

EMG analysis of trapezius and masticatory muscles: experimental protocol and data reproducibility

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Sforza C, Rosati R, de Menezes M, Musto F, Toma M. EMG analysis of trapezius and masticatory muscles: experimental protocol and data reproducibility. *J Oral Rehabil.* 2011;38(9):648-54.

The study from Sforza et al. brings up a very relevant aspect to Dentistry and Orofacial Motricity. The proposal aims to define a standardized protocol for evaluating the electrical activity of the trapezius muscle, and to emphasize the importance of this muscle in relation to the masticatory muscles, as well as to verify the reproducibility of this protocol in evaluation sessions.

To justify the research the authors reported that in some cases of temporomandibular disorders (TMD), besides the presence of pain in masticatory muscles, it is frequent the complaint of pain in the cervical region, due to the close relationship between the different components of the cervical craniomandibular system. They approach the important role of the sternocleidomastoid and trapezius muscles in the masticatory dynamics, and show that the simultaneous evaluation of jaw and neck muscles might improve the understanding of problems related to these muscles. They also describe the easiness to evaluate these muscles using surface electromyography, a noninvasive and low-cost method.

The authors evaluated 21 women and 19 men, healthy young adults aged between 20 and 35 years. Initially, all were evaluated by a dentist surgeon, presenting 28 teeth and Angle class I occlusion; they did not show periodontal problems or histories of orthodontic treatment, TMD, facial trauma or orthognathic surgery.

For the surface electromyography, the electromyograph Freely® (De Gotzen) was used, and the following procedures were performed:

- Use of six pairs of electrodes distributed on the left and right masseter muscles, right and left anterior temporal muscles, and left and right trapezius muscles;
- Placement of the reference electrode on the forehead of the volunteers;
- Use of the EMA software (De Gotzen) for recording and signal analysis;
- Task 1a: standardization of the signal for masticatory muscles – request for maximum voluntary contraction – clenching of the teeth with the use of cotton rolls of 10 mm thickness for five seconds;
- Task 1b: standardization of the signal for the trapezius

muscle – request for maximum voluntary contraction – shoulder elevation for five seconds;

- Task 2: capture of the electrical activity from the six muscles assessed by asking the volunteer to position his/her teeth in maximum intercuspation (MI) for five seconds. During this task, the patient was instructed to avoid head and neck movements and to remain in neutral position. The test was repeated three times;
- Analysis of the collected material considered the most constant three-second period of the electromyographic signal in *Root Mean Square* (RMS), which was automatically selected by the EMA software;
- All results were expressed as percentage of the value, based on the standardization tasks (100%);
- Establishment of electromyographic indices: index of muscular symmetry (POC) between the pairs of muscles tested (right and left), considering a total symmetry the value of 100%; rate of lateral displacement (torque), considering 0% as the presence of complete lateral displacement and 100% as absence of lateral displacement force; activity index (activation), considered positive (100%) when the potentials of the masseter muscle were higher than the potentials of the temporal muscle, and negative (-100%) when the potential of the temporal muscle were greater than the potential of the masseter muscle;
- For the trapezius muscle, they considered 100% the value of the state of maximum muscle co-contraction with the masticatory muscles during teeth clenching, and the value of 0% was considered as a state of non-concurrent co-contraction.

The Student t test was used to calculate the technical error of measurement (TEM), and the analysis of variance was used to evaluate the effect of different treatments of data collection (factor 1) and the repetition effect (factor 2).

Results showed that the minor measurement technical errors (less than 8%) were found in the POC of the masseter and temporal muscles, and at the torque and activation of the trapezius during dental clenching. The major measurement technical errors (20%) were found in the trapezius POC and in the activation of the temporal and masseter during teeth clenching. They also demonstrated that the upper trapezius fibers contracts simultaneously to the jaw elevators, on average of 10 to 12% of its maximal contraction (high shoulder) during clenching. The trapezius POC ranged between 78% and 80% (100% is the perfect symmetry).

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The authors conclude that the proposed protocol of surface electromyography for simultaneous analysis of the electrical activity of masticatory muscles and upper trapezius has reproducibility power. They emphasize that it is a method that do not require special tools, and can be used in private practices, providing a more complete assessment of the muscular condition during the activity of the stomatognathic system. They recommend that the simultaneous assessment of masticatory muscles and the sternocleidomastoid muscle should be a step for future research.

The relationship between the muscles studied by the authors is part of the discussions in the area of Orofacial Motricity. The findings scientifically support what is found

in clinical evaluations and, in particular, in patients with temporomandibular disorders. The burden of alterations in masticatory muscles on cervical muscles is a topic that instigates clinicians and researchers to further studies in understanding these relationships.

It is important to emphasize that the technology used in the study is already a reality in Brazilian laboratories and research from Brazilian speech-language pathologists. Such studies have shown the further possibilities to studying the relations between head and neck muscles at our academic centers. Concern about using these data in the clinical setting should be a challenge for our future studies.