

EXAMINATION OF TEMPOROMANDIBULAR DISORDERS IN THE ORTHODONTIC PATIENT: A CLINICAL GUIDE

Ana Cláudia de Castro Ferreira CONTI¹, Paula Vanessa Pedron OLTRAMARI¹,
Ricardo de Lima NAVARRO^{1,2}, Márcio Rodrigues de ALMEIDA¹

1- DDS, MSc, PhD, Assistant Professor of Orthodontics, UNINGÁ Dental School, Maringá, PR, Brazil.

2- DDS, MSc, PhD, Assistant Professor of Oral and Maxillofacial Surgery, UNINGÁ Dental School, Maringá, PR, Brazil.

Corresponding address: Ana Cláudia de Castro Ferreira Conti - Rua Renato Tâmbara, 2-147 - Res. Samambaia, Cep.: 17018-100, Bauru-SP - phone/fax: +55 14 3223-5217 - e-mail: accfconti@uol.com.br

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ABSTRACT

The possible association between orthodontic treatment and temporomandibular disorders (TMD) is a topic of great interest in the current literature. The true role of orthodontic therapy on the etiology of TMD, however, is still uncertain. From the clinical prospective, a thorough examination of the stomatognathic system is always necessary in order to detect possible TMD signs and symptoms prior to the beginning of the orthodontic therapy. Caution should be exercised when planning, performing and finalizing orthodontics, especially in patients who with history of signs and symptoms of TMD. The clinician must always eliminate patient's pain and dysfunction before initiating any type of orthodontic mechanics. Muscle incoordination, unstable disc-condyle relationship and bone alterations are usual TMD conditions that can interfere with the presenting occlusal relationship. This article reviews these aspects and presents a detailed clinical guide for the examination of the orthodontic patient, considering aspects related to facial pain and dysfunction.

Uniterms: Temporomandibular joint disorders; Orthodontics; Orthopedics; Dental occlusion.

INTRODUCTION

The possible relationship between orthodontic treatment and temporomandibular disorders (TMD) is frequently subject of discussion between clinicians and issue of different studies in the last decades^{1,3,5,10,14,16,20-23}. Despite these studies, many doubts concerning the real participation of orthodontic treatment in the etiology of TMD still remain unsolved. A thorough clinical interview and physical examination to detect TMD signs and symptoms prior to the establishment of the orthodontic therapy is mandatory. Even considering that orthodontic treatment does not cause TMD signs and symptoms²⁷, caution should be exercised when planning, performing and finalizing orthodontics, especially in patients with a past history of signs and symptoms of TMD.

ORTHODONTIC TREATMENT AND TMD

Orthodontic therapy as a possible TMD etiologic factor has been a subject of discussion, especially after a lawsuit, in which orthodontic treatment was considered the main cause of pain³⁵. Thereafter, many studies in this field have been developed based on scientific data^{1,14,18}.

Some authors have speculated that the deleterious effects of orthodontic mechanics in the stomatognathic system

would be due to occlusal interferences or even to a new occlusal design, achieved after orthodontic therapy. Premolar extractions and incisor retraction, causing posterior displacement of the condyle and consequent overload to pain-sensitive areas used to be considered TMD-contributing factors as well^{9,25,28,42}. This alteration in the condyle position would cause intra-capsular problems and joint pain. These statements, however, have been based merely on clinical experience and reports of personal points of view. Most scientific, evidence-based studies do not confirm these assumptions^{5,13,19}.

Orthodontics and TMD

The role of functional and morphological malocclusion as a TMD-contributing factor has been widely discussed. The first report correlating occlusal factors and TMD symptoms is attributed to Costen⁷ in the 1930's. Since that time, different types of therapies involving orthodontic/orthopedic treatment as well as occlusal adjustment have been proposed to correct malocclusion and improve TMD signs and symptoms⁸.

According to these theories, functional and morphological malocclusions cause TMD, and the achievement of an ideal occlusion through orthodontics or occlusal adjustment must eliminate pain and dysfunction.

However, available longitudinal studies and well-designed statistical tests have shown that patients submitted to irreversible treatment frequently present relapse of TMD problems. Based on that, investigations concerning the role of occlusal and skeletal factors as contributors to TMD onset have been carried out.

Sadowsky and Begole³⁸ (1980) reported that no relationship should be expected from orthodontic treatment and risks to develop TMD signs and symptoms. In a similar study, Conti, et al.⁵ (2003), evaluated the influence of orthodontic treatment on TMD etiology, comparing treated and untreated patients with malocclusion. Severe TMD was not found in the surveyed population, and no association between TMD severity and the type of orthodontic therapy was detected. The authors concluded that occlusion is considered a secondary factor in TMD etiology, which has a multifactorial aspect. Yet, TMD incidence was very similar in treated and untreated patients. It was also reported that orthodontic treatment has no relationship with TMD signs and symptoms when considering a successful orthodontic treatment. As orthodontics cannot cause TMD it also cannot be indicated to treat TMD.

According to McNamara²⁶ (1997), the relationship between orthodontic treatment and TMD can be summarized in few topics:

- 1) TMD signs and symptoms may exist in healthy individuals;
- 2) TMD may develop during orthodontic treatment, but it does not cause TMD;
- 3) Orthodontic treatment performed during adolescence does not alter TMD risks;
- 4) There is no evidence that orthodontic mechanics can predispose the subject to a higher risk for TMD;
- 5) Even though the accomplishment of a stable occlusion is one of the orthodontic goals, TMD cannot be attributed to the failure in achieving this aim;
- 6) There is little evidence that orthodontic treatment can prevent TMD.

Orthopedics and TMD

Orthopedic treatment was first considered an etiologic factor of TMD because condyle position can be affected when mandibular protrusion is assumed with the use of orthopedic appliances. This type of therapy is worldwide used for correction of Class II in patients with mandibular deficiency.

Several studies^{30,31,41} have been conducted to evaluate TMD risks caused by the alterations in condyle position. Pancherz³² (1985) reported an increase in muscular sensitivity in patients treated with mandibular repositioning appliances in the first 3 months. After 12 months these symptoms disappeared, which was explained based on the great level of TMJ adaptation. This finding is corroborated by Sfondrini, et al.³⁹ (1996), who found an increase in muscle fibers resistant to fatigue and a decrease in muscle fibers sensitive to fatigue.

When considering condyle position, studies based on MRI findings before and after orthopedic treatment^{33,34,36,37}

have demonstrated a tendency of condyle to return to its original position after the treatment is completed. It is worth mentioning that those reports do not consider the absence of condyle concentricity as a condition for joint health.

Even though anterior condyle position was partially maintained after orthopedic treatment with Herbst or Bionator appliances, this advanced mandibular position could improve joint pain in symptomatic subjects. This fact is due to the partial time repositioning appliances for these patients, which induce a retrodiscal adaptation, and an improvement of TMJ pain⁶.

To effectively deal with orthodontic patients, the professional should have a comprehensive knowledge of TMD, which would improve the quality of the treatment. Even considering that orthodontic treatment does not represent a great risk to develop TMD signs and symptoms, there is also no evidence that orthodontic treatment prevents TMD. Based on this, it is mandatory that the clinician performs a thorough examination before initiating any sort of rehabilitation treatment, such as orthodontic therapy.

Patient examination

For most patients, the examination process includes a detailed clinical interview and a comprehensive physical inspection. Temporomandibular joint (TMJ) imaging and additional tests (as serology and electromyography) are necessary only for very few specific cases. It has been stated that approximately 70% of the diagnostic process is based on the history review³. Physical examination must include investigation of the mandibular active range of motion (AROM), standardized TMJ and masticatory and cervical muscle palpation, as well as inspection of articular joint sounds. In case of any abnormality, the orthodontist should refer the patient to a TMD specialist to perform TMD management prior to the starting the orthodontic therapy.

The clinical interview of the TMD patient should be well documented and must contain questions regarding the onset of the problem, previous diagnosis and performed treatment^{2,24,29}.

Anamnesis

The following information should be part of a comprehensive history: chief complaints, history of present illness, past medical and dental history, review of the systems (systemic conditions that can enhance or cause the pain sensation) and psychosocial history.

History review is the most important part of the examination process. The first question to be done is about the chief complaint, which is the main reason that made the patient seek help. This information is of great importance because even if the patient has many complaints, the attenuation or resolution of the main problem may improve the general status and quality of life^{2,24,29}.

Each complaint should be listed separately in order of importance to the patient, and shall contain information about:

- Onset: it relates to when the patient first noticed the symptoms and is important in order to define for how long

the patient has been sick. This information is useful to determine whether the patient has an acute or chronic condition, which is crucial for the establishment of a proper therapy.

- Location: the patient should be oriented to indicate with only one finger the exact site of his/her pain. The intracapsular pain is well pointed by the patient, but muscle pain is diffuse and difficult to be localized. The detection of the pain source is decisive for the success of the treatment. It is important to note that the site of pain can be different from the source of pain (ectopic pain), as in the myofascial pain syndromes.

- Intensity: Intensity of pain is a difficult parameter to quantify. The visual analogue scale (VAS) is a simple and reliable method that is extensively used in clinical practice and research to measure pain intensity. It is a visual representation of relative pain intensity consisting of a 10-cm horizontal line with “no pain” at one end and “worst pain ever” at the opposite end. By simply placing a mark along this line, the patient is able to display his/her relative pain intensity.

- Frequency: it is known as its temporal behavior. The patient is asked whether the pain is constant or paroxysmal, which means that it comes in periods of attacks. Constant pain will obviously require an immediate care. When pain is of musculoskeletal origin and manifests only during activities such as chewing and speaking, the treatment normally assumes a non-invasive approach. Pain that comes in quick attacks and lasts for seconds is usually related to either trigeminal or glossopharyngeal neuralgia.

- Quality: Patients are often not able to determine exactly the quality of pain they are suffering. TMD pain is normally described as deep, dull and sometimes aching (throbbing), like in the inflammatory acute processes of the joints. Burning or shock-like pain is probably from neuropathic origin. Headache reports are associated with migraine or other primary headache disorders.

- History of the chief complaints: it is valuable to detect possible aggravating factors to the pain and to obtain more information about the patient's chief complaints. Musculoskeletal pain is aggravated when using masticatory system structures and also by emotional stress. Avoiding these activities or using antiinflammatory or analgesic medications may alleviate patient symptoms. Vascular or neurogenic pain is usually not affected by masticatory function. The orthodontist should also ask patients about previous treatment modalities, traumatic events and mode of pain onset.

- Current and past medications: If the patient is taking any medication, it must be reported because some conditions can be associated with drug side effects. Additionally, drugs that will be possibly prescribed can interact with those that the patient is already taking. Questions regarding allergies are also very important.

- Medical and surgical history: Questions related to general health conditions must be answered by the patient. Some systemic pathologies, such as fibromyalgia and osteoarthritis, among others, can cause generalized pain

and dysfunction.

- Family history: The patient should report if some relative presents the same conditions because some disorders are genetically predisposed. Migraine, for instance, is a primary headache related to family inheritance.

- Dental history: many patients associate the onset of the painful sensation with a procedure performed by a dentist. Patients very often report the onset of pain after long dental treatment appointments, such as root canal therapy and third molar extractions.

- Presence of parafunctional habits: The patient should be asked about the presence of any parafunctional activity. The habits most frequently found in TMD patients are clenching and grinding. Nail biting and poor posture due to occupational activities should also be recorded.

Physical examination

At this point, the clinician should have a reasonable idea of the nature of patient's problem. A comprehensive physical examination will help to determine the source of pain as well as the severity of the dysfunction. This part of assessment includes TMJ evaluation (joint range of motion, inspection of joint sounds and pain on palpation), and muscle palpation. Additional diagnostic tests can be necessary for some patients. Dental and occlusal evaluations are also performed^{2,4,29}.

I- TMJ evaluation

TMJ clinical inspection is often based on joint range of motion, pain on palpation and presence of joint sounds during mandibular and opening movement.

TMJ range of motion: some chief complaints include limitation of opening and difficulties in mandibular movement. The patient is requested to fully open the mouth and the sum of interincisal distance and overbite, measured with a millimeter rule is documented (Figure 1). The normal values to maximum opening range from 45 to 55 mm¹¹, although smaller figures are frequently found in asymptomatic individuals. The mandibular opening and closing movements may be accomplished in a straight line, to assess deviation or deflection. Measurements of protrusion, lateral right and left movements must also be performed. For these measurements it is recommended the demarcation of two reference points, on the maxilla and mandible, close to the midline. These reference points will assist the measurements of the range of motion during mandibular excursion (Figure 1).

- Detection of joint sounds: The presence of joint sounds during mouth opening and mandibular excursion can be useful in the diagnosis of disc-condyle incoordination. It is believed that the clinical registration by means of manual inspection or by using a stethoscope is very reliable in the detection of articular sounds¹¹ (Figure 2). Clicking, crepitation and terminal thud (related to hypertranslation) are the most common sounds in TMD patients.

- TMJ palpation: Tenderness to palpation is considered one of the most important signs in the detection of intracapsular pathologies. During repeated opening and

closing movements the clinician should locate the lateral pole of mandibular condyle. After that, with the patient maintaining the mouth in a relaxed position, TMJ bilateral and simultaneous palpation of the lateral aspect of the joint should be done. This palpation should be performed with pressure of 1 kgf in the lateral and posterior aspects of the joints (Figure 3). Reports of pain can lead to diagnosis of capsulitis and/or sinovitis. In order to graduate the patient's response to palpation, score ranging from 0 to 3 can be used: 0 - absence of pain on palpation; 1 - mild pain; 2 - moderate pain; 3 - severe pain, palpebral reflex or "jump sign"^{2,12}.

II- Muscle palpation

Muscle palpation is a very important step in the diagnosis of TMD and myofascial pain syndromes. By means of mechanical stimuli caused by digital pressure, nociceptive neurons located in the muscular and myofascial structures are stimulated to detect and transmit pain messages to the central nerve system. The graduation of patient's response to palpation allows evaluating the severity of pain and is used to measure the efficacy of a given treatment modality in follow-up visits. Palpation should be performed with a pressure of 1.5 Kg, which is strong enough to elicit pain message in symptomatic patients, and mild enough to not cause pain in asymptomatic control subjects^{2,15,40}.

Palpation should be done bilaterally, in a relaxed position, with the tip of the finger or by pincer palpation, when no underline bone support is present. Yet, during the examination, the patient should be seated facing the orthodontist in such a way that the clinician can observe the patient's reactions.

The three portions of the temporalis (posterior, medial and anterior) (Figure 4), superficial and deep masseter (Figure 5), as well as the insertion of the medial pterygoid muscle should be examined. The sternocleidomastoid, superior trapezius and suboccipital are important cervical muscles to be also considered in this evaluation.

Muscle palpation is also scored 0 to 3, according to the patient's response³⁴. The detection of trigger points in the myofascial structures is done during the examination. When the patient presents severe pain, this spot is continuously pressed from 8 to 10 seconds in order to stimulate referred pain. When referred pain zones are reproduced, a diagnosis of myofascial pain is done, which requires specific management modalities.

III- Dental and occlusal evaluation

Dental examination

Dental and periodontal conditions, such as defective restorations, missing teeth or periodontal problems that could contribute to pain onset should be detected at this moment. Most orofacial pain conditions has a dental origin¹⁷. The presence of incisal or occlusal dental attrition is also an indicator of possible parafunctional habits.

Occlusal examination

The presence or absence of lateral and anterior guides (Figure 6) is recorded as the overbite and overjet. In this evaluation, the patient is asked to perform lateral mandibular movements in order to detect occlusal interferences in the non-working side, using a cellophane paper. The discrepancies between centric relation and intercuspal position are also registered by means of the mental pressure technique. When large discrepancies are detected or the results are uncertain, an articulator mounting can be indicated².

IV – Additional Diagnostic Tests²

In case some doubt still persists, additional tests can help defining a diagnostic impression. Functional muscle manipulation, TMJ overloading, cryotherapy and diagnostic nerve blockage are useful for this purpose.

V- TMJ imaging assessment

The real need and validity of TMJ images in the diagnosis of TMD is controversial, despite all technological apparatus available in present days. Joint imaging should be indicated based on the dentist's good sense, but diagnosis and treatment techniques are still mainly elaborated based on clinical examination²⁴.

The general rule is that imaging exams are necessary when they might, somehow, change an initially established management strategy. The overestimation of image findings, followed by unnecessary irreversible treatment is a potential problem, especially for non-experienced clinicians.

Panorex is helpful only to rule out dental and bone pathologies, with no validity on the diagnosis of TMJ position or anatomical form. Transcranial, lateral images and computed tomography can detect bone changes, condyle degeneration, mobility and fractures. Magnetic resonance image (MRI), on the other hand, is able to detect TMJ disc position and the presence of inflammatory processes.

Again, the detection of small abnormalities in TMJ images is highly prevalent in asymptomatic individuals and does not mean that a treatment is mandatory. Flattening of the condyle in older subjects is an example of this statement.

CONCLUSION

The available evidence-based data demonstrate that orthodontic treatment has little to do with TMD signs and symptoms. Some conditions, such as muscle incoordination, unstable disc-condyle relationship and bone alterations can interfere with the occlusal relationship and interfere with orthodontic analysis. A non-invasive approach and reversible treatment of the TMD conditions are mandatory for all patients before the orthodontic therapy starts. In case of relapse of symptoms during the course of orthodontics, the patient should be reexamined and, if necessary, mechanics should be discontinued until the improvement of TMD signs and symptoms.



FIGURE 1- Measurement of maximum active opening and maximum lateral movement



FIGURE 2- Joint sound inspection with a stethoscope



FIGURE 3- Palpation of TMJ's lateral and posterior aspects

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FIGURE 4- Palpation of anterior and posterior temporalis muscle



FIGURE 5- Palpation of the superficial and deep masseter muscle



FIGURE 6- Anterior and lateral guide assessment

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