Surface electromyography and magnetic resonance imaging of the masticatory muscles in patients with arthrogenous temporomandibular disorders

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Objective. The purpose of this study was to verify the characteristics of surface electromyography (sEMG) of masticatory muscles in patients with temporomandibular disorders (TMDs) with differing pathology.
Study Design. A total of 24 patients with TMDs were categorized according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD); magnetic resonance imaging (MRI) classified the patients as having disk displacement alone (DD) (mean age, 22 years; SD, 5; 3 men, 6 women) or having osteoarthrosis with or without disk displacement (OA) (mean age, 37 years; SD, 10; 4 men, 11 women); sEMG was performed according to a standardized protocol.
Results. The MRI score was significantly correlated to the torque coefficient ($r = 0.57$) and the temporalis ($r = 0.85$) and masseter ($r = 0.46$) muscle standardized symmetry. The discriminating ability of participant age and sEMG scores in separating the 2 groups was assessed by receiver operating characteristic analysis. Each of the sEMG scores showed a significant ability in discriminating between osteoarthrosis and disk displacement.
Conclusions. The recording of the masticatory muscle function through sEMG can be a first diagnostic approach to patients with TMDs, reserving MRI assessment to selected cases. (Oral Surg Oral Med Oral Pathol Oral Radiol 2014;118:248-256)

Temporomandibular disorders (TMDs) are among the most studied chronic orofacial pain conditions. Dworkin et al.[1,2] and Suvinen et al.[3] estimate that 7% of the general population are in need of treatment. In their systematic review, Dahlström and Carlsson[4] underline the effect of this pathology on the oral health–related quality of life (OHRQoL). The 12 studies that fulfilled the inclusion criteria of their review found a negative effect on the quality of life in patients diagnosed with a TMD. Despite the epidemiologic prevalence of TMDs in women,[5,6] no sex differences in the clinical aspects of the disease were reported. A muscular diagnosis of TMD, arthralgia, or disk displacement without reduction was associated with a more important effect on OHRQoL than was disk displacement with reduction. The studies selected in that review found that OHRQoL is influenced principally by pain and not by functional limitation of the jaw. This aspect accords with the findings reported by Greenspan et al.[7] in a large case-control study: patients with TMDs are more sensitive to many experimental noxious stimuli at extracranial body sites than are control persons.

An accurate anamnesis and a clinical examination supplemented with imaging are considered the gold standard for the diagnosis of a pathology not yet completely understood.[8-11] To establish uniform assessment criteria, in 1992 Dworkin and LeResche[2] introduced the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD). This system has 2 assessment components. Axis I, a clinical and radiographic assessment, is designed to differentiate myofascial pain, disk displacement, and arthralgia, arthritis, and arthrosis. Axis II evaluates psychologic status and pain-related disability.

Statement of Clinical Relevance

The capacity of surface electromyography z score to discriminate between patients with TMDs with different pathologies indicates surface electromyography of the masticatory muscle function and dysfunction as a first diagnostic approach to patients with TMDs. Magnetic resonance imaging assessment could be reserved for selected cases.

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Received for publication Feb 7, 2014; returned for revision May 6, 2014; accepted for publication May 7, 2014.

2212-4403/$ - see front matter
http://dx.doi.org/10.1016/j.oooo.2014.05.005

Some authors discussed the relation between RDC/TMD and image findings provided by magnetic resonance imaging (MRI). Galhardo et al.[12] reported that the use in clinical practice of RDC/TMD is limited because of the high rate of false-positive results. Robinson de Senna et al.[13] assert that the type of dysfunction and the severity of alterations on the imaging examinations were not related to the severity of pain or the mandibular range of motion assessed with RDC/TMD. In a recent review, Koh et al.[14] reported that there is no evidence of correlation between clinical findings and MRI. Park et al.[15] suggested the use of MRI when clinical examinations cannot predict the true position of the disk. Other investigators[16-18] state that the presence of skeletal changes is a sign of progression of disease, because it occurs in the joints with advanced internal derangement and it is associated with the duration of the symptoms.

MRI provides information concerning joint morphology and inflammation that cannot be discerned through clinical examination,[15] but it has major limitations because of the high operating costs. MRI requires highly qualified technical staff, long times of image acquisition, and expensive medical equipment.

Different protocols have been developed to objectively record the dysfunction present and to supplement the diagnosis of TMD, such as surface electromyography (sEMG). sEMG analyses the masticatory muscle activity through an objective and quantitative record.[3,19-22]

Tartaglia et al.[23] used the quantitative sEMG characteristics of the masticatory muscles of patients with TMDs to allow a differentiation among different diagnostic categories defined according to the RDC/TMD. In particular, it was possible to differentiate between healthy control participants and patients with impairment of arthrogenous and psychogenic origin, in whom a significant reduction in the standardized muscular activity was found. More recently, De Felício et al.[24] found significant correlations among sEMG findings, orofacial myofunctional status, and TMD severity, showing that the larger deviations from sEMG reference values were found in the patients with the worse clinical findings.

Apparently, in no previous investigations were the objective characteristics of masticatory muscles compared among subgroups of patients categorized according to the MRI interpretation. In the present study, a group of patients with TMDs were categorized according to both RDC/TMD and MRI as patients with disk displacement or those with osteoarthrosis with or without disk displacement. The quantitative sEMG characteristics of their masticatory muscles were analyzed. We wanted to see if patients in the different groups had some objective differences in the sEMG characteristics of their masticatory muscles during standardized teeth clenching. Patient data were also compared with those collected in 2 control groups without muscular or temporomandibular joint (TMJ) alterations.

MATERIALS AND METHODS

Patients

In 2010, a total of 100 patients with pain in the preauricular area, movement limitation, and joint sounds during the functional excursions of the jaw were referred to the Dental Clinic of the University of Brescia for TMJ treatment. All participants were visited by a dentist, and their clinical history was gathered according to the Research Diagnostic Criteria for TMD (RDC/TMD).[2,10] Among the patients, those who presented arthrogenous TMD according to the RDC/TMD, axis I, groups II and III, were selected to undergo bilateral high-resolution MRI scans of the TMJs and an sEMG analysis of their masticatory muscles. All patients had a long-lasting TMD (duration of symptoms longer than 6 months).[11]

Additional inclusion criteria were pain to one or both joints during mastication (greater than 4 on a visual analog scale in which 1 = no pain and 10 = the greatest possible pain), limitation during opening (maximal nonforced opening <30 mm) or during left and right excursion or protrusion (<7 mm), and at least 1 molar maxillary-mandibular contact per dental hemiarch. Exclusion criteria were the presence of congenital craniofacial anomalies, systemic disease, or both; dental pain; periodontal problems; craniofacial and cervical trauma and surgery; unilateral or bilateral posterior edentulism; and current orthodontic treatment.

According to the inclusion and exclusion criteria, 24 patients were selected (17 women and 7 men; age range, 14-60 years; mean age, 31 years; SD, 11). According to the MRI examination protocol (described later), the patients were subdivided into group A (15 patients, 11 women and 4 men; age range, 26-60 years; mean age, 37; SD, 10), patients with osteoarthrosis (Figure 1), and group B (9 patients, 6 women and 3 men; age range, 14-29 years; mean age, 22; SD, 5), patients with damage limited to the soft tissues (unilateral or bilateral disk dislocation) (Figure 2).

Group A was significantly older than group B, so we recruited 2 different control groups: a “young” control group (CB) (19 participants, 9 men and 10 women; age range, 20-35 years; mean age, 23 years; SD, 2) and an “old” control group (CA) (19 participants, 5 men and 14 women; age range, 26-71 years; mean age, 37 years; SD, 12). All control participants were submitted to clinical evaluation according to the RDC/TMD and to sEMG examination. They were all healthy, with no