

# ALTERED MANDIBULAR DYNAMICS BETWEEN BRUXISM AND TEMPOROMANDIBULAR JOINT DYSFUNCTION

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Received 23 May 2019, Accepted 29 July 2019

<https://doi.org/10.31688/ABMU.2019.54.3.12>

## ABSTRACT

**Introduction.** The face and its associated structures (cranial, oral, dental) form one of the most complex areas of the human body, hence the diversity of the anatomical and functional pathologies at this level. Sometimes, the approach from the perspective of only one medical specialization may lead to symptomatology improvement or even remittance, but there are many situations when relapse occurs over time; the effect was treated, but not the cause in its totality. Proper diagnosis, selection and implementation of the most appropriate therapeutic approach require the involvement and collaboration of a multidisciplinary team.

**The objective of the study** was to highlight the advantage of combining manual therapy and myofunctional therapy, along with general relaxation, in patients with a mandible opening limitation in order to regain the harmony of the neuromuscular control and temporomandibular arthrokinematics.

**Material and methods.** 46 patients were divided into 3 groups: group 1 benefited from manual therapy alone, group 2 only myofunctional therapy; group 3, manual therapy together with myofunctional therapy.

**Results.** The data confirm the increased efficacy of the combined therapy used with group 3 compared to the groups where only one type of therapy was applied.

## RÉSUMÉ

**Dynamique mandibulaire modifiée entre bruxisme et dysfonction de l'articulation temporo-mandibulaire**

**Introduction.** Le visage et ses structures associées (crâniennes, orales, dentaires) représentent l'une des régions les plus complexes du corps humain, complexité qui détermine la diversité des pathologies à ce niveau. Parfois, l'approche du point de vue d'une spécialisation médicale peut améliorer la symptomatologie, où même engendrer la rémission, mais il y a aussi de nombreuses situations où, après une période de temps variable, une rechute se produit, précisément parce que c'est l'effet qui a été traité, pas la cause dans sa totalité. Un diagnostic correct, la sélection et la mise en œuvre de l'approche thérapeutique la plus appropriée nécessitent l'implication et la collaboration d'une équipe multidisciplinaire.

**Objectifs.** Démontrer que la combinaison de la thérapie manuelle avec la thérapie myo-fonctionnelle bucco-faciale, associées aussi à la relaxation générale, est la meilleure méthode par laquelle le patient atteint de limitation d'ouverture mandibulaire parvient à retrouver l'harmonie du contrôle neuromusculaire et de l'arthrocinétique temporo-mandibulaire.

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Therefore, it is confirmed the importance of involving the multidisciplinary team in addressing the patient with temporomandibular joint dysfunctions.

**Conclusions.** The short- and medium-term outcomes of combined therapy demonstrate the reduction of symptoms without recurrence, an improvement in dental functioning and, as a consequence, an increase in the quality of life of this patient population.

**Keywords:** temporomandibular joint, limited mandible opening, bruxism, myofunctional therapy, pain.

**Abbreviations.** TMJ - temporomandibular joint, TMD - temporomandibular dysfunction, OMT - orofacial myofunctional therapy, MT - manual therapy.

**Méthodes.** 46 patients partagés en trois groupes : le premier groupe : a reçu de la thérapie manuelle, le deuxième groupe a bénéficié d'une thérapie myo-fonctionnelle bucco-faciale et le troisième groupe a reçu une thérapie manuelle, en même temps qu'une thérapie myo-fonctionnelle bucco-faciale.

**Résultats.** Les données confirment l'efficacité accrue de la thérapie d'association (manuel et myo-fonctionnelle bucco-faciale) utilisée avec le troisième groupe par rapport aux groupes dans lesquels un seul type de thérapie (manuel ou myo-fonctionnelle bucco-faciale) a été appliqué. Par conséquent, il est confirmé, même sur un nombre réduit de lots, l'importance de faire participer l'équipe multidisciplinaire au traitement des patients atteints de dysfonctions de l'articulation temporo-mandibulaire.

**Conclusions.** Les résultats, à court et à moyen terme, obtenus après la thérapie d'association, démontrent une réduction de symptômes jusqu'à leur disparition, sans récurrence, une amélioration du fonctionnement au niveau du système stomatognathique et, par conséquent, une augmentation de la qualité de vie de cette catégorie de patients.

**Mots-clés:** articulation temporo-mandibulaire, ouverture mandibulaire limitée, bruxisme, thérapie myo-fonctionnelle bucco-faciale, douleur.

## INTRODUCTION

We are increasingly experiencing situations in which the dentist or patient signals, directly or indirectly, changes in the performance of one of the functions of the stomatognathic system, namely the mandibular opening. The accepted threshold value for typical, physiological mandible opening is 40 mm. Values below 40 mm fall within the limited opening category, and those over 50 mm occur in cases of joint laxity. In order to have a 40 mm aperture it is necessary for each condyle to perform a 10 mm lateral translation motion, concurrently with the anterior-posterior translation during the mandibular opening<sup>1</sup>. Any alteration of the lateral translation during the opening leads us to an intra-articular biomechanical alteration, whereas a limitation of the vertical opening with the keeping of laterality (in passive manual tests) is more related to altered muscular coordination, an analgic limitation or rarely, to a neurological disorder (e.g., facial nerve palsy) or skeletal asymmetries.

According to the International Diagnostic Criteria<sup>2</sup>, one can clearly determine the dominance of one of the two components or the presence of both components (intra- and extra-articular), but the identification of the causes that led to such abnormalities

necessarily implies the collaboration of the members of a multidisciplinary team<sup>3,4</sup>.

During a carefully conducted anamnesis, the medical history of the patient and his lifestyle can lead us to some predisposing factors and also trigger factors, following the rule from effect to cause. However, it is necessary to bear in mind that a limited mandibular opening has a psycho-emotional implication as in most cases pain occurs<sup>5</sup>. Its mechanism of involvement is extremely versatile: even if the pain is not present at the time of examination, most of the patients have had at least one episode of pain in the past and pain intensity has determined, as a body defense mechanism, a limitation in opening, in order to avoid or lessen the pain. Over time, this mechanism becomes reflex; therefore, the pain is often lacking, but the patient limits the opening to prevent a possible pain (mental anticipation).

A limited opening interferes with the proper and complete realization of the functions of the stomatognathic system<sup>6</sup>. In the diction, there are changes in the mechanism of articulation of sounds and, therefore, of expressive language. The mastication is incomplete, sometimes painful or done with great effort, sometimes even avoided<sup>7</sup> to the limit of anorexia; feeding becomes selective, food requiring reduced masticatory

movements is preferred, the patient avoids biting the food. All these are elements of the vicious circle that fortifies, by avoidance, the fear of pain.

The limited mandibular opening has also an impact on the medical and therapeutic maneuvers that become impossible or difficult to achieve – from dental ones to those with a vital impact, such as the use of the laryngoscope in tracheal intubation (in general intubation anesthesia, in the cardiac arrest or in acute respiratory failure).

The persistence of the mandibular opening limitation leads to changes in the infra- and suprahyoid muscles activity, the extensor muscles of the head and neck, resulting in oropharyngeal and cervical (anterior and posterior) pain<sup>8,9</sup>, as well as changes in the other functions of the stomatognathic system (mastication, swallowing, speech); these changes become, in time, engrams for a new activity pattern<sup>10</sup>. The engrams are theoretical constructs that explain how our memories are stored in the form of biochemical and biophysical changes of the brain in response to external stimuli. This means that at some point there was pain in the physiological mandibular opening, for which the body activated the defense mechanisms and determined the limitation of the opening to the threshold at which there was no pain or it was bearable<sup>11</sup>, learning this new pattern of movement. At that time and context, that dysfunctional pattern was the most functional. This cause must not necessarily be active all the time; but its disappearance does not automatically remove the dysfunctional pattern, due to the engram: our brain will continue to repeat this pattern of movement (though, by the disappearance of the cause, the functional pattern will become available or accessible) because the old, dysfunctional one is done with minimal effort and the recovery of the functional one involves a learning effort, which cannot be realized spontaneously but only consciously.

**THE OBJECTIVE OF OUR STUDY** was to demonstrate that the combination of MT and OMT, together with general relaxation, is the key by which the patient with the mandibular opening limiting manages to regain the harmony of neuromuscular control and temporomandibular arthrokinematics. This may be possible through tissue-targeted intervention in which the effort to regain spontaneously the lost or altered function would entail excessive energy consumption, which is not justifiable for the central nervous system (e.g. a capsulitis or an atypical swallowing)

## MATERIAL AND METHODS

The study was conducted at the Linea Medica Clinic in Oradea, Romania between October 2018

and March 2019, on a group of 46 patients, 6 men (13.04%) and 40 women (86.96%), aged between 14 and 52 years. The age span is very broad because we included all the patients who requested our help and met the inclusion criteria, who expressed their written consent to participate in the study and who showed compliance with the study requirements. The professions and hobbies of the subjects are of the most diverse, without establishing causality or influence on symptoms.

We suggested a multidisciplinary teamwork (the team included dentist, orthodontist, physiotherapist, psychologist, speech therapist, maxillofacial surgeon) in order to more accurately determine the delineation of the causes that led to the mandibular opening limitation. Each specialty has specific tests available to determine component of this dysfunction (joint, muscle or mixed).

The inclusion criteria were:

- limitation of the mandibular opening below 35 mm (we have taken into account the fact that there may be some constitutional factors that do not allow the standard opening of 40 mm);
- maximum passive opening with a limited active opening (patients who can achieve the opening of 40 mm but do not do it actively during the normal movements of the stomatognathic system);
- the possibility of a 40 mm opening, but a voluntary limitation (patients with a self-imposed limitation due to a painful episode, due to the perception of some articulatory noises which, although not classified as injuries, generate the fear of being pathological, due to a perceived pathology, due to aesthetic problems – ectopic canines, partial edentation, unaesthetic dentition);
- consent to be included in the study.

The exclusion factors were: psychiatric pathology, severe facial malformations or asymmetries, neurological pathology (the consent of the neurologist is required).

The following assessment methods were used: the Assessment Card for the Patient with Cranio-Cervical-Mandibular Dysfunctions, developed by Marius Sorin Pop, based on the *Diagnostic Criteria for Temporomandibular Disorders* (DC/TMD)<sup>12</sup>; The Visual Acuity Difference (VAD, developed by Luca Giannelli)<sup>13</sup>, The Protocol of Orofacial Myofunctional Evaluation with Scores (de Felicio)<sup>14</sup>, The Depression, Anxiety, Stress Scale (DASS)<sup>15</sup>.

The patients were divided into 3 groups based on the findings of the initial examination and assessment.

Thus, patients with articular dominance (disc dislocation, capsulitis, synovitis, degenerative pathology, post orthognathic surgery, unnatural head positions that are part of the subject's postural profile,

with strong interference on mandibular dynamics) have benefited exclusively from targeted MT and cranio-cervical-mandibular functional reeducation<sup>16</sup> – 17 patients.

If there was a strong orofacial muscular dominance or an atypical deglutition, the therapeutic strategy followed the myofunctional line (myogymnastics and reeducation of swallowing, where applicable)<sup>17</sup> – 9 patients.

In patients with a complex picture (anxiety, primary headache associated with secondary headaches, orofacial surgical sufferings, parafunctional habits), the therapeutic strategy was complex, and they benefited from both MT and OMT<sup>18</sup> (the category of patients in which the functional tests identified the availability or possibility of a mandibular opening within physiological limits, but there was the „memory“ of a pain). They form a group of 20 patients.

We have to mention that all patients who have benefited from OMT (either alone or in combination with the MT) have also learned correct breathing and general relaxation techniques (autogenic training, directed imagery).

It should be outlined that the muscular structures controlling the mandibular dynamics (in its closing, opening, lateral or protrusion movements) cannot be delimited with great precision from the facial muscles involved in the functions of the stomatognathic system (swallowing, phonation, mimics), all of them performed by the synchronous operation of several orofacial muscles<sup>19</sup>.

## RESULTS

The analysis of the subjects' symptoms revealed that:

1. TMD (limited opening of the mandible with or without pain) occurs in 35 patients (77.7%), followed by laterognathism (25 patients – 55.5%), bruxism (24 patients, 53.3%) and headache (21 patients, 46.6%);
2. Most commonly, TMD is associated with laterognathism (22 of 45 patients have both symptoms, 48.8%), then with bruxism (20 out of 45 patients, i.e. 44.4%) and headache (16 out of 45, i.e. 35.5%);
3. Laterognathism is often associated with bruxism (14 of the 45 subjects have both symptoms, 31.1%), so we can think that, besides the anatomical, biological, personal pathological / surgical antecedents, bruxism is a mechanism that triggers or actively supports this pathology<sup>20</sup>.

After a variable number of therapy sessions (MT, OMT or both), there are significant improvements in the mandibular opening.

A number of 34 patients (73,91% of the patients) experienced improvements, as follows: 11 (64.7%)

following MT, 6 (66,6%) following OMT and 17 (85%) as a result of MT associated with OMT.

Significant improvements in pain and jaw opening are achieved, even if some patients still have articular noises. The rehabilitation of the motor control (laterognathism) and the removal of parafunctions remain a long-term, obligatory challenge requiring the total involvement of the patient. It is very important to ensure the patient, in the long-term collaboration, that we have control over the situation together.

## DISCUSSION

It is confirmed that the one-way approach does not have the best impact either in the short- or long-term. Our patients come to us after they have been treated by various medical specialists. Our recommended strategy is multidisciplinary, but unfortunately our patients do not all follow all the ways we suggest and this is reflected in the patient's short-term evolution.

The short-term (6 weeks) and medium-term (12 weeks) outcomes were promising, confirming the efficiency of the targeted and combined therapies. This is essential for optimizing the strategies used. As we have had results, even on a small batch, we suggest the expansion of the strategy to a larger lot.

The results of this study prove that the classification according to the Diagnostic Criteria is no longer enough, but a closer examination is needed to avoid the misunderstanding or confusion of certain aspects. The delineation of the causes that led to limited mandibular opening is sometimes difficult to achieve. Applying a certain, even assigned, therapeutic method does not always have the expected results and, moreover, cannot be done in a „universal“ way, solely on the symptom. The impossibility of achieving the opening of the mandible to physiological dimensions has various causes: from articular, muscular, mixed, to causes that are no longer related to the physical body, but, more and more confirmed by authors, to the emotional area<sup>21</sup> and to functions that apparently have no direct connection with the stomatognathic system<sup>22,23,24</sup>.

Our experience so far has led us to this conclusion: it may happen that the patient starts a type of treatment but in fact to need another type or something more to cover the entire area of his/her pathology.

The interdisciplinary approach described above has a greater benefit, besides the correct approach to the causes: by gaining comfort, the patient is then willing to follow other pathways for long-term functional stabilization – handling the trigger factors that often make up his lifestyle, becoming aware of some

behaviors and their correction, in areas where the patient can get involved.

The factors that cause TMJ pain are the same as those that induce an alteration of the mandibular dynamics, mandibular control<sup>25</sup>.

A TMJ pain can create an asymmetry and a limitation in the opening, but thinking about patients without TMD symptoms, but with strong muscular tensions and some of them with already installed laterognathism, we may picture the following sequence: risk factors – trigger factors (many, in time) – neuromuscular alterations – joint wear.

In recent years, our patients come with laterognathism and limited opening, but without TMJ pain. Bruxism and parafunctions, though controversial as etiology, appear to be the most common group of trigger factors<sup>26</sup> – the forces in the masticatory muscles are clearly superior to muscle tensions occurring in onychophagia or atypical swallowing. Thus, it is possible, based on this clinical and scientific evidence, to consider that TMJ pathology is most often caused by parafunctions, bruxism because through these, the articular and orofacial overuse constant.

The cause of bruxism is controversial at an international level, but the some elements that lead to forms of bruxism are beginning to emerge: the nocturnal, as part of the upper airway resistance syndrome, the diurnal – in behaviors associated with a need to release oxytocin, in labial incompetence (physiological reason), alteration of ocular convergence and as a compensatory mechanism in cranial cervical stabilization.

Unfortunately, the possibilities of prevention are extremely low because patients do not spontaneously report the presence of bruxism or parafunctions, nor the limited opening until the moment of pain, and, even then, do not always make the causal link with the TMJ, even when it comes to cranial cervical muscular instability<sup>27</sup> triggering a compensatory orofacial tension.

Mandibular dynamics is an adaptive passage of the craniomandibular tissues from the constantly altered or pathological behavior, which often means local pain and frequently manifested remotely by neurogenic or biomechanical involvement. To treat only the painful structures (arthralgia, myalgia) without identifying the primary origin is a useless long-term effort, because it generates momentary relief but does not solve the underlying problem<sup>28</sup>. The approach of both primary origins (parafunctions, atypical swallowing, abnormal head position) and TMD, but without optimizing the mandibular dynamics (e.g. if laterognathism remains untreated) is also an incomplete approach, precisely because it leaves behind the active source for new permanent temporomandibular irritations which will become active causes.

We recommend the interdisciplinary approach from the earliest ages, intercepting the risk and trigger factors, involving parents and educators, and necessarily the professionals interested in cranial cervical tissues (neurologist, ENT doctor, ophthalmologist, dentist, physiotherapist, maxillofacial surgeon, plastic surgeon).

**THE LIMITS OF THE STUDY.** The main limitation of the study is the low number of subjects, which does not reduce its scientific value, but may draw criticism on its statistical value. We are already working on overcoming this limitation, continuing the same methodology, with the inclusion of new subjects for a broader and more statistically significant study.

Another limit may be the compliance to the therapy. The number of necessary therapy sessions ranges from 6 to 18 or more. After 3-4 sessions the patient feels relief at some degree and he/she is prone to „relax“ and abandon the process, so relapse may occur.

Moreover, sometimes it is hard for the patients to understand that a bite guard is very useful to protect their teeth but it will not address the cause and they have to eliminate the cause to live a healthy, painless life.

## CONCLUSIONS

1. In order to get a correct and complex diagnosis, it is very important to detect the predisposing and the trigger factors, which are sometimes part of the patient's lifestyle.
2. The limited mandibular opening has a psycho-emotional implication; even if the pain is not present at the time of examination, the patient has learnt, in time, that limiting the opening may prevent a possible pain (mental anticipation).
3. The limited mandibular opening leads to changes in the infra- and suprahyoid muscles activity, as well as in the extensor muscles of the head and neck; thus, the oropharyngeal and cervical pain, as well as changes in the functions of the stomatognathic system (mastication, swallowing, speech) may occur.
4. The changes become, in time, engrams for a new activity pattern. The functional pattern, once available because of removing the cause, involves a learning effort, which cannot be realized spontaneously but only consciously.
5. The MT and OMT combination proved to be the more effective to get rid of pain and limitation, as it addresses all the muscle layers in the area, inducing new movement patterns by improving the neuromuscular control.
6. The present study and our clinical practice support the concept of multidisciplinary approach in diagnosing and treating the limited mandibular opening.



**Compliance with Ethics Requirements:**

„The authors declare no conflict of interest regarding this article“

„The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Informed consent was obtained from all the patients included in the study“

„No funding for this study“

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