An assessment of the usefulness of jaw kinesiography in monitoring temporomandibular disorders

Correlation of treatment–related kinesiographic and pain changes in patients receiving temporomandibular joint injections

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Temporomandibular joint (TMJ) disorders are characterized by a classic triad of signs and symptoms: pain, joint sounds and functional limitation.[1] Their treatment usually is directed toward the achievement of symptom management and pain relief by means of conservative approaches.[2] Because the assessment of pain is a fundamental step in the diagnostic process as well as a target for therapy, treatment outcome measures should be based on monitoring pain symptoms.[3] According to this premise, all instrumental approaches to the diagnosis and monitoring of TMJ disorders should prove to be reliable for discriminating between patients with and without pain as well as for detecting changes in pain levels across time.

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ABSTRACT

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Background. The authors conducted a study in patients with temporomandibular joint (TMJ) osteoarthritis to assess whether treatment-related changes in pain levels and chewing ability coincide with a change in jaw kinesiographic (KG) parameters.

Methods. The authors selected 34 patients with a diagnosis of TMJ osteoarthritis that met Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) to undergo a cycle of five weekly arthrocentesis procedures with injections of 1 milliliter hyaluronic acid. They performed a permutation test to assess the correlation between changes across time (from baseline to end of treatment) in two clinical outcome parameters—pain level and chewing ability—and changes across time in the KG outcome parameters.

Results. The authors observed improvement across time in both chewing ability ($F = 8.328$; $P = .005$) and pain level ($F = 10.903$; $P = .002$). The authors observed no significant changes in any KG variables. With minor exceptions, no significant correlations were shown between changes in the clinical and KG parameters during the treatment period.

Conclusions. Treatment-related changes in pain levels and chewing ability in patients with TMJ osteoarthritis do not coincide with changes in KG parameters.

Practical Implications. If one assumes pain variables to be the primary outcome measures in assessing treatment of TMJ osteoarthritis, KG recordings of the jaw are not useful for monitoring TMJ osteoarthritis in the clinical setting.

Key Words. Temporomandibular disorders; kinesiography; temporomandibular joint arthrocentesis; hyaluronic acid; pain.
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Through the years, several technological devices have been proposed as diagnostic tools or instruments to measure treatment effectiveness.[4-6] Among these, jaw-tracking devices for kinesiographic (KG) recordings of jaw movements were intended to provide an objective evaluation of mandibular motion,[7] and their adoption was recommended by panels of trained users as an approach to detect dysfunction of the stomatognathic system.[8] Notwithstanding that, the devices' diagnostic accuracy for temporomandibular disorders (TMD) never has been proven to be good.[9] Recent investigations involving commercially available devices suggested that a combination of surface electromyography (EMG) and KG assessment does not reliably detect pain in the jaw muscles[10] and that KG recordings lack acceptable reliability in identifying patterns of jaw movements in relation to the TMJ status.[11] Another potential use for such techniques is at the intraindividual level to monitor treatment effects. Thus, it should be interesting to evaluate the correlation of treatment-related pain changes with modifications in KG parameters.

Does a treatment-related change in pain level and chewing ability coincide with a change in any kinesiographic parameters?

We conducted a study in patients with TMJ osteoarthritis who were receiving a treatment protocol involving a cycle of five weekly arthrocenteses plus hyaluronic acid injections for pain relief and improved subjective chewing ability (as suggested in previous research findings[12-14]). Participants underwent KG recordings of jaw movements at baseline and at the end of the treatment. Our working hypothesis was that the protocol involving injection of an osteoarthritic joint would produce changes in clinical parameters (that is, pain level and chewing ability) related to changes in the KG parameters of mouth opening and jaw-movement speed. Specifically, we designed the study protocol to answer the following clinical research question: does a treatment-related change in pain level and chewing ability coincide with a change in any KG parameters?

METHODS

Study design. The study participants were 34 patients (94 percent female, mean age 55.7 years, range 39-76 years) who had monolateral TMJ osteoarthritis, as diagnosed according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD Axis I Group IIIb),[15] in the absence of rheumatic diseases. All were patients at the TMD Clinic, Department of Maxillofacial Surgery, University of Padova, Italy. To meet the RDC/TMD criteria for osteoarthritis, participants needed to have the following symptoms:

- arthralgia (TMJ pain on lateral or posterior palpation or both, as well as anamnestical reporting of TMJ pain during maximum voluntary mouth opening, maximum assisted mouth opening, lateral excursions or a combination of these);
- crepitus sounds;
- radiological signs of TMJ bone structure abnormalities (such as erosions, sclerosis, flattening, osteophytes).

As for radiological signs, Dworkin and LeResche's[15] 1992 publication of the RDC/TMD diagnostic criteria allowed only plain tomography and panoramic radiographs to support the clinical diagnosis of osteoarthritis. In our investigation, plain radiographs already were available for some participants at the time of the first assessment. In some other participants, we obtained cone-beam computed tomographic scans to integrate the clinical diagnosis, despite this technique's obviously not being available at the time of the RDC/TMD guidelines' initial publication.[15] All participants had a history of pain lasting for more than six months that either was not improving or was improving only minimally with conservative physiotherapy or oral appliance therapy provided by their practitioners. The presence of jaw muscle pain was not an exclusion criterion, provided that it was not the main source of patients' complaints.

The treatment protocol involved a cycle of five arthrocentesis procedures, one per week for five weeks, each accompanied by an injection of 1 milliliter of hyaluronic acid (Sinovial, IBSA Farmaceutici Italia, Lodi, Italy) according to the technique described by Guarda-Nardini and colleagues.[12] All interventions were performed by two trained operators with experience in the procedure (D.M., L.G.-N.). All participants gave written informed consent to the treatment received before taking part in the study. The operators performed both a clinical and a jaw KG assessment at baseline and at the end of the

ABBREVIATION KEY. EMG: Electromyography. **KG:** Kinesiography/Kinesiographic. **RDC/TMD:** Research Diagnostic Criteria for Temporomandibular Disorders. **TMD:** Temporomandibular disorder. **TMJ:** Temporomandibular joint.