



# Can clinical factors predict postoperative temporomandibular disorders in orthognathic patients?

## A retrospective study of 219 patients

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**Objective.** To determine the predictive value of preoperative clinical factors for postoperative temporomandibular disorders (TMDs) in patients receiving combined surgical–orthodontic treatment.

**Study Design.** TMDs were classified according to Research Diagnostic Criteria for TMD in 219 patients. The severity of the TMD was scored according to the Helkimo anamnestic index (Ai) and clinical dysfunction index (Di).

**Results.** Anamnestic TMJ clicking was the only significant predictor of TMD (odds ratio [OR] = 3.61,  $P = .006$ ). The mean difference between clinical dysfunction index points was significant for pain on masticatory muscle palpation.

**Conclusion.** This study demonstrated that in orthognathic patients, the following factors had high predictive value: (1) anamnestic TMJ clicking for TMD, (2) TMJ clicking, TMJ pain on palpation and bimaxillary surgery for Ai worsening, (3) maxillary retrusion and mandibular excess for Ai improvement, and (4) pain on masticatory muscle palpation for Di worsening. (*Oral Surg Oral Med Oral Pathol Oral Radiol* 2015;119:531-538)

According to Laskin, who was the first scientist to separate temporomandibular disorders (TMDs) into two main groups—muscle and intra-articular disorders—“...the time has come to eliminate TMD from our vocabulary.”<sup>1</sup> Even so, the term *temporomandibular disorder* (TMD) continues to be used most often in the literature to define dysfunction of the masticatory system. TMDs are common and account for pain and dysfunction in patients worldwide, with a prevalence rate between 5% and 30%.<sup>2</sup> TMDs classically encompass joint and muscular problems.<sup>1-4</sup> Temporomandibular joint (TMJ) problems include several diagnostic subcategories, such as congenital and developmental disorders, traumatic injuries, ankylosis, arthritis, neoplasia, and disk displacement. Problems involving the masticatory muscles include myositis, myofascial pain, myospasm, hyperkinesia, hypokinesia, contracture, and fibromyalgia. Disk displacement and myofascial pain dysfunction (MPD), isolated or combined, are, by far, the most commonly encountered TMD.<sup>1-3</sup>

The etiology of TMD is considered multifactorial, but malocclusion is still routinely pointed out as a substantial factor initiating the pathogenesis of TMD.<sup>5-11</sup>

Although repetitive occlusal microtraumas have been related to the development of TMJ intra-articular disorders, fundamentally, the exact role played by the malocclusion is still obscure and speculative. Some studies have reported the prevalence of TMD in patients with severe malocclusion associated with particular dentofacial deformities (mandibular protrusion, mandibular retrusion associated with a deep-bite or an open bite) is higher than in the general population.<sup>5-12</sup> On the therapeutic side, controversy also exists about the actual positive or negative cause-and-effect relationships between TMD and orthodontic treatment alone versus combined surgical–orthodontic treatment in the management of malocclusion. Although some reports have shown a positive effect of these treatments on pre-existing TMDs, others support the opposite effect with a worsening of TMD-related symptoms.<sup>10,11</sup>

Studies have been mainly focused on the prevalence of TMD in orthognathic or orthodontics patients, the possible association between TMD and the type and severity of dentofacial deformity, and the possible beneficial or detrimental effects of orthognathic treatment on the functional status of the TMJ.

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### Statement of Clinical Relevance

Our findings showed that anamnestic temporomandibular joint (TMJ) clicking acts as an independent predictor of developing temporomandibular disorders after surgery. Anamnestic TMJ clicking and pain on palpation of the TMJ and masticatory muscles are associated with an increased severity of postoperative TMJ anamnestic dysfunction.

Thus far, to our knowledge, no studies have been published reporting on the possible clinical predictors for TMD in patients receiving combined orthodontic–orthognathic treatment.

Thus, the purpose of the present study was to determine the predictive value of clinical factors for postoperative TMDs as well as for TMD severity in patients undergoing combined orthodontic–orthognathic treatment.

## MATERIALS AND METHODS

The procedure followed in this retrospective study was in accordance with the Helsinki Declaration of 1975, as revised in 2000, and was approved by our local ethical board.

### Study design

To address the research purpose, the investigators designed and implemented a retrospective cohort study. The study population was composed of 219 patients with dentofacial deformities treated by a combined surgical–orthodontic approach at the Hôpitaux Universitaires de Genève, Switzerland, between 1998 and 2012.

Patients were excluded from the study if they had a previous history of facial surgery, trauma, treatment for TMDs, and genioplasty alone. The variables reviewed included age and gender, type of dentofacial deformity, surgical procedure, and TMJ and masticatory muscle examination. TMJ and masticatory muscle examination included (1) a *yes/no anamnestic questionnaire* to assess the following symptoms and signs: (a) pain in the TMJ; (b) pain in the masticatory muscles; (c) pain on mandibular movements; (d) hearing sounds from TMJ joints; (d) feeling fatigue, stiffness upon awakening and on mandibular movements, or both; (e) difficulty opening the mouth wide or yawning; (f) TMJ locking, luxation, or both; and (g) parafunctional habits (bruxism or clenching); and (2) a *clinical examination* that included (a) *intraoral examination*: Angle classification of malocclusion, overjet, overbite, maximal interincisal opening, maximal lateral and protrusive movements, deviation and pain at the mouth opening and palpation of the masticatory muscles; and (b) *extraoral examination*: TMJ palpation to determine the presence of pain at rest and at opening of the mouth, as well as the presence and the type of articular sounds (clicking or crepitus) and palpation of the masticatory muscles to determine the presence of pain. The details of the clinical examination are summarized in [Table I](#). Anamnestic and clinical data from the preoperative and 1-year postoperative examinations were evaluated and used to calculate the Helkimo indices (*anamnestic index* [ $A_i$ ] and *clinical dysfunction index* [ $D_i$ ]) to score

**Table I.** Characteristics of patients (n = 219) included in the study

Variable	Category	n (%)
Gender	Male	96 (43.8)
	Female	123 (56.2)
Dentofacial deformity	Facial asymmetry	13 (5.9)
	Open bite	42 (19.2)
	Mandibular excess	51 (23.3)
	Mandibular deficiency	76 (34.7)
	Maxillary retrusion	37 (16.9)
Surgical procedure	Le Fort I osteotomy	44 (20.2)
	Bilateral sagittal split osteotomy (BSSO)	51 (23.4)
	Le Fort I and BSSO	124 (56.6)

the severity of the TMD.<sup>13</sup> TMDs were classified according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) as follows: (1) *MPD*: (a) Myofascial pain, (b) myofascial pain with limited opening ( $\leq 40$  mm); (2) *disk displacements (DD)*: (a) disk displacement with reduction, (b) disk displacement without reduction, with limited opening ( $\leq 35$  mm); and (3) *arthralgia*. The number of patients presenting with the diagnosis of arthralgia was too limited to reach a statistical power allowing significant results; thus, we decided to exclude this diagnostic group as a parametric variable.<sup>14</sup>

With regard to the surgical procedures, the repositioning of the maxilla was performed either through conventional one-piece Le Fort I osteotomy or through a two- or three-piece maxillary osteotomy. The repositioning of the mandible was performed by bilateral sagittal split osteotomy of the mandible (BSSO) by using the Hunsuck/Epker-type procedure, with the placement of two bicortical positioning screws for osteosynthesis. None of the patients had an adjunctive postoperative maxillomandibular fixation. The exhaustive criteria for each disorder are detailed within the original report.<sup>14</sup>

### Statistical analysis

Data were analyzed by using R 3.1.1 statistical software (R Development Core Team, Vienna, Austria). Outcomes (*postoperative TMD development or worsening and TMD severity indices*) and patient characteristics (*age and gender, as well as dentofacial deformity and surgical procedure*) were described by counts and percentages. Pre- and 1-year postoperative anamnestic and clinical TMD signs and symptoms were assessed by using a McNemar test or exact McNemar tests if less than five patients were positive. For continuous variables (e.g., Helkimo indices, maximal mouth opening, maximal protrusion, and maximal lateral movements), paired *t* tests were used to compare scores before and

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