

Research article

Temporomandibular joint dysfunction syndrome – a therapeutic approach

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Abstract: 1) Background: Temporomandibular joint (TMJ) is responsible for vital functions like mastication, swallowing, and suction reflex and other relational functions, like talking and phonation. The etiology of temporomandibular joint disorders is multifactorial and involves subjective and objective clinical symptomatology. (2) Methods: The therapy is complex and encompasses a series of methods that interconnects various medical specialties. Bad habits and parafunction are risk factors that may initiate and exacerbate a temporomandibular joint pathology. This prospective study aimed to show the positive impact of correct multidisciplinary therapy on the complex of TMJ disorders - pain and bad oral behaviors. The therapy methods used in this study were: medical, prosthetic, orthodontic, surgical, and physiotherapy (PKT). (3) Results: The data obtained showed good results if the oral habits and TMJ disorders are treated correctly and simultaneously. (4) Conclusions: All therapeutical approaches addressed in this study had beneficial effects on the recovery of the temporomandibular joint.

Keywords: therapeutic approach; temporomandibular joint; TMJ disorders; pain; multidisciplinary therapy

1. Introduction

Temporomandibular joint (TMJ) disorders embrace some conditions that either disrupt the joint either are having an impact on masticatory muscles and neighbor structures, often associated with emotional stress, depression, sleep deprivation and other hormonal and functional complications [1]. This pathology is often found in daily dental

practice, affecting all age groups [2]. Taxonomic Classification for TMJ disorders includes temporomandibular joint disorders (TMD), masticatory muscle disorders, headache (TMD-associated) or affecting the associated structures. TMD symptomatology includes joint pain, joint disorders (disc displacement affecting mobility), hypomobility (by fibrosis or ankylosis) or hypermobility disorders (traumatic injury), joint diseases (osteoarthritis, osteoarthritis systemic diseases, tumors, fractures, congenital malformation etc.). Masticatory muscle disorders clinical picture includes localized pain (myofascial in nature), muscle contraction, dystonia, and dyskinesia at the level of orofacial apparatus [3].

Regarding a correct diagnostic process for TMD, the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) classification [3] is widely used. A rigorous history of the disorder, as well as a thorough clinical and paraclinical examination helps with the correct diagnosis [4]. Inflammatory biomarkers have been widely used for confirming this disorder [5]. For obtaining a favorable response, the treatment requires a multidisciplinary approach [6]. This involves the use of medication [7], of a prosthetic, orthodontic, surgical, and physiotherapeutic treatment singular in a synergic approach based on the particularities of each case. Local infiltrates with hyaluronic acid on TMJ level also may be associated [8].

Bad oral habits and parafunctions (OB) are risk factors that maintain or even worsen temporomandibular joint pathology [9, 10]. They are acts adopted by the patient, used with certain rhythmicity, frequency and intensity which may lead to alterations in the stomatognathic system and, implicitly, in the temporomandibular joint. Daytime or nocturnal bruxism (with a prevalence of up to 90%, more common in women, related to anxiety and stress), squeezing, biting the lips, and thumb sucking is considered oral parafunction. In general, parafunctions appear intermittently, do not cause significant damage and most of the time, do not require treatment. Moderate or severe forms can cause damage to the oral structures (teeth damage, destruction of the periodontium), joint and muscle damage. These can be factors that initiate and exacerbate symptoms of the TMJ disorders [11].

“Oral behaviors checklist” represents a self-report scale used to identify and quantify oral behavior during the last month [12]. Initially, the Oral Behaviors Check-list scale (OBC) was used to identify the bad habits and parafunctions which can potentially affect the stomatognathic system. Later a summarization of the habits was introduced to establish the degree of the disorder. Nowadays, due to this scale we can determine the seriousness and prevalence of bad habits in the daily routine of the patient [13]. The treatment of patients with TMJ disorders aims to remove oral bad habits and parafunctions, as well as to recover the morphological function of the temporomandibular joint.

The purpose of the study is to highlight the beneficial effect of using the correct therapy in temporomandibular algodysfunctional syndrome. The study is a prospective cohort study on the first and the 21st day after treatment.

2. Results

The two groups did not differ significantly in terms of age, rural or urban background, or gender. Also, no statistically significant differences were found between the two groups in terms of the presence of clinical manifestations, uni/bilateral joint damage, and occlusion stability (Table 1). All patients (in both groups) presented pain.

Pharmacological treatment and mechanotherapy were used in all patients included in the study. Medication consisted mainly of myorelaxants and local and oral anti-inflammatories, with no significant differences between the two groups ($p \geq 0.05$). Hyaluronic acid infiltrations were used for about 2% of the subjects included in the study and corticosteroids for about 4% of them. Orthodontic and prosthetic treatment was applied to both groups without significant differences.

Table 1. Baseline characteristics of the groups.

Parameter	LOT - PKT	LOT + PKT	p
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Age, M, SD (N)	41.20 ± 14.78 (96)	44.27 ± 13.19 (44)	0.240*
Female, N (%)	57 (59.38 %)	27 (61.36 %)	0.825*
Rural area, N (%)	34 (35.42 %)	9(20.45 %)	0.076*
Clinic manifestations, N (%)			
Crackles N (%)	38 (39.58 %)	21 (47.73 %)	0.309*
Creptitations N (%)	39 (40.63 %)	20 (45.45 %)	0.593*
Joint limited range of movement N (%)	24 (25 %)	10 (22.73 %)	0.772*
Uni-/bilateral affection			
Bilateral affection N (%)	30 (31.25 %)	15 (34.09 %)	0.739*
One-sided right N (%)	27 (28.13 %)	14 (31.82 %)	0.655*
One-sided left N (%)	39 (40.63 %)	15 (34.09 %)	0.462*
Occlusion type N (%)			
Unstable N (%)	47 (48.96 %)	26 (59.09 %)	0.267*
Therapy			
Orthodontic N (%)	26 (27.08%)	10 (22.73%)	0.585*
Prosthetic N (%)	63 (65.63%)	28 (63.64%)	0.819*
Surgical N (%)	5 (5.21%)	0 (0%)	-
Physiotherapy N (%)	0(0%)	44 (100%)	-

M, mean value; SD, standard deviation value; N, total number; PKT – physiotherapy; p values, statistical significance (*, chi-square test).

2.1. The evolution of pain

The initial values of the VAS pain score were insignificantly higher in the physiotherapy lot (47,38 vs 45,99, p=0,462). Compared to the initial values, in both lots, VAS values de-creased significantly after 21 days (from 45,99 to 22,03, p<0,001, respectively from 47,38 to 18,30, p<0,001) (Table 2). The treatment effect on the VAS score at 21 days was very good in both groups (ES=2.32 and ES=2.80, respectively).

Table 2. Evolution of the VAS score and effect size.

Parameter	LOT - PKT	LOT + PKT	p-value
VAS pain score			
Initial, M, SD	45.99±10,33	47.38±10.37	0.462*
After 21 days, M, SD	22.03±14.04	18.30±14.47	<0.001**
ES – effect size			
After 21 days - value	2.32	2.80	-

PKT– phyiotherapy; M – Mean values; SD – Standard Deviation; ES – effect size; * p values, statistical significance (*, chi-square test); ** p values, compared to the initial value.

2.2. Effects of treatment on parafunction

The incidence of vicious habits in patients with TMJ disorders is high and represents a risk of maintaining or even worsening the joint pathology. Early identification or habituation of the reflex mechanisms represents a primary phase in the treatment of articular pathology. For this reason, the progression of the patients by recording the OBC score is required. The initial values of the OBC score were almost the same in the two groups (40.04 vs. 40.11, p=0.951). After 21 days the OBC scores significantly decreased in both groups (from 40.04 to 29.69, respectively from 40.11 to 28.95, p<0.001). The effect of the treatment on the OBC score after 21 days was very good in both groups (ES=1.70 respectively ES=1.68). The OBC score significantly decreased after 21 days (p<0,001), with similar results for both groups (ES=1.70 respectively ES=1.68). Table 3 presents the obtained scores as well as the impact of the treatment on vicious habits in patients with TMJ disorders.

Table 3. OBC score evolution

Parameter	LOT - PKT	LOT + PKT	p-value
OBC score			
Initial, M, SD	40.04±6.10	40.11±6.65	0.951*
After 21 days, M, SD	29.69±8.23	28.95±8.74	<0.001**
ES – effect size			
After 21 days - value	1.70	1.68	-

PKT – physiotherapy; M – Mean values; SD – Standard Deviation; ES – effect size; * p values, statistical significance (*, chi-square test); ** p values, compared to the initial value.

2.3. The Outcome of Patients with TMJ Disorders According to the Different Therapeutic Approaches

The efficiency of TMJ disorders therapy and morpho-functional recovery is different according to the chosen treatment method. An association of more methods of treatment increases the success rate of a treatment plan. The prosthetic treatment consists of dental restoration by filling the edentulous space (dental prosthesis from various materials, crowns, dental bridges). The orthodontic treatment refers to malocclusion correction determined by the teeth irregularity or by the abnormal relationship between both maxillae, or a combination of these two conditions.

We were assessing the pain progress and its control, besides the assessment of the OBC score in relation to the treatment initiated. Medication (NSAIDs, other analgesics in oral administration and/or intraarticular infiltration) was administrated in 65 patients; 18 patients of the 65 patients' group were following physiotherapy procedures. Prosthetic treatment was approached in 47 patients, from which in 17 patients were added physiotherapy. Orthodontic treatment was approached in 23 patients, from which in 9 cases was also added physiotherapy. From the total group of 140 patients, 5 patients were submitted to surgical intervention. No statistically significant differences were identified in assessing the initial values of the sub-groups (VAS and OBC score), $p < 0.05$. After 14 days of treatment, was noticed a decrease in the overall pain intensity, with an even higher significant drop in pain scores ($p = 0.003$) in the physiotherapy group patients following orthodontic therapy compared to the no physiotherapy group ($p = 0.05$) (table 4). Noticeable is also a drop in VAS pain score in the Med+PKT group patients with a wider gap referring to the initial VAS values. On the re-assessment after 21 days, the OBC score was registering a statistically significant decrease, regardless of the applied treatment (Figure 3).

Table 4. VAS and OBC score evolution depending on the applied therapy.

Treatment	Group	Initial VAS score	VAS score after 14 days	P	Initial OBC	OBS score after 21 days
Drugs	Med - PKT	46.60±10.89	42.02±11.92	0.037	39.68±6.30	29.11±8.74
	Med+PKT	51.67±11.63	43.61±14.33	0.055	39.39±7.22	26.28±10.25
Prosthetic	Prot-PTK	44.50±8.65	36.00±11.70	0.002	41.80±6.03	33.07±6.09
	Prot+PTK	43.24±7.49	33.82±13.41	0.003	43.06±5.98	33.82±5.36
Orthodontic	Orto-PTK	47.86±12.51	36.43±16.92	0.050	37.14±4.54	25.29±7.48
	Orto+PTK	46.67±10.00	30.00±9.82	0.003	36.00±4.06	25.11±6.81

In general, in temporomandibular dysfunction the treatment is conservative, the surgical indication is reduced to a percentage below 5%. In our study only 5 cases required surgery (3.57%).

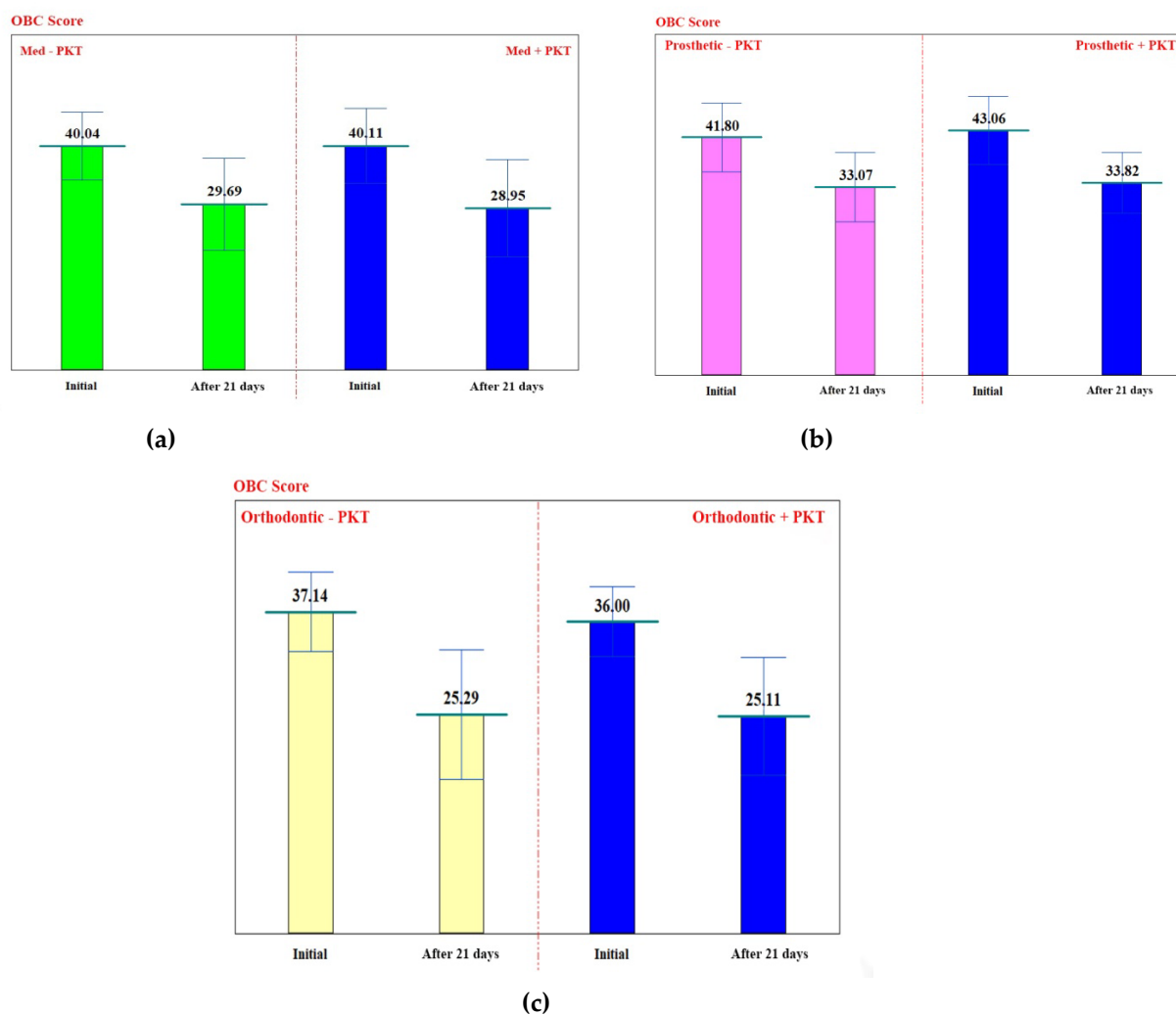


Figure 3. a. The evolution of the OBC scale in patients with medical treatment; b. The comparative evolution of the OBC score in both groups with prosthetic treatment; c. The evolution of the OBC scores in both groups with orthodontic treatment.

3. Discussion

The etiologic diagnosis of pain from the oro-facial system is an important feature of the therapeutic approach [4, 14]. Regarding the therapeutic approach, the effects of four different therapies were explored. In addition, TENS (transcutaneous electrical nerve stimulation) and laser therapy were used, in order to improve the results obtained. Although the use of TENS may be considered an alternative method of treatment in patients with TMJ, its benefits in therapy depend more on the clinician's experience [15, 16]. The analgesic and biotrophic effects of the laser are useful in reducing the pain experienced by the patients and can be considered as a non-invasive treatment option [17]. Prosthetic therapy aimed at occlusal adjustment is considered by some experts to be useful, especially in combination with other forms of therapy, such as psychological counseling or physiotherapy [18]. In this research, prosthetic therapy was beneficial as a singular treatment or associated with physiotherapy. The orthodontic treatment was adapted to each case because the patients had different diagnoses, each class of malocclusions requiring a different therapeutic approach [19, 20].

The use of NSAIDs (non-steroidal anti-inflammatory drugs) [21] and novel developed compounds [22,23] (some of them plant-based [24-26]) are beneficial in other studies, as well, as being useful in both reducing pain and inflammation.

Considering the aim of the study, it is important to highlight the fact that only a few studies investigate possible connections between parafunctions, bad oral habits and TMJ pathology. Bad habits play an important role in the occurrence of TMJ disorders [27].

Parafunctions, especially bruxism is also a frequent risk factor noticed in patients with this pathology. This affects, also, young patients and this may lead to the occurrence or maintenance and aggravation of the pathology of the temporomandibular joint [28].

The study carried on by Iodice G. et al. (2019) demonstrated the correlation between TMJ pain and the presence of oral bad habits [27], confirmed by other studies as well [10], from a total of 21 items only 4 were used. The difference between this scientific research and the research of Iodice G. et al. is that here the entire OBC scale was used. The authors consider the use of the 21 items as being necessary for establishing the OBC score, which is suggested by the rules of interpreting the scale as well.

The study published by R. Fadeyev and V. Parshin (2018) followed the efficacy of physiotherapy (63 patients) in TMJ pathology and in improving masticatory muscle para-function. The results proved increased efficacy at $12.49 \pm 2.18\%$ compared to traditional treatment methods [29].

The literature refers to pharmacological treatment as dopaminergic agonists, non-benzo-diazepine hypnotics, analgesics, anticonvulsants and botulinum toxin, anxiolytics and buspirone in severe cases of bruxism. In our study, the medications used were oral analgesics (gabapentin and pregabalin) or topical analgesics, NSAIDs, myorelaxants, corticosteroids and hyaluronic acid infiltrations.

Following the administration of drugs (oral or topical), the effects on oral parafunctions were found, as follows: the association of physical therapy with the administered medication decreases the symptoms of TMJ disorders and the incidence of parafunctions evaluated with OBC. This is explained by better pain control and decreased inflammation, all of which lead to improved joint mobility.

Occlusal adjustment (therapy of choice for maintaining functional comfort) is applied to minimize the effects triggered by teeth grinding and clenching [30]. In our study, this procedure was applied to 91 patients.

In the presented study, the surgical treatment consisted of the repositioning of the condyloid in the glenoid cavities, in the patients with mandibular tension, while in the patients with severe facial dimorphism, orthogonal surgical interventions were performed. The value of the OBC score significantly decreased after 21 days from 41.00 ± 6.56 to 27.20 ± 10.71 ($p=0.040$).

TENS in dentistry was first described in 1967 by Shane and Kessler; it is considered to be an adverse reaction-free maxillofacial pain relief therapy [31].

In establishing the treatment plan, it is essential to consider the biopsychosocial model for pain control [32, 33].

As limitations of the study, first of all, we must mention that triggering factors such as: emotional stress, depression, sleep disorders or hormonal factors were not evaluated. Another limitation could be the fact that we do not have a long-term study of the presence of para-functions after the treatment applied for the follow-up of OB recurrence. Some strengths of this study could be the significant number of patients recruited and the variety of treatments applied, in addition to the remarkable results, which proved to be the optimal treatment choice.

4. Materials and Methods

4.1. Study Design

The present prospective cohort study was conducted on consecutive patients diagnosed with TMJ disorder (TMD), admitted to the Oral and Maxillofacial Surgery Clinic Timișoara, Romania, between January 2019 and August 2021.

The initial group consisted of 503 patients but after applying the exclusion criteria, 140 patients were selected as the final study group.

For evaluating the effect of the physiotherapeutic treatment, we divided the group of 140 patients into two sublots:

1. without physiotherapy treatment – LOT - PKT, (N=96);
2. with physiotherapy – LOT + PKT (N=44).

The inclusion criteria were a diagnosis of confirmed ATM disorder (muscular and articular), according to the Diagnostic Criteria for TMD (DC/TMD). The patients included in the study, presented a diagnostic of TMD, with at least one of the following etiology identified: joint disorders (disc displacement affecting mobility), hypomobility (by fibrosis or ankylosis) or hypermobility disorders (traumatic injury), joint diseases (osteoarthrosis, osteoarthritis, systemic diseases) [3]. The etiology confirmation was based on the history, panoramic X-rays and MRI (patients who are psychically and emotionally stable and compliant with treatment). Excluded criteria were genetic syndromes with osteoarticular implication, degenerative muscular diseases, chronic ethanolic problems, severe communication deficiency, cognitive impairments, severe cardio-vascular affections, psychological disorders and/or without judgment; also, they excluded the patients and/or relatives who refused to take part in the study or those subjects who dropped out during the study. Moreover, those patients who registered three consecutive treatment procedures (prosthetic, orthodontic, surgical) have been also excluded.

A total of 145 patients were declared eligible, but 5 patients were lost to follow-up because they did not complete all the required assessments; figure 1 summarizes the information provided above.

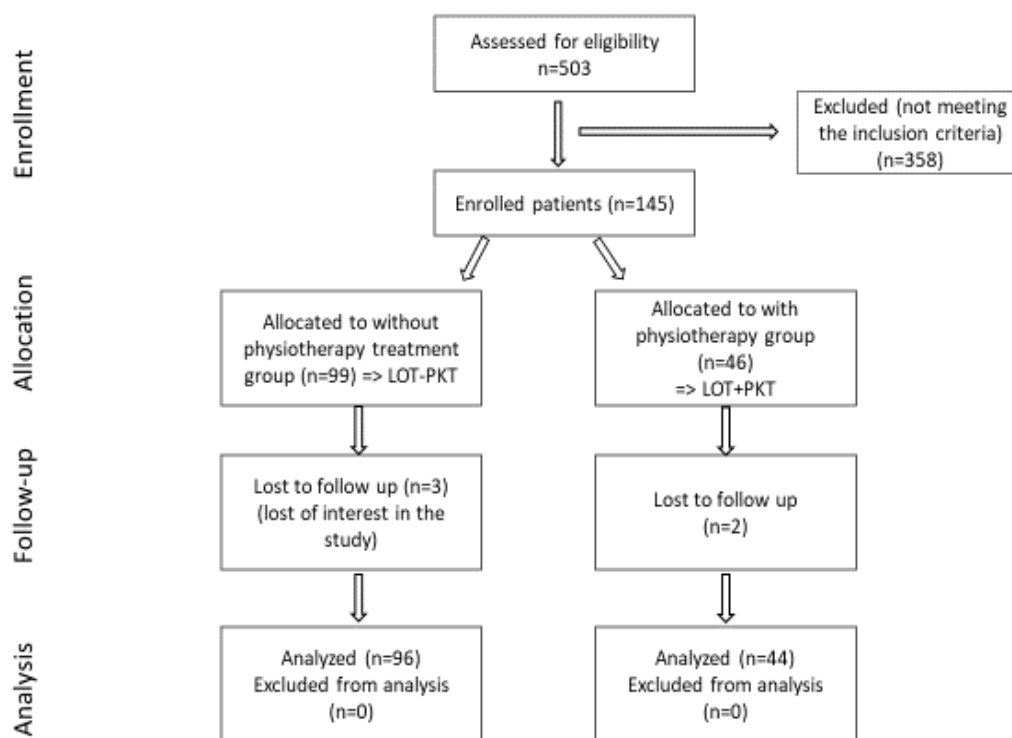


Figure 1. CONSORT flow diagram of the study.

4.2. Clinical and Paraclinical Examination

For the diagnosis of TMJ we used Axis I TMD Pain and Axis II DRC / TMD. The pain was present in all patients included in the study; myofascial pain present on palpation and caused by jaw mobilization was identified in 98 patients. Arthralgias were identified in all patients followed. Movement limitation was present in 91% of patients in the study group. Following the disorder history, the clinical examination and the radiological investigations, all the patients were given a correct diagnosis of the TMJ disorder, muscular or articular.

Panoramic radiographs and MRI were used for the imagistic investigation (figure 2). The radiology results focused on both temporomandibular joints, highlighting the pathological changes that are being compared, normal structure vs pathological structure. So, the presence of possible uni- / bilateral asymmetries or alterations could easily be noticed.

The therapeutic approach consisted of conservative or surgical treatment, in situations where conservative treatment was insufficient. To quantify the effects of treatment, a reassessment of all patients was performed after 21 days.

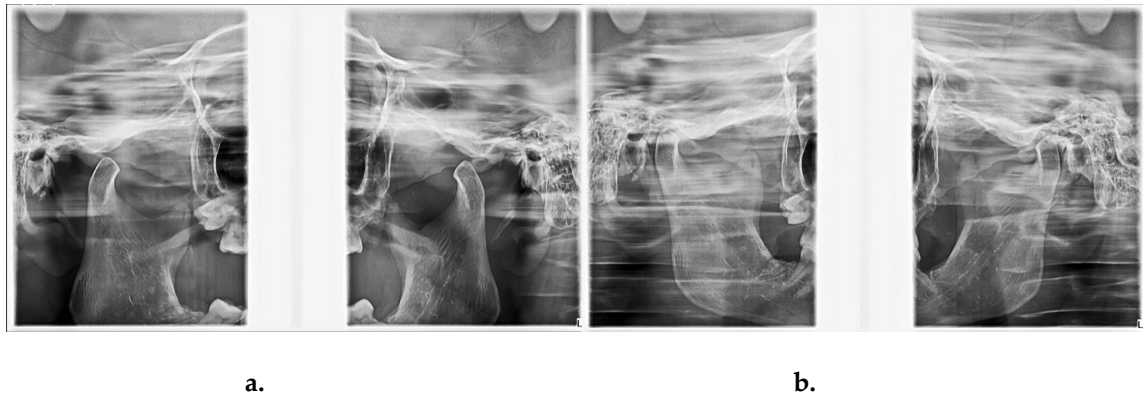


Figure 2. Panoramic radiography, lateral imaging: a. open mouth and b. closed mouth.

4.3. Study Tools

All patients were assessed for pain using the VAS scale (0-100 mm) at baseline and 21 days. To quantify the bad habits of the patients with TMJ affection, the Oral Behaviors Checklist scale (OBC) was used (21 items). The score is between 0-84 points [13]. In the current study, we considered values greater than 25 to estimate the increased risk.

4.4. Therapy Methods Used in the Treatment of TMJ Disorders

The therapeutic approach of TMJ must be multidisciplinary. The treatment is targeting the joint structure, the neighbor structures, and the neuro-muscular system but is also targeting the social environment which is impacting the pathology set going [34,35]. In general, the treatment is conservatory. Most of the time pain killers or anti-inflammatory medication, local infiltrations, orthodontic treatment, prosthetic or physio-therapy (electrotherapy of kinesiotherapy), all work quite well. The electrotherapy procedures often applied are transcutaneous electrical nerve stimulation (TENS), ultra-sonophoresis (with AINS), but also laser therapy with biotrophic and biostimulant effects.

4.5. Statistical Analysis

The processing of the data was performed using the SPSS 20 program. Average values of the parameters, frequency intervals, standard deviations and tests of statistical significance were calculated by using the Student method (test t) and χ^2 . To compare studies, ANOVA, and the level of statistical significance of 0.05 were used, also considering the statistic indicator "sensitivity to change" evaluated by the use of Effect Sizes (ES).

4.6. Ethical Considerations

The research was conducted according to the Declaration of Helsinki (Ethical Principles for Medical Research Involving Human Subjects) and with the approval of the Ethical Committee of the Municipal Clinical Hospital of Timișoara, Romania (Decision no. 30088/10 of December 2019).

5. Conclusions

The study demonstrated the need for a multidisciplinary approach and a multimodal combination of therapeutic resources, depending on the etiology of TMJ disorders and the response to treatment. Physiotherapy is successfully applied in the early stages associated with prosthetic, orthodontic and drug treatment.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy reason.

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Conflicts of Interest: The authors declare no conflict of interest.

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