth. The 8-channel electromyograph BioEMG III, compatible with BioPAK Measurement System, was used for the recording.

Results: Mean resting electrical activity of the TA muscle was significantly higher ($p < 0,05$) among women (TA-R: $1,78 \mu V$; TA-L: $1,95 \mu V$) comparing to men (TA-R: $1,05 \mu V$; TA-L: $1,30 \mu V$). The differences between the two groups in relation to the mean bioelectrical activity of the MM muscles during

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resting mandibular position, and TA and MM muscles during maximum intercuspal clenching and maximum voluntary clenching with cotton rolls between teeth, were not statistically significant ($p > 0,05$).

Conclusions: The resting activity of anterior temporalis muscles is higher in women, which may be a predictor of pain and TMD within this group.

Introduction

Temporomandibular disorders (TMD) are a group of diseases including disorders of the masticatory system, temporomandibular joints and associated structures. [1] The incidence of TMD in the population is over 5%. [2] Etiology of TMD is considered multifactorial, resulting from the complex interaction between biological, psychological, social, and environmental factors. [3] In addition, the literature states that TMD signs and symptoms prevail more frequently in women than in men. [4-6] However, the possible causes of differences between the prevalence of TMD in men and women have not been fully explored and explained.

The occurrence of changes in masticatory muscles activity, observed in people diagnosed with TMD, is currently the subject of numerous research works using surface electromyography. [7] The results of current scientific reports describe an increase in resting activity of anterior temporalis (TA) and masseter muscles (MM) in people with a painful form of TMD compared to people from control groups. [8,9] The publications also show the presence of the asymmetrical activity in the TA and MM muscles in people with TMD. [10,11] In addition, a shift in the distribution of muscle activity towards the TA muscles in relation to the MM muscles, can be observed in people with TMD during electromyographic examination. [12]

However, the change of masticatory muscles activity is more often considered as a consequence of disorders and not as their cause. It is assumed that, excessive increase of masticatory muscles activity results from functional disturbances in the stomatognathic system. [13] Similarly electromyographic activity of the masticatory muscles differs according to facial type. [14] Various craniofacial morphologies can lead to differences

in neuromuscular activities, such as muscles' bioelectrical potentials. [15,16] Thus, morphological differences between women and men in the stomatognathic system may also affect the muscle activity.

Hence, we hypothesized that differences in masticatory muscles activity may be gender-related.

Aim

The aim of the study was to examine bioelectrical activity of the masticatory muscles among healthy young adults in relation to sex

Materials and methods

Ethics statement

This study was approved by the ethical committee of Medical University of Lublin, Poland (KE-0254/331/2015) and was in accordance with the Declaration of Helsinki for Human Research. All participants were informed about the procedures they would undergo and gave their informed consent to participate in the tests.

Subjects description

The study comprised forty full dentate, normo-occlusion healthy young adults (20 women, 20 men; mean age 21 ± 2 years).

Exclusion criteria: the presence of signs or symptoms of temporomandibular disorders based on an RDC/TMD examination, neurological disorders, past trauma to the jaw, pain in TMJ or masticatory muscle on palpation, presence of myofascial trigger points in the head and cervical spine muscles (trapezius, sternocleidomastoideus).

Measurement plan

The 8-channel electromyograph BioEMG III (BioResearch Associates, Inc., Milwaukee, WI, USA), compatible with BioPAK Measurement System, was used for the recording. The sample rate was 2000 Hz for each channel and the filtering is to a bandwidth from 30 Hz to 1000 Hz.

Two muscle pairs were examined: anterior temporalis (TA) and superficial masseter (MM) muscles. Electromyographic activity of the TA and MM was evaluated in three conditions: during resting mandibular position, during maximum intercuspation clenching, and during maximum voluntary clenching with cotton rolls between teeth.

The pairs of surface electrodes (Ag/AgCl) were distributed bilaterally on the TA and MM muscles in relation to the muscle fibre direction. For TA muscle, electrodes were distributed vertically along the anterior muscular margin, approximately over the coronal suture. For MM muscle, surface electrodes were placed at the intersection between the tragus-labial commissure and the exocanthion-gonion lines. The reference electrode was secured to the forehead, in compliance with SENIAM standards, as shown in Figure 1.

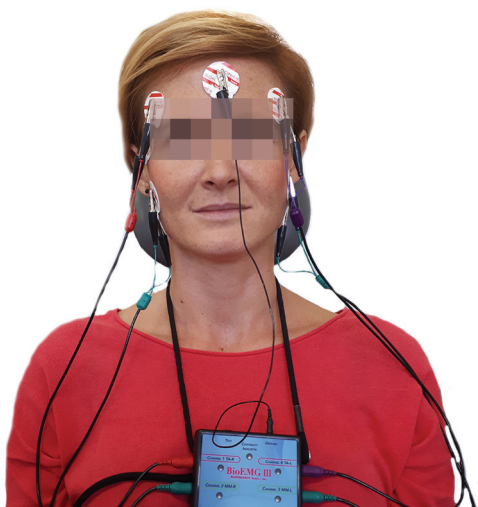


Fig. 1. Surface electrodes placement for sEMG measurement

Statistical analysis

IBM SPSS STATISTICS 21 program was used to prepare the statistical analysis. To compare the variables between the two groups (women and men) in three conditions (during resting mandibular position, during maximum intercuspation clenching, and during maximum voluntary clenching with cotton rolls between teeth), the U Mann-Whitney test was used. Differences were regarded as statistically significant if the level of probability value was lower than the statistical significance 0,05.

Results

Mean resting electrical activity of the TA muscle was significantly higher ($p < 0,05$) among women (TA-R: 1,78 μV ; TA-L: 1,95 μV) comparing to men (TA-R: 1,05 μV ; TA-L: 1,30 μV) (Table 1).

The differences between the two groups in relation to the mean bioelectrical activity of the MM muscles during resting mandibular position, and TA and MM muscles during maximum intercuspation clenching, and during maximum voluntary clenching with cotton rolls between teeth were not statistically significant ($p > 0,05$) (Table 2, 3).

Discussion

Changes in masticatory muscles activity is often observed in patients with temporomandibular disorders. Although the large and rapidly increasing number of studies have investigated the associations between the masticatory muscles activity and TMD, there are only few studies on the bioelectrical activity of the masticatory muscles among healthy young adults.

The aim of the present study was to examine bioelectrical activity of the masticatory muscles among healthy young adults in relation to sex. The results showed higher resting activity of anterior temporalis muscles among women in comparison to men. However, muscles activity differences between women and men during maximum intercuspation clenching and

Table 1.

Mean sEMG activity of temporalis anterior (TA) and masseter muscles (MM) between women and men during resting mandibular position

Muscle	Mean sEMG activity ± SD (µV)		Z	p
	Women (n=20)	Men (n=20)		
TA right	1,78 ± 0,33	1,05 ± 0,19	-5,412	0,001*
TA left	1,95 ± 0,50	1,30 ± 0,43	-3,638	0,001*
MM right	1,51 ± 0,37	1,43 ± 0,55	-1,258	0,208
MM left	1,67 ± 0,80	1,52 ± 0,57	-0,636	0,525

* significant differences (p<0,05)

Table 2.

Mean sEMG activity of temporalis anterior (TA) and masseter muscles (MM) between women and men during maximum intercuspation clenching

Muscle	Mean sEMG activity ± SD (µV)		Z	p
	Women (n=20)	Men (n=20)		
TA right	121,56 ± 75,18	109,41 ± 47,94	-0,487	0,626
TA left	131,39 ± 64,68	124,91 ± 63,51	-0,568	0,570
MM right	125,21 ± 110,01	142,64 ± 86,02	-1,055	0,291
MM left	123,05 ± 83,80	130,92 ± 70,94	-0,514	0,607

Table 3.

Mean sEMG activity of temporalis anterior (TA) and masseter muscles (MM) between women and men during maximum voluntary clenching with cotton rolls between teeth

Muscle	Mean sEMG activity ± SD (µV)		Z	p
	Women (n=20)	Men (n=20)		
TA right	114,68 ± 55,76	111,81 ± 58,94	-0,352	0,725
TA left	123,99 ± 62,14	125,27 ± 70,14	-0,108	0,914
MM right	152,24 ± 89,39	191,54 ± 129,30	-0,920	0,358
MM left	158,53 ± 98,55	177,28 ± 105,53	-0,595	0,552

during maximum voluntary clenching with cotton rolls between teeth, were not statistically significant. A study by Wieczorek et al. 2015 on young adults with and without orthodontic treatment showed that the temporalis anterior muscles were predominant in women, while the masseters were predominant in men. [17] The mentioned study put under scrutiny electromyographic measurement during maximum clenching, in comparison to our study, in which all three conditions, including resting activity, are tested. Similar results were also obtained by Ferrairo et al. 1993 and McNamara et al. 1988. [18,19] Moreover, McNamara et al. found morphological differences among stomatognathic systems between women and men, where the Sella–Nasion Subspinale Angle was larger in men almost by 2.0°, and that the gonial angle also differed between female and male populations. [19] However, due to limited number of publications which test the relationship between the morphological differences and masticatory muscles activity, further investigation should be conducted. [17]

According to our results, we hypothesize that the increased TA muscles activity in women may be associated with the frequent occurrence of TMD in this group. However, these are only suppositions that need to be confirmed in further studies in larger groups of healthy young adults. In spite of the mentioned evidences, the mechanism which leads to the increased masticatory muscles activity in women, remains still unexplained.

Conclusions

The resting activity of anterior temporalis muscles is higher in women, which may be a predictor of pain and TMD within this group. In order to confirm the above observations, it is required to continue the electromyographic studies on a larger group of healthy young adults.

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