original research article

APPLICATION OF MYOFUNCTIONAL ORTHOGNATHODONTIC BIODYNAMIC THERAPY (MOBT) PROTOCOL IN TEMPOROMANDIBULAR DISORDERS: THERAPEUTIC EFFECTS IN PAIN AND ANXIETY MANAGEMENT

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SUMMARY
Objectives. International literature on temporomandibular disorders offers show a relationship between temporomandibular disorders and psychosocial factors. This study aims to go beyond this already known relationship (fully supported by previous literature) and shows how the application of an innovative therapeutic protocol for temporomandibular disorders (called MOBT; Myofunctional Orthognathodontic Biodynamic Therapy), may generate relevant effects in respect to anxiety, pain and disorders associated to temporomandibular disorders.
Method. A total of 40 patients with TMD underwent a MOBT treatment in a private clinic in Italy, and completed a self-report questionnaire for evaluating anxiety and pain before and after the treatment.
Results. Results showed that MOBT treatment gave a significant benefit for anxiety and pain in subjects with TMD symptoms, especially those with a high trait anxiety and severe correlated pains.
Conclusion. MOBT appears to be an efficient therapeutic protocol for temporomandibular disorders.

Key words: Myofunctional Orthognathodontic Biodynamic Therapy, pain, anxiety, temporomandibular disorders.

Temporomandibular disorders (TMD) (sometimes called craniomandibular disorders) are a heterogeneous group of dysfunctions affecting the masticatory muscles and/or temporomandibular joints (ATJs) and adjacent structures (1). According to the classification of diagnostic criteria of TMD (2) Axis I, temporomandibular disorders are: muscular dystrophy (characterized by myalgia, myofascial pain with referred pain and cephalea) and joint disorders (characterized by simple arthralgia or arthritis or by different types of disc displacement, with or without a spontaneous reduction and with or without the functional limitation during opening movement of the mouth, degenerative syndrome against temporomandibular joint - TMJ and subluxation). After clinical examination of temporomandibular joint, masticatory and cervical muscles, patients were divided into two groups: one group suffering from neuromuscular and vegetative pain and the second one suffering from temporomandibular joints pain. In the first case, we have an additional diagnosis of myofascial pain syndrome with projected pain: a large and heterogeneous group

of muscle pathologies that occur with constant pain, associated with contracture, limited muscle functionality, and occasionally, neuralgia symptoms, such as, paresthesia, tingling and vegetative disorder (3).
By using the classification of diagnostic criteria of the TMD's Axis II (2), we have valued the impact that pain and dysfunction symptoms have on patients' quality of life and psychological state. Therefore, we have used questionnaires to acquire patient's medical history and questionnaire to value pain and functional limitation of the orofacial district. Patients without discernible pathologies during the clinical examination, have a bigger engagement of the psychological sphere with or without somatic symptoms. It is important in medical diagnosis take into consideration neuromuscular factors, occlusal-articular factors and psychogenic factors.
The Myofunctional Orthognathodontic Byodinamic Therapy (called MOBT) is the innovative therapeutic protocol, created by the Authors, for the occlusal and functional disorders treatment and the treatment of oral intra and extra muscle disorders. It involves the use of two orthognathodontic equipments: the Giuliani and Burruano's Functional Plaque (PFGB; see Figure 1), a new biodynamic ortognathodontic device, innovative as regards the device of Cervera and of the Turin School (4); and the Apparatus to Reprogramme the Postural Occlusion, by Burruano and Giuliani (AROP; see Figure 2), reneved as regards the plaque of type A, B and C of Terry T. Tanaka.
The MOBT needs a personal prescription based on the diagnosis of TMD. Prescription includes the use of the equipment associated with myofunctional therapy (which is helped and given by the equipment itself), treatment times and patient condition monitoring MOBT protocol provides the use of the above-mentioned equipment as a true re-educational tool whereby the patients learns and saves the new functional strategies (learning and memory are the molecular alphabet of central nervous system CNS' plasticity). Autostimulations are definitely the best one (5). Self management cranial mandibular exercises (posture exercises, assisted active movements exercises, hypomobility joints exercises, hypermobility joints exercises, hypomobility exercises caused by muscolar hypertonicity). The combination of equipment and exercises restores a proper occlusal-articular pattern of TMJ, setting a physiological flow of information to neuromotor system, that associated to a re-educational muscular therapy allows the recovery of a better cranio-cervical mandibular activity, resulting in a bilateral and symmetrical isotonicity of intra and extra oral muscles and of the tem-

Figure 1
Giuliani & Burruano's Functional Plaque (PFGB).

Figure 2
Apparatus to Reprogram the Postural Occlusion (AROP).

poromandibular joints (AXIS I). In addition to the benefits to AXIS I, MOBT protocol restores the balance and reduces anxiety and pain (AXIS II) thanks to the correct stimulation of the trigeminal afferents in the nasopalatine nerve emergency area.

Tongue has the physiological function of swallowing, this function takes place by moving the tip of the tongue on the palatine raphe, allowing a rhythmic and regular stimulation of the emergency area of the palatine nerve (6), generating signals that from the dorsal and ventral trigeminal thalamic pathway, reach the ventral posterior nucleus of the thalamus. From thalamus, the thalamus cortical fibers reach the primary and secondary somesthetic areas of the cerebral cortex (Brodmann area); moreover, from thalamus, fibers reach the Locus Coeruleus. Therefore, tongue's stimulations of the palatine spot and trigeminal, give remote answers involving the CNS unit activities: the Locus Coeruleus (5). The Locus Coeruleus, if activated, releases noradrenaline that has an excitatory effect on most of the brain. Nerve connections of this nucleus innervate the spinal cord, the brain stem, cerebellum, hypothalamus, the amygdala, the basal telencephalon and the cerebral cortex. Through this connections Locus Coeruleus plays a central role in modulating arousal, attention, sleep-wake cycle, learning, pain perception, anxiety and mood. Particularly interesting for the effects on AXIS II, are the connections reaching hyppocampus and amygdala affecting limbic system activity and participate in controlling emotions, learning process, memory and attention. While hyppocampus is associated with memory, amygdala processes emotions giving to each stimulus the right level of attention and storing it as memory. Amygdala can react before the cortex know what is happening, because the raw emotion is independent from the conscious thought, and usually it comes first (7).

When stimulated by some stressful stimuli, the amygdala acts as follows: it sends emergency signals to the whole brain, it stimulates the release of hormones (adrenaline, dopamine, and noradrenaline), that cause a fight-or-fight reaction or escape, activates the motor system, the cardiovascular system, muscles and intestine. At the same time, mnemonic systems are browsed to recall any useful situation when we fear.

Normal functioning of amygdala, thanks to some regular and continuous stimuli of palatine spot by tongue, during the act of swallowing, will take to a flow of harmonic stimuli with equal intensity, that will allow the emotional memory to re-organize the central nervous system and will lead to a state of psychomotor wellness that will overcome stressful situations and anxiety. MOBT protocol guiding the tongue during the process of learning the physiological function of swallowing and setting a correct movement of the tongue in the emergency zone of nasopalatine nerve, triggers the whole process described above.

Anxiety and pain affect significantly the quality of life in subjects with TMD. Anxiety is a restlessness state, it is anxious waiting of an imminent and unknown danger, lived as a primary, global phenomenon, anxiety is also associated with an uncertain and powerless feeling. While fear is en emotional response to an actual threat and is recognized by individuals as it is, anxiety follows from an unknown or poorly defined threat that individual can't recognize (8). In this study we focused on trait-anxiety. Spielberger and colleagues (9) introduced the difference between "state" anxiety and "trait" anxiety in the developing of the self-evaluation scale, the State-Trait Anxiety Inventory (STAI). This theory is based on the conceptual distinction between anxiety as transitory state and anxiety as fairly stable characteristic related to personality. In particular, state anxiety can be defined as a temporary interruption of the continuum emotional state characterized by subjective feeling of tension, apprehension, nervousness, restlessness associated with the activation of the autonomic

nervous system. Trait anxiety can be considered a stable characteristic of personality, a behavior that reflects the way the subject sees as threatening or harmful stimuli the environmental factors**.** Nociceptive stimulus has been defined by the National Association for the Study of Pain as "An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (10). Severe pain can affect the muscular system. It is clear that pain, has a sensory and affective component how it could come from a tissue damage even if the tissue damage is not necessary (11). The ability of CNS of modulating the nociceptive stimulus is an extremely important function (it can increase and reduce the perception of pain itself), and the perception at cortical level, starts a complex interaction of different factors including: past experiences, expectations, perceptions of the threat and attention to it. Therefore, patients suffering from of modest pain can feel more pain, while the others suffering from a severe pain can suffer less. Pain is a subjective experience.

Literature highlighted the role of physical, psychosocial and cultural factors in etiology and in keeping the symptoms of TMD, revealing the multidimensional nature of chronic pain disorders (12-14; 16-21). In support of this, patients suffering from TMD, have shown a higher level of psychological stress and anxiety (13, 14). Researches have shown a higher level of trait anxiety in patients suffering from TMD associated with muscles disorders than patients suffering from joints disorders (14-16). TMD tends not only to cumulatively affect an individual, but also to present central sensitization and perception of amplified pain (19, 20); a presence of pain sites widely distributed in the body has been demonstrated in patients with a high degree of anxiety (21). These results suggest the need to differentiate both the different pain groups and the highest and lowest levels in pain, in order to correctly evaluate the effectiveness of the MOBT treatment and to verify, at the same time, if different levels of pain affect the variation in anxiety levels.

Therefore, we decided to focus on variations in anxiety and pain levels in a situation of general pain associated to TMD. Specifically, this study aims to compare anxiety and different aspects of the experience of individual pain, related to temporomandibular disorders in a group of patients suffering from TMD presenting higher pain scores than the patients of a second group who had low pain scores before and 6 months after the treatment for TMD with MOBT.

Method

Sample and measures

The total sample consisted of 40 patients suffering from TMD (87,5% females, mean age = 35,73 years, *SD* = 12,22) have been treated with MOBT in a private clinic in Italy. No specific criteria of inclusion or exclusion have been used. 22,5% of the sample received a diagnosis of myofascial syndrome too. 80% of the sample have been treated with MOBT & AROP; 20% of the sample have been treated with MOBT & PFGB.

The sample group treated with MOBT & AROP presents a predominantly articular TMD with a muscular disorder. The sample group treated with MOBT & PFGB had a TMD with muscular and swallowing disorders, parafunctional occlusion. Patients' state anxiety has been evaluated by the State-Trait Anxiety Inventory (STAI-form Y) (9) first (T1) and after six months (T2) from wearing MOBT.

Pain has been evaluated by the "Questionario Italiano del Dolore" (QUID) (Italian pain questionnaire) (22), the Italian version of McGill Pain Questionnaire, categorizing different groups of pain (sensory, affective, evaluative,

and mixed) depending on patients records of pain. Furthermore, this tool provides and indicates the overall intensity of real pain, on a scale of 0 to 5. Statistical data analyses have been processed through parametric statistics and t test has been used for paired sample.
All participants provided signed, informed consent to participate in the study.

Results

We divided the total sample into two groups, depending on the average value for total real pain intensity T1 (LP [low pain] < 2; group HP [high pain]: ≥ 3, in order to study the difference between patients with high and low pain level. Levels of anxiety and quality pain (sensory, affective, evaluative and mixed) of the patients in each group has been compared between T1 and T2. Results have shown that variations between T1 and T2 for both the LP group and HP group. Generally, MOBT treatment has given an important benefit for anxiety and any kind of pain measured by QUID, regardless of overall level of pain (Table 1).

Discussion and conclusion

Research on the association between Temporomandibular Disorders and stress has not ended, and we can't state that important psychological factors contribute or influence pain, although some patients suffering from depression have a higher risk of TMD than patients who don't (23). Generally speaking, MOBT treatment, using PFGB and AROP, has shown to provide significant benefits for anxiety and pain, in subjects with TMD's symptoms. And since high level of anxiety may lead to a higher pain perception in TMD (24), it's particularly important for us to demonstrate that, both at clinical and human level, the application of the MOBT protocol re-

Table 1. Quality of pain and levels of anxiety variations between Time 1 and Time 2.

	Time 1		Time 2		t
	M	SD	M	SD	
LP Patients					
State Anxiety	60.94	23.00	40.06	21.11	4.357*
Trait Anxiety	63.38	24.04	43.25	26.43	3.195*
Sensorial Pain	.23	.16	.06	.11	4.599*
Affective Pain	.37	.28	.10	.18	2.928*
Evaluative Pain	.32	.24	.06	.15	3.924*
Mixed Pain	.39	.31	.04	.13	4.015*
HP Patients					
State Anxiety	66.24	27.65	50.05	27.96	2.576*
Trait Anxiety	64.90	29.99	52.95	28.44	2.566*
Sensorial Pain	.37	.14	.17	.19	3.794*
Affective Pain	.38	.18	.21	.19	3.132*
Evaluative Pain	.28	.15	.12	.14	4.798*
Mixed Pain	.30	.16	.14	.17	3.187*

Note. * $p < .001$. LP = Low Pain; HP = High Pain.

duced anxiety and pain.

Fully aware of how key is interdisciplinary for therapeutic success, we decided for an integrated approach, focusing also on a psychological perspective. Literature shows how psychological and etiological factors of temporomandibular disorders obstruct the clinical management of these patients. From an evolutionary point of view, the masticatory system, through hormones and others psychomotor strategies and neuromuscular system, plays a very important stress-protective and stress-modulating role (25). In fact, directly or indirectly, it attenuates or rework all the different types of stress of any kind on our body, so as to influence the general psycho-physical bio-energetic well-being, that is state of mind, functioning of the nervous system, posture, hormones, immune system. It is important to look for any causes, that can be: at anatomical-structure level, metabolic, psychic, often acting simultaneously, and it is therefore clear that interdisciplinary collaboration and/or competence represent the key to therapeutic success (26). We hope, in the future to be able to monitor the long-term results of the MOBT benefits, in order to assess its effectiveness and stability over time.

Conflict of interest

The Authors declare that there is no conflict of interest regarding the publication of this article.

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