Treatment of chronic pain associated with bruxism through Myofunctional therapy

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Abstract

Temporomandibular disorders such as bruxism may cause painful clinical conditions and over time lead to chronic facial pain. A combination of therapeutic strategies that are usually undertaken by dentists and gnathologists to reduce bruxism episodes and consequently pain, are myofunctional therapy, pharmacological treatment, intraoral interventions and behavioural treatments. The aim of this work was to understand if myofuntional therapy alone can be a useful therapy for the reduction of chronic facial pain. 24 patients, 9 male and 15 female, age ranging between 25 and 45, were treated with a myofunctional therapy for 9 month. Each patient was evaluated through a numeric pain intensity scale ranging from 0 to 10 and the number of bruxism episodes/hour per patient were also recorded; electromyographic examinations of the temporal, masseter, sternocleidomastoid and digastric muscles were performed to evaluate muscle activation. Each patient was tested before (T0) and after (T1) the treatment period. Pain intensity decreased from T0 to T1 (8.13±0.39 vs. 1.75±2.43, respectively, $p<0.01$). The number of bruxism episodes also significatively decreased between T0 and T1 (24 vs. 9, $p<0.01$). Electromyographic assessment showed a decrease in the tonic activity of the masseter muscle (T0: 1.88±0.31 vs. T1: 1.4±0.25 μV; $p<0.05$) and a reduction of the electric activity of the temporal and digastric muscles during serration of the mandible (T0: 167.9±19.6 μV Vs T1: 144.6+16.43 μV; $p<0.05$ and T0: 58.97+8.38 μV Vs T1: 52.79+7.44 μV; $p<0.05$, respectively). Myofunctional therapy could be used to reduce facial pain as a consequence of bruxism episodes.

Key Words: Electromyography, myofunctional theraphy, bruxism, jaw clenching.

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The altered neuromuscular behavior of the orofacial district known as facial hypertonia is a pathological clinical condition characterized by facial muscle tensive pains often associated with incorrect swallowing patterns that may result in temporo-mandibular disorders (TMD) or be the onset of episodes of jaw clenching or bruxism.[1-5] Clinical diagnosis is based on the examination of the electromyographic assesment of the jaw-closing muscles: the masseter, the digastric and sternocleidomastoid that have been seen to show an increase in their muscle tone when compared to their reference values, both in resting position and during specific postures.[6-8] The therapy usually involves a pharmacological approach in case of pyramidal hypertonia, relieving the disorder through muscle relaxants such as dantrolene, and through the use of plates and splints, transcutaneous electrical nerve stimulation (TENS) or other physical therapies. However, to date there isn't an univocal consent on the therapy that should be delivered.[9-13] Some authors have proposed myofunctional therapy (MFT) for the treatment of facial hypertonia, but there is no scientific consistent evidence showing the possibility of treating such painful condition exclusively through physiotherapic myofunctional treatment rehabilitation.[10,11,14] MFT is however universally accepted for the treatment of gnathological problems and orthodontics, but not for the treatment of myofacial pain and for the reduction of the episodes of jaw clenching and bruxism.[1,3,11 15] Therefore, the aim of this study was to evaluate the effectiveness of MFT alone as treatment for facial hypertonia through clinical parameters and objective evaluation of electromyographic activity of the temporal, masseter,

digastric and sternocleidomastoid muscles in patients suffering from chronic facial pain and bruxism.

Material and Methods

Patients

24 subjects, of which 9 males and 15 females age ranging between 25 and 45 years of age from the orthodontic and gnathology section of the Santa Chiara Hospital of Pisa, were treated with myofunctional therapy if at least one of the following conditions were present: facial pain, incorrect swallowing, clenching and hypertonia of the jaw muscles. If patients had been already treated with other physical manipulations, took drugs or medications or had orthodontical supports, they were excluded from investigation. Informed consent was provided to and signed by all participants according to the Helsinki Declaration.

Clinical Evaluation

The painful subjective feeling of the facial pain of all subjects was assessed by a visual analogue scale, the numeric pain intensity scale (NPIS), characterized by a grading range between 0 and 10, where 0 indicates no pain and 10 worst possible pain, which was compiled before (T0) and 15 days after (T1) the completion of the MFT.[16,17] The clenching episodes were divided in relation to the physical discomfort reported by the subjects and by frequency per hour during the day. In particular, three categories were identified: low frequency (1-5 episodes/h); medium frequency (6-10 episodes/h) and high frequency (>10 episodes/h). The number of clenching episodes were assessed through a questionnaire where each participant reported the number of clenching episodes that occurred during a period of 3 days and through audio sleep recordings for the evaluation of sleeping clenching episodes during a period of 3 days. The mean values of the 3 days was reported for analysis.

Electromyographic evaluation

Muscle facial hypertonia was assessed through surface electromyography (BioEMG™ of the Bio Research, Inc.) with the use of the BioPak 2.1iRC6 software, by detecting electromyographic activity of the following muscles: Right and left anterior temporal muscle (TA); right and left masseter muscles (MM); right and left sternocleidomastoid (SCM), and right and left digastric muscles (DA). Electromyographic recordings, each of which of the duration of 9 seconds, have been performed in two different jaw positions: 1) In resting position, holding the tip of the tongue in a physiological position (on the palatine spot), mouth closed with loose teeth and trying not to swallow nor touching the teeth with the tongue; 2) In a jaw clenching position for evaluation of voluntary muscle activity. The recorded signal was filtered through a band bass filter between 20 and 400Hz, the output signal was subsequently rectified and the root mean square (RMS) was taken into account for amplitude analysis. Mean bilateral muscle activity was taken into account for each muscle group of both sides. All recordings were performed before and after the standardized MFT Protocol described in "Myofunctional Therapy" of Daniel Garliner.[10]

Statistics

Statistical analysis was performed using Student's t-test for paired data and Wilcoxon test for nonparametric assessments. A p values <0.05 was considered statistically significant. The STATISTICA software (StatSoft. Tulsa, ver.10) was used for all statistical analysis.

Results

All subjects completed the MFT protocol for a period of 9 months. Facial pain, from the hypertonic muscles reduced significantly between T0 and T1 (NPIS: T0: 8.13±0:39 vs. T1: 2:43±1.75; $p<0.01$). The mean value of the bruxism episodes during the daytime reported by the patients also reduced, passing from 6.75±0.92 at T0, to 1.05±2 at T1 ($p<0.01$); in particular at T0 3 subjects reported a low frequency (1-5 episodes/h), 18 a medium frequency (5-10 episodes/h) and other 3 a high frequency (>10 episodes/h). At T1 in 62.5% of cases the episodes of bruxism disappeared, in 12.5% a low frequency was reported and only in 25% of cases a medium bruxism frequency was present. No high frequency cases were reported after the MFT protocol (Table 1).

Table 1. *Number of daily bruxism episodes in the analyzed cohort*

N° of episodes	T0 N (%)	T1 N (%)
0	0 (-)	15 (62.5)
1-5 / hour	3 (12.5)	3 (12.5)
5-10 / hour	18 (75)	6 (25)
> 10 / hour	3 (12.5)	0 (-)

Table 2. *Tonic activity of anterior temporal, masseter, sternocleidomastoid and digastric muscles*

Muscle group	Parameter	Registration interval		*P*
		T0	T1	
Anterior temporal(μV)	Mean	2.67 ± 0.56	2.09 ± 0.26	Ns
Masseter(μV)	Mean	1.88 ± 0.31	1.4 ± 0.25	0.04
Sternocleidomastoide(μV)	Mean	2.19 ± 0.77	1.5 ± 0.16	Ns
Anterior Digastric (μV)	Mean	2.29 ± 0.31	2.53 ± 0.72	Ns

Ns: Not significant

The tonic activity of the anterior temporal muscle, masseter, anterior digastric and sternocleidomastoid muscles bilaterally recorded in the resting position, showed a reduction in the mean amplitude, however such reduction was statistically significant from T0 to T1 only in the masseter muscle (T0: 1.88±0.31 μv vs. T1: 1.4±0.25 μv; p <0.05) (Table 2).

Recordings of the anterior temporal, masseter and digastrics muscles during the voluntary activation tests showed in all cases clinical improvements characterized by the reduction of muscle activity after the completion of the MFT cycle, which was found to be statistically significant in the anterior temporal (T0: 167.9±19.6 μv vs. T1: 144.6±16:43 μv; p<0.05) and anterior digastric muscles (T0: 58.97±8:38 μv vs. T1: 52.79±7:44 μv; p<0.05) (Table 3).

The differences in absolute values between the activation of each of the right and left muscle groups performed at T0 and T1 during clenching and swallowing showed a tendency towards symmetry after MFT for all muscle groups, with a significant improvement in relation to the masseter muscles (p<0.05) (Table 4).

Discussion

Myofunctional therapy, has been studied by various authors in order to solve problems and painful conditions regarding dentistry and gnathology. Some studies show that, MFT has been applied and compared with the use of splints, resulting more effective than the latter for the treatment of temporomandibular joint disorders[11, 15, 18]; other authors have observed that MFT can affect perioral muscles balancing their activity[19, 20].

To date positive results have also been highlighted in the use of MFT for the resolution of otologic problems,[21] typical and atypical swallowing problems in infants[22] and as main supportive therapy to prevent relapses after orthodontic treatment.[3]

Our work seems to indicate that myofunctional therapy can be used alone as a treatment strategy to reduce facial pain, episodes of clenching and facial hypertonic muscle imbalances. The analysis of pain perception according to the NPIS, has clear clinical significance. The improvement resulting from the myofunctional therapy has also a psychological impact in patients with chronic pain; the significant reduction of pain with which these patients have long lived with, is a definite clinical outcome. In addition, the American Academy of Oro-facial pain, has stated that 50% of the causes thet may lead to facial pain is caused by muscle hypertonia[23] and therefore the reduction of the NPIS score after MFT proves that it is possible to reduce or eliminate painful episodes exclusively through physical therapy.[4,24]

The electromyographic results at T0 and T1 has also enabled us to draw some encouraging conclusions. Despite the limited number of patients, the automatization of the tongue's posture on the palatine spot and the swallowing function, obtained by the MFT

Table 3. *Electric activity of the anterior temporal muscles, the masseter muscles and the anterior digastrics muscles during bruxism episodes*

Muscle group	Parameter	Registration interval		*P*
		T0	T1	
Anterior Temporal(μV)	Mean	167.9 ± 19.6	144.6 ± 16.43	0.049
Masseter(μV)	Mean	117.48 ± 20.89	112.79 ± 27.88	Ns
Anterior Digastric (μV)	Mean	58.97 ± 8.82	52.79 ± 7.44	0.03

Ns: *Not Significant*

Table 4. *Absolute difference between right and left muscles*

Muscle group	Parameter	Registration interval		*P*
		T0	T1	
Anterior Temporal(μV)	|Δ|	70.86 ± 14.19	43.95 ± 5.72	Ns
Masseter(μV)	|Δ|	36.83 ± 9.23	20.46 ± 8.52	0.04
Anterior Digastric (μV)	|Δ|	13.11 ± 4.17	6.50 ± 3.18	Ns

Ns: *Not significant*

appears to have yielded significant results in regard to the reduction of the bilateral activity of the masseter muscles during the resting position and a better activation pattern during the voluntary jaw serration. Since the masseters are the main muscles involved during the episodes of bruxism,[25] a reduction of their resting activity combined with the reduction of the number of bruxism episodes per day indicates the effectiveness of the MTF for the treatment of bruxism and involuntary jaw clenching. Other interesting conclusion may be drawn by the results obtained during the voluntary clenching tasks; the bilateral electromyographic activity of the digastrics muscles significantly decreased after the MFT and a better balance between the right and left muscle was obtained. MFT could also be used as a viable therapy for muscle tensive headaches, neck pain, and for prevention of TMJ disorders[1 26,27]. In conclusion, this study showed that MFT can be an effective therapeutic strategy in regard to the treatment of muscle facial pain and hypertonia of the chewing and swallowing muscles. All treated patients had a reduction of facial pain and reduced the number of bruxism episodes per hour, and in many cases such episode disappeared. MFT combined with electromyographic assessment may be effective to evaluate and balance muscle asymmetries that could result in facial pain.

List of acronyms

DA - digastric muscle
MFT - myofunctional therapy
MM - masseter muscle
NPIS - numeric pain intensity scale
RMS - root mean square
SCM - sternocleidomastoid muscle
TA - anterior temporal muscle
TENS - transcutaneous electrical nerve stimulation
TMD - temporo-mandibular disorders

Author's contributions

GM, FM and AI have designed and conceived the work. ET and LP have drafted, edited and revised the final work. GBFM and LP have collected the data. PS has analyzed and interpreted the data.

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Conflict of Interest

The authors state no conflict of interests.

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