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RESEARCH ARTICLE

Transdisciplinary Management of Temporomandibular Disorders

Zenati L, Chouakri S, Ait Mehdi M

Mujahid Doctor Youcef El-Khatib University of Health Sciences, Faculty of Dental Medicine, Mustapha University Hospital, Algeria.

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Corresponding Author: Zenati L, Mujahid Doctor Youcef El-Khatib University of Health Sciences, Faculty of Dental Medicine, Mustapha University Hospital, Algeria.

Abstract

Introduction: Temporomandibular disorders (TMD) are common and multifactorial, and are often managed along a therapeutic gradient running from reversible measures to invasive procedures. We assessed the contribution of a transdisciplinary management programme, run at the occlusodontics unit of Mustapha University Hospital, to pain, mandibular kinematics, functional disability and joint noises.

Methods: This prospective, descriptive and analytical clinical study ran from October 2018 to February 2026 and included 150 patients, or 300 temporomandibular joints (TMJ), diagnosed according to the DC/TMD criteria. Treatment combined behavioural advice, medication, psychological support, functional rehabilitation and one of four types of occlusal splint, according to the diagnosis. Pain was scored on a visual analogue scale, and the condylar slope was measured on axiographic tracings before and three months after splint wear.

Results: The diagnosis was muscular involvement in 12 TMJs, reducible disc displacement in 160, acute irreducible displacement in 96, chronic irreducible displacement in 9 and degenerative disease in 23. Pain reduction reached 80% with the neuromuscular reconditioning splint, 97% with the anterior repositioning splint and 100% with the joint decompression splint in an anterior position, whereas simple decompression failed in all five cases in which it was used. The condylar slope increased in every diagnostic group, from 2° in reducible disc displacement to 32° in degenerative disease ($p = 0.017$).

Discussion and conclusion: These findings support an early, coordinated combination of interventions tailored to the type of TMD and the patient's profile, rather than a strictly sequential escalation. The study is single-centre and uncontrolled, and the combination of treatments does not allow the specific effect of the splint to be isolated; multicentre comparative studies are needed to confirm these observations.

Keywords: Temporomandibular Disorders, Occlusal Splint, Joint Decompression, Axiography, Transdisciplinary Management, Pain.

1. Introduction

Temporomandibular disorders (TMD) encompass the painful and functional conditions affecting the temporomandibular joint and the masticatory muscles. Pain, localised to the joint, occurs at rest as well as on movement or on palpation of the jaw, with no known cause in a substantial proportion of cases [1]. Clinically, three cardinal signs are found to varying degrees: joint noises, pain and mandibular dyskinesia. For many patients, everything begins with a simple click that, at first, nothing distinguishes from a healthy joint.

These disorders are not rare. They mainly affect adults between 20 and 45 years of age, with three women for every man, and the OPPERA study puts their annual incidence at 4% [2]. Between 50 and 75% of the population presents at least one sign of TMD, but only 3 to 12% of individuals seek treatment. This gap

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between the frequency of signs and the demand for care makes it necessary to decide whom to treat, and how.

Conventional management is based on the therapeutic gradient, which Orthlieb and Giraudeau describe in ten steps [3]. It begins with therapeutic education, maxillofacial physiotherapy and first-line analgesics, then moves through the occlusal splint, hypnotherapy, the neuromuscular splint, additive and/or subtractive occlusal modifications and second-line pharmacological treatments, to end with botulinum toxin, platelet-rich fibrin (PRF), hyaluronic acid and, as a last resort, TMJ surgery. The first steps are simple, minimally invasive, reversible and supported by a high level of evidence. The last are more complex, more invasive and sometimes irreversible, and their level of evidence is lower.

Recent work tempers this linear logic. The report of the National Academies of Sciences, Engineering, and Medicine of the United States [2] provided a conceptual basis for the development of TMD care networks, as illustrated in Europe by CEPROF in France, the European Academy of Orofacial Pain and Dysfunction and the INFORM network. These structures share a common language, a horizontal organisation of care and networked working. It is in this spirit that an occlusodontics unit, supported by an interdisciplinary team and a defined care pathway, has operated at Mustapha University Hospital, Algeria, since October 2018. We report here the experience of this unit, with the aim of testing and evaluating the contribution of transdisciplinary treatment in the management of TMD.

2. Materials and Methods

This was a prospective, descriptive and analytical clinical study, conducted at the occlusodontics unit of the prosthodontics department of Mustapha University Hospital from October 2018 to February 2026. Patients were managed by an interdisciplinary team within a well-defined care pathway, which could call on functional rehabilitation, physiotherapy, rheumatology, maxillofacial surgery and psychology.

The sample comprised 150 dentate patients, or 300 TMJs examined, aged between 20 and 40 years and with no previous treatment. The positive diagnosis was classified into five groups according to the DC/TMD diagnostic criteria [5]: muscular involvement, reducible disc displacement, acute irreducible disc displacement, chronic irreducible disc displacement and degenerative disease.

The therapeutic objectives were more palliative than curative: to eliminate pain, to optimise mandibular kinematics, to reduce functional disability and to reduce joint noises. When the joint was noisy without disability or pain, the attitude adopted was therapeutic abstention, with an explanation of the origin of the noise and reassurance about its favourable course. In the other cases, several modalities could be combined. Behavioural measures comprised therapeutic education, dietary advice (avoiding hard foods, chewing gum and bulky sandwiches), functional advice on chewing, swallowing and breathing, gymnotherapy and cognitive behavioural therapy, with the patient placed in the position of an active participant in his or her own care. First-line pharmacological treatment was prescribed according to the clinical case. Psychological follow-up, functional rehabilitation and botulinum toxin injections (Dysport, 20 to 25 IU per injection) completed the programme in some of the patients with myalgia. Mandibular physiotherapy exercises combined passive decoaptation mobilisations, work against resistance and proprioception exercises.

Four types of occlusal splint were used according to the diagnosis. The neuromuscular reconditioning splint was intended for myalgia, reducible disc displacement and bruxism. The anterior repositioning splint was reserved for acute and chronic irreducible disc displacements. For degenerative disease, we first recommended a joint decompression splint, but it failed after two months of wear, and we therefore turned to joint decompression splints in an anterior position. The latter was made after programming the articulator, by interposing a 2 mm protrusive wedge and a radiographic film between the condylar ball and the roof, and then fabricating the splint in wax in the anterior position. The splint was worn at night, with check-ups at one week, two weeks, one month, two months and three months.

The primary outcome was pain, measured on the visual analogue scale (VAS), from “no pain” to “worst pain imaginable”. The efficacy of each splint was expressed as the reduction in the pain score. The condylar slope was recorded from axiographic tracings before splint wear and again three months later.

3. Results

Of the 150 patients, or 300 TMJs, reducible disc displacement accounted for more than half of the diagnoses, ahead of acute irreducible disc displacement. Degenerative disease affected 23 joints (Figure 1).

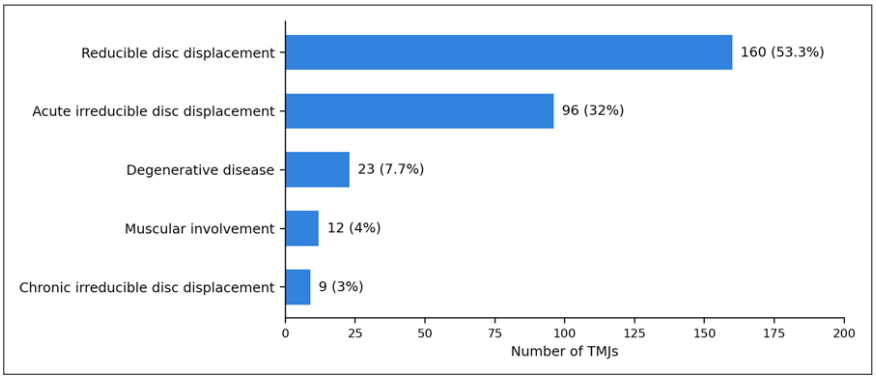


Figure 1. *Distribution of the 300 TMJs according to the positive diagnosis.*

The treatment implemented varied markedly from one group to another (Table 1). All joints received an occlusal splint. Pharmacological treatment was given in all muscular involvements and acute irreducible disc displacements, but in only 60 of the 160 reducible displacements and 13 of the 23 degenerative diseases, and in none of the chronic irreducible displacements. Psychological follow-up concerned 58 joints with reducible displacement, 42 with acute irreducible displacement and 7 with degenerative disease. Functional rehabilitation was added in all cases of muscular involvement and acute irreducible displacement, in 60 cases of reducible displacement and in 5 cases of degenerative disease. Patients with chronic irreducible displacement received only the splint.

Table 1. *Therapeutic modalities implemented according to the diagnosis (n = 300 TMJs).*

Diagnosis	N	Pharmacology	Psychology	Functional rehabilitation	Occlusal splint
Muscular involvement	12	12	4	12	12
Reducible disc displacement	160	60	58	60	160
Acute irreducible disc displacement	96	96	42	96	96
Chronic irreducible disc displacement	9	0	0	0	9
Degenerative disease	23	13	7	5	23

The neuromuscular reconditioning splint was fitted for 12 muscular involvements and 160 reducible disc displacements, and the anterior repositioning splint for 10 persistent reducible displacements, 96 acute irreducible displacements and 9 chronic irreducible displacements. In degenerative disease, the joint decompression splint was made in 5 cases, after which the joint decompression splint in an anterior position was fitted in all 23 cases. The efficacy on pain depended on the type of splint (Figure 2). It reached 80% for the neuromuscular reconditioning splint, 97% for the anterior repositioning splint and 100% for the joint decompression splint in an anterior position. The joint decompression splint ended in failure after two months of wear in the five cases in which it was used, which led us to adopt another alternative.

The analytical study of the efficacy of the occlusal splint found a positive correlation between the type of splint and its efficacy, assessed by the score of pain reduction. The correlation coefficient r = 0.93 indicates a positive correlation between the type of splint and its efficacy, except for the decompression splint, for which there was no correlation (r = 0).

Table 2. *Analytical study of the efficacy of the occlusal splint used.*

Type of splint	Splint efficacy (score: pain reduction)
Neuromuscular reconditioning splint	80%
Anterior repositioning splint	97%
Joint decompression splint	0%
Joint decompression splint in anterior position	100%

Axiography showed that the condylar slope increased in all groups after three months of splint wear (Figure 3). The gain was 26° in muscular involvement, 28° in acute irreducible displacement, 7° in chronic irreducible displacement and only 2° in reducible displacement. It was greatest in degenerative disease, where the slope rose from 0° to 32° while pain decreased by 100%. Pain reduction was 100% in muscular involvement, 80% in reducible displacement, 97% in acute irreducible displacement and 88% in chronic irreducible displacement. The difference between the slopes before and after splint wear was significant (p = 0.017, Student's t-test).

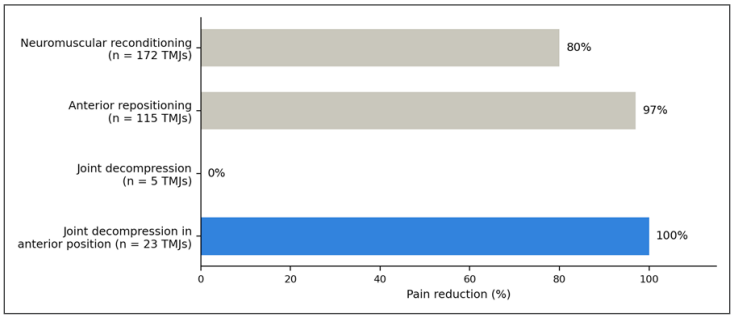


Figure 2. *Efficacy of the splint on pain according to its type.*

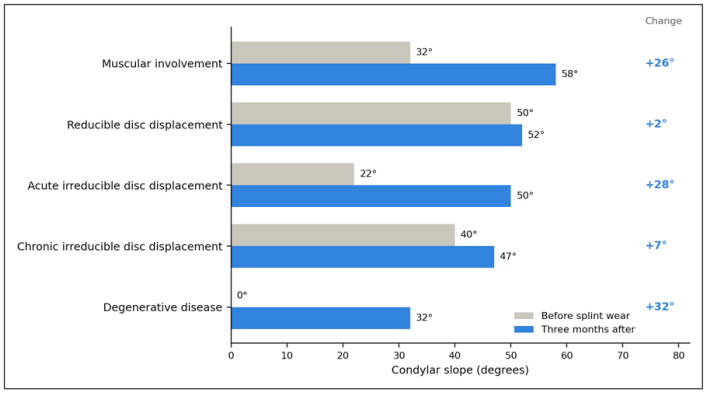


Figure 3. *Condylar slope on axiography before and three months after splint wear.*

4. Discussion

This series of 150 patients shows that transdisciplinary management, centred on the occlusal splint and combined with behavioural, pharmacological, psychological and rehabilitative measures, is accompanied by a marked reduction in pain and a change in the condylar slope three months after the start of splint wear. The most striking result concerns degenerative disease, a group nevertheless reputed to be difficult: joint decompression in an anterior position abolished pain in all 23 cases, whereas the joint decompression splint had failed in the five cases in which it was first attempted. We find here the flat axiography, with a null slope, described in our case series of TMJ osteoarthritis.

Our results fall within the debate on the very structure of management. The therapeutic gradient retains the favour of recent literature because it limits irreversible procedures and favours reversible treatments as first-line options [3, 6]. It nevertheless appears insufficient for a condition whose aetiology is multifactorial. Recent reviews stress that efficacy rests on the combination of interventions rather than on their sequential escalation, and that optimal management requires a multidisciplinary team able to draw up personalised plans according to the type of TMD and the patient's profile [7, 8]. Henien et al. summarise this difficulty by recalling that no single approach suits every case [9]. The gradient therefore remains a necessary but insufficient framework, and the best strategy seems to us to lie in combining it with a more flexible and more comprehensive transdisciplinary approach. This combination joins the prudence of the one with the flexibility of the other.

The role of the occlusal splint has long been debated. The most recent meta-analyses of randomised trials acknowledge its efficacy on pain, comparable or superior to that of other conservative treatments [10]. Ferrillo et al. reach a similar conclusion for conservative approaches as a whole [11]. Our results go in the same direction, but they do not allow the specific effect of the splint to be isolated, since patients also benefited from advice, medication, rehabilitation or psychological follow-up. The mechanisms at play are, moreover, probably multiple: the nociplastic nature of pain in many cases of TMD [4] justifies the psychological and cognitive behavioural support that we offered.

The efficacy of joint decompression in an anterior position in degenerative disease deserves particular comment. Thorpe et al. report that the anterior repositioning splint and advice therapy are the most effective treatments for reducing pain and noises in degenerative TMJ disease [12]. Several mechanisms can be invoked: a reduction in mechanical stress, with less load on the cartilage and less synovial inflammation, and better lubrication through improved diffusion of synovial fluid, associated with reduced muscle contraction. We must nevertheless acknowledge that we found no scientific article dealing directly with this splint, so these mechanisms remain hypotheses. The splint does not completely halt the

progression of degenerative disease, and its success depends on the stage of degeneration, the precision of the fit and the quality of overall management.

The comparative analysis of the studies presented in Table 3 highlights the potential value of occlusal splints in the management of temporomandibular disorders (TMD), in particular for pain reduction and functional improvement. The results must nevertheless be interpreted in light of the diversity of the devices studied, the methodologies used and the populations included. The distinction between stabilisation splints and anterior repositioning splints (ARS) is particularly important, as their therapeutic indications and mechanisms of action are not necessarily identical.

The data attributed to Zhang et al. (2020) [13] report a pain reduction of the order of 2 to 4 points on the visual analogue scale (VAS), associated with a significant improvement in mouth opening. The results attributed to Al-Moraissi et al. (2020) [14], presented as coming from a network meta-analysis, likewise indicate a significant reduction in pain with several therapeutic modalities. This methodological approach allows different interventions to be compared indirectly from a network of clinical trials. Concerning anterior repositioning splints, the data attributed to Wang et al. (2025) [15] show a 3.2-point reduction in VAS and an efficacy superior to that of physiotherapy. The review attributed to Alqutaibi et al. (2023) [16] reports an overall improvement with different types of splints, accompanied by functional improvement. In the absence of sample size, quantitative estimate and confidence interval, this observation mainly provides qualitative insight. It does not allow the efficacy of the treatment to be quantified precisely or a reliable hierarchy between devices to be established. This limitation illustrates the importance of distinguishing narrative reviews from systematic reviews with meta-analysis, which provide quantitative estimates when the data are sufficiently homogeneous.

Table 3. *Studies of occlusal splints in TMD cited in the discussion, as reported in the text.*

Study	Design	Main findings reported
Zhang et al., 2020 [13]	Systematic review of randomised controlled trials	Pain reduction of 2 to 4 points on the VAS; significant improvement in mouth opening
Al-Moraissi et al., 2020 [14]	Network meta-analysis of randomised controlled trials	Significant pain reduction with several therapeutic modalities
Wang et al., 2025 [15]	Systematic review and meta-analysis (anterior repositioning splints)	VAS reduction of 3.2 points; efficacy superior to physiotherapy
Alqutaibi et al., 2023 [16]	Review (types and effectiveness of splints)	Overall improvement with different splint types and functional improvement; no sample size, quantitative estimate or confidence interval

Overall, the studies reviewed suggest that occlusal splints may contribute to improving pain and certain functional parameters in patients with TMD. Nevertheless, the heterogeneity of splint types, diagnoses, outcome measures and statistical methods limits direct comparisons. It is therefore essential to distinguish the results concerning muscular TMD, disc displacements and degenerative TMJ disease. Pain reduction must also be distinguished from functional improvement and from morphological or biomechanical changes.

This work has important limitations. It is a single-centre study without a control group, although it is prospective. The combination of several treatments in the same patient makes it difficult to attribute effects. The definition of the percentage of pain reduction is not made explicit, and objective follow-up is documented only at three months. Multicentre studies with a comparator group and standardised outcome measures would make it possible to confirm these observations and to clarify the place of each modality in the overall strategy.

5. Conclusion

The management of TMD is moving from a model based on the therapeutic gradient towards a networked transdisciplinary approach that integrates personalised medicine. In our experience of 150 patients, the combination of an occlusal splint adapted to the diagnosis with behavioural, pharmacological, psychological and rehabilitative measures was accompanied by a marked reduction in pain and a change in the condylar slope, with a particularly favourable result for joint decompression in an anterior position in degenerative disease. There is no universal treatment for TMD. The best strategy is progressive, conservative, individualised and multidisciplinary, and can be summed up in five requirements: the right method, for the right patient, at the right time, with the right objective and the right support. The collaboration between dentists, physical and rehabilitation medicine,

physiotherapists, psychologists and medical specialists constitutes, in our view, a major step towards a more precise medicine better adapted to each patient.

Declarations

Conflicts of interest: the authors declare no conflicts of interest.

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