

# The Use of Front Plateau in the Treatment of Temporomandibular Disorders: A Case Series and Literature Review

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**Abstract:** Temporomandibular disorders (TMDs) are conditions with multifactorial etiology and complex treatment. Among the non-invasive therapeutic possibilities for these conditions is the Front Plateau, a partial anterior plate made from colourless self-curing acrylic resin. It is a simple procedure that can be carried out in a single clinical session promoting muscle relaxation to reduce symptoms associated with TMDs. This study aims to report a prospective, consecutive, single-centric case series to evaluate the Front Plateau's effectiveness in patients with temporomandibular disorders. A questionnaire adapted from the Research Diagnostic Criteria for TMDs was used and 4 patients were treated with the Front Plateau plaque. Patients were monitored after 5 and 9 months, respectively, after starting to use the Front Plateau. Of the 4 cases listed, 2 showed significant improvement in initial signs and symptoms. Front Plateau may be a favourable treatment option for patients with TMD, if the guidelines are followed. Clinical trials on this modality should seek to minimize possible biases and limitations associated with the design of this type of research.

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## Introduction

Temporomandibular disorders (TMDs) are a set of signs and symptoms that may be of joint and/or muscle origin and are associated with masticatory muscles, the temporomandibular joint (TMJ), bone tissues, and adjacent soft tissues (Melchior et al., 2019; Eriksen et al., 2020). These conditions are among the most common pains of non-dental origin, with an overall prevalence of approximately 31%, and represent a relevant public health problem (Valesan et al., 2021). According to Blanco-Hungria et al. (2016), women between 30 and 40 years old are the group most affected by these conditions.

Known for their complex and multifactorial etiology, TMDs can be categorized into two axes: axis I, associated with physical conditions and related to nociceptive stimuli, and axis II, characterized by psychological factors that can cause or influence the pain experience of patients (Okeson, 2013; Schiffman et al., 2014; González-Sánchez et al., 2023). Among the etiological factors that can be listed as TMDs, are anatomical, occlusal, neuromuscular, psychological, hormonal, trauma, and/or parafunctional habits such as bruxism, tooth clenching, and nail-biting, which may be influenced by the emotional state of the patient (Cruz et al., 2020).

Generally, the signs and symptoms reported by individuals who suffer from TMDs include pain on palpation, joint noises and cracks, tension-type headaches, otalgia, pain in the face region, muscle fatigue, spasms, a change in mandibular trajectory during mouth opening and closing, bruxism, and tooth sensitivity due to wear (Felício and Braga, 2005; Sassi et al., 2018). Therefore, therapeutic approaches involve making rigid occlusal splints (total or partial), guidelines for patients with TMDs, laser therapy, physiotherapy, pharmacotherapy, and acupuncture, among other approaches that may or may not be associated (Piozzi and Lopes, 2002; Al-Moraissi et al., 2020).

In this perspective, a type of treatment that could be adopted in patients with complaints related to TMD is the confection of a partial anterior plate, commonly made with colourless self-curing acrylic resin and known as Front Plateau. Its confection must be carried out considering the anterior guides in the protrusion movements and the canine guide in the lateral movements, with disocclusion of the posterior teeth (Dekon et al., 2007). It is a technique indicated for a short period of time due to the possibility of extrusion of the posterior teeth since they do not touch during the use of the plaque (Okeson, 2013).

Although Front Plateau does not have a well-understood mechanism of action, the literature

associates its effectiveness with muscle relaxation obtained through modification of proprioception, occlusion, vertical dimension, musculoskeletal stabilization, and the placebo effect (Oliveira, 2002). Although some reports show advantages over the use of the Front Plateau, there is still a lack of studies about its use as a therapeutic modality for patients with TMDs (Gomes et al., 2018; Belchior et al., 2021). Therefore, the objective of this study was to present a prospective, consecutive, and unicentric series of cases where the Front Plateau was used as a treatment for patients with TMD.

## Front Plateau: What is it, what is it for and why use it?

It is very common to find studies comparing occlusal splints with different therapeutic modalities. However, few studies evaluate the effectiveness of different occlusal devices against each other (Pfcifer et al., 2017; Al-Moraissi et al., 2022). The evaluation of the performance of therapeutic modalities by clinical trials can suffer from the Hawthorne effect, where participants tend to behave differently when they are taking part in a research study (Sedgwick and Greenwood, 2015). This can lead some researchers to associate the positive effect of occlusal splints with a placebo effect. However, a systematic review with meta-analysis revealed that the action of occlusal splints goes beyond this influence (Alkhutari et al., 2021).

Partial-coverage occlusal splints have emerged as an alternative to rigid full-coverage occlusal splints, which can involve a series of clinical steps, requiring more clinical time (Januzzi et al., 2010; Al-Moraissi et al., 2020; Alkhutari et al., 2021). In this context, the Front Plateau and a prefabricated device used by some professionals, the nociceptive trigeminal inhibition tension suppression system (NTI-tss), are possibilities reported in the literature (Jokstad, 2009). The main mechanism of action of both is the disocclusion of the posterior teeth, thus relieving the hyperactivity of the chewing muscles and protecting the teeth (Klasser and Greene, 2009). However, unlike the Front Plateau, which involves a larger number of teeth, the NTI-tss is small and has a greater risk of being aspirated by the patient, as reported in some studies. In addition, there is a need for a greater number of adjustments in the mouth (Jokstad et al., 2005; Stapelmann and Turp, 2008).

Therefore, the Front Plateau can be indicated and has been used by some researchers, thanks to its easy manufacture in a single session and low cost (Doepel et al., 2012; Gomes et al., 2018). In addition, it is possible to find in the literature the use

of the device to establish differential diagnoses of conditions associated with TMDs that are difficult to identify (Belchior et al., 2021). In a study of 20 patients comparing the use of the Front Plateau with a rigid full-coverage occlusal splint to control TMDs, it was found that there was no significant difference between the devices. Evaluations were conducted using electromyography and showed that both devices appear to be effective in controlling muscle pain associated with TMDs (Dahlström and Haraldson, 1985). These data corroborate another crossover clinical trial conducted with 71 patients, comparing patient satisfaction with the use of a full-coverage splint without the occlusal portion (placebo), the Front Plateau and a rigid full-coverage splint (Greene and Laskin, 1972).

Because this device only covers the anterior teeth, its use is limited to short periods of time. This is because, when used for prolonged periods of time, they can induce extrusion of the posterior teeth due to the lack of contact and mobility of the anterior teeth due to the accumulation of load during the use of the Front Plateau (Jokstad et al., 2005; Klasser and Greene, 2009).

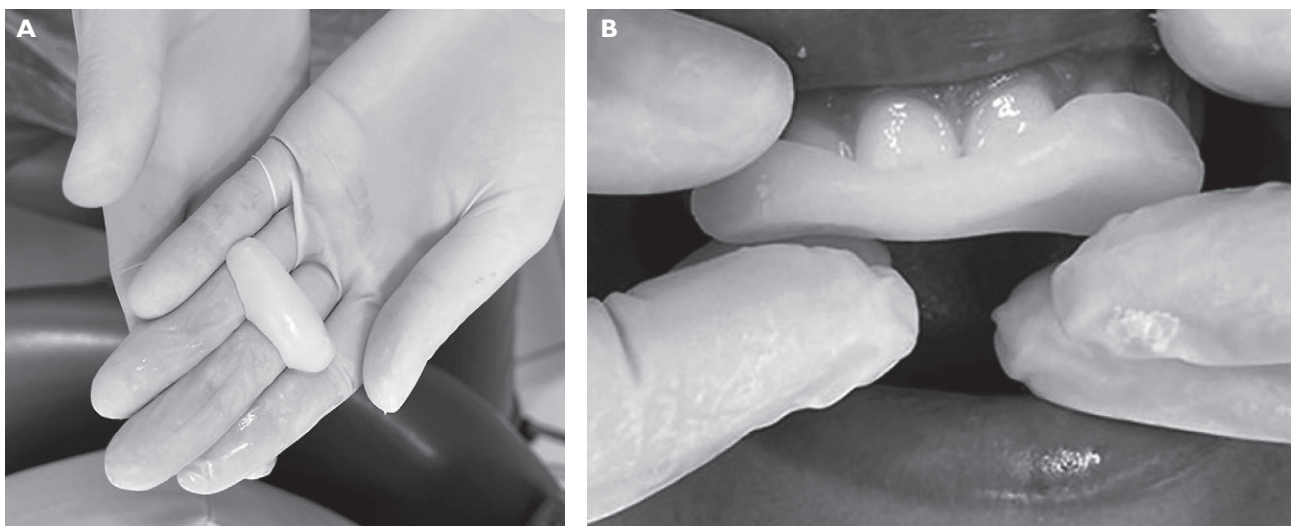
## Material and Methods

This case series was prepared at the TMD clinic and conducted in accordance with the Declaration of Helsinki of 1975, revised in 2013 (World Medical Association, 2013). All participants provided informed

consent forms. The anamnesis, clinical examination, diagnostic impressions, and proposed therapeutic modalities were carried out according to the clinical form adopted at the institution. Mouth opening characteristics and the presence of pain on palpation in muscle and joint regions were recorded according to a questionnaire adapted from the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD).

Therefore, the pain reported by the patients was classified on a scale from 0 to 3, where 0 – no pain, 1 – mild pain, 2 – moderate pain, and 3 – severe pain. After 5 months of starting to use the interocclusal devices, the patients were contacted via telephone to follow-up on the evolution of the treatment. This case series was developed following the preferred reporting of case series in surgery – PROCESS guideline (Agha et al., 2020).

To manufacturing the Front Plateau, some materials are needed: liquid and powder of self-curing acrylic resin; measuring pot; Vaseline; Paladon glass pot; carbon paper; milling cutters for finishing and discs for polishing; straight nosecone handpiece and low-speed handpiece; Spatula n° 31; Muller forceps; clinical kit. After assembling the work table, the powder and liquid of the self-curing acrylic resin are handling. Then, the resin in its rubbery phase is adapted to the patient's teeth (Figure 1A and B). After the material has completely cure, it is necessary to make occlusal adjustments (Figure 2A and B). After final adjustments, finishing and polishing (Figure 3A and B) the Front Plateau is ready.



*Figure 1: Adaptation of the polyacrylic resin to the patient's teeth. A) After reaching its rubber phase, the patient's teeth were isolated with liquid Vaseline and the resin was removed from the Paladon glass pot and manipulated to obtain a format similar to that shown in the image. B) Then, the resin was adapted to the patient's upper anterior teeth. To allow free manipulation of the material, the operator rubbed Vaseline on the fingers so that the material would not stick. In addition, at some moments, the patients were instructed to close their teeth so that they could make small marks where the lower anterior teeth would fit. To avoid excessive heating during the setting of the material, throughout the entire process, the resin was removed from the patient's mouth and immersed in water.*

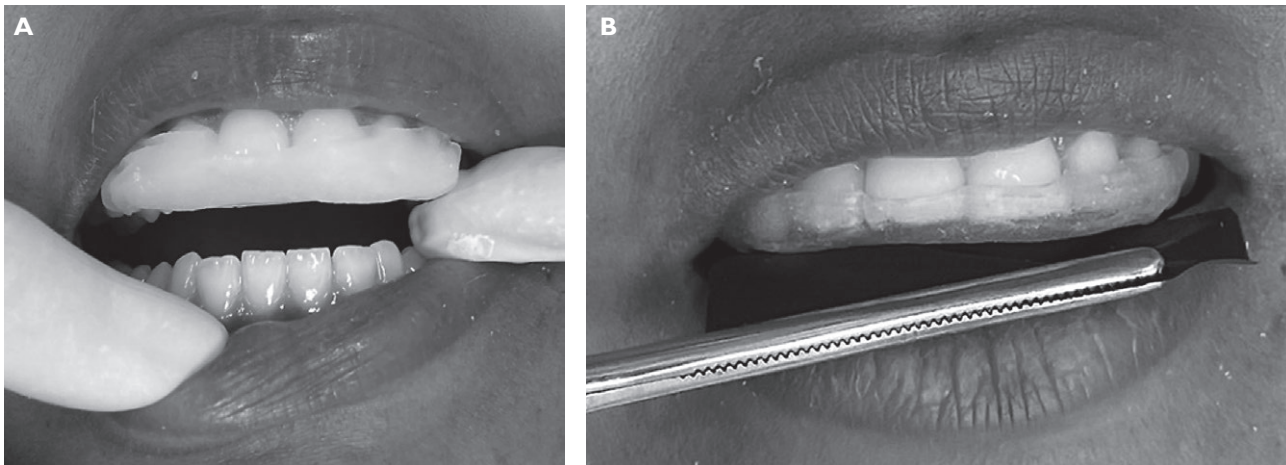


Figure 2: Checking the contacts between the teeth. A, B) After setting the material, the contact points between the upper and lower anterior teeth were checked, assessing the need for adjustments before finishing and final polishing.

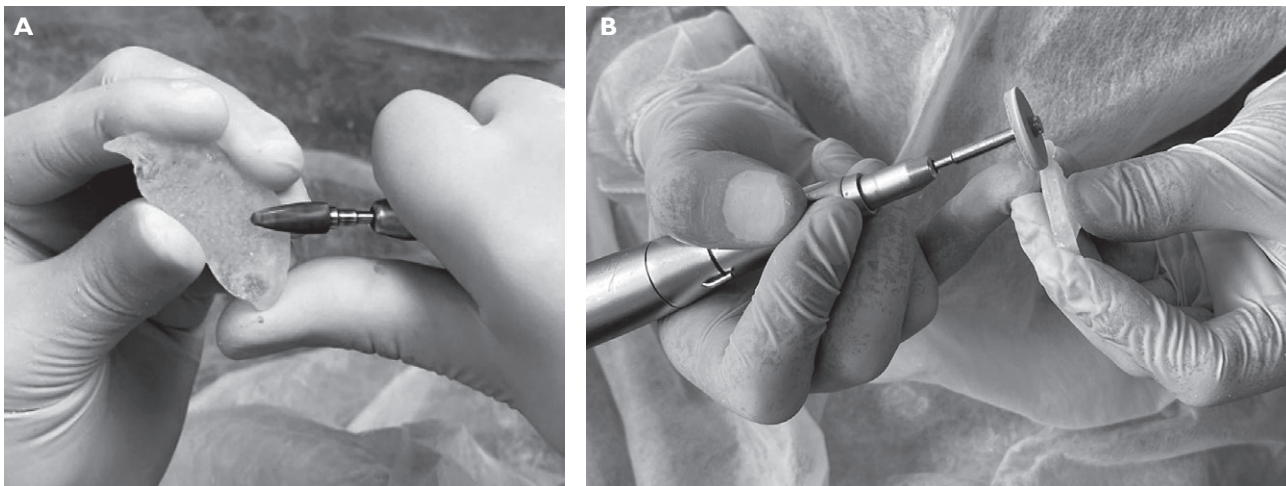


Figure 3: Necessary adjustments, finishing and final polishing. A) When necessary, adjustments were made to the Front Plateau so that all the upper and lower anterior teeth touched each other during its use. B) Then, the final finishing and polishing were carried out with abrasive discs using a straight nosecone handpiece.

## Cases description

### Case 1

A 26-year-old female was referred by the Otorhinolaryngologist with the following report: frequent otalgia on the left ear, without signs of otitis, with spontaneous improvement. Audiometry showed no alterations. Mild pain on palpation of the left TMJ and slightly limited mouth opening. The patient was using Otosylase 10,000 IU, a drug with anti-inflammatory and analgesic actions indicated to treat external ear inflammation. During the clinical examination, a difference between the centric relation (CR) and the maximum habitual intercuspation (MHI) greater than 4 mm and bilateral clicking during mouth opening were detected, being symmetrical and with soft active movement. The patient had the habit

of grinding and clenching her teeth, chewing gum frequently, and continuously using the telephone. In addition, her head was slightly deviated to the left and had an Angle Class III facial pattern (postural).

When performing the palpation exam in different areas of the face, head, and neck, the patient reported grade 3 pain in the region of the masseter, lateral pterygoid, and temporalis tendon on the right and left sides. Among the diagnostic impressions were disc displacement with reduction and myalgia (local muscle soreness). In the same session, a low-power laser was applied following the manufacturer's recommendations (Laser Smile, Quick Smile) in these regions, and recommendations were also given regarding nighttime habits for sleep hygiene. In the following session, the Front Plateau plaque was made to stabilize the mandible in a more comfortable position for the TMJ

in centric relation. The patient was instructed to use the device at night.

Two weeks later, during re-evaluation, the patient reported a significant improvement in pain symptoms. Therefore, she was instructed to continue using the device overnight and was also referred to the Orthodontist to assess the need for orthognathic surgery or conventional orthodontic treatment. In the reassessment appointment five months later, the patient reported no symptoms except pain when the weather was colder, requiring the use of Otsylase 10,000 IU. A new evaluation was carried out 9 months after using the Front Plateau and the patient reported the absence of initial symptoms, except on colder days.

### Case 2

A 57-year-old female sought care complaining of pain and clicking in the TMJ region. According to the patient, the pain started after traumatic personal events four years prior. She reported having depression, fibromyalgia, bruxism, and teeth clenching and using medications such as Pregabalin (75 mg), Duloxetine (30 mg), Trazodone (50 mg), Losartan, Pantoprazole (40 mg) and Tramadol (50 mg).

When performing the palpation examination in different areas of the face, head, and neck, the patient reported grade 2 pain in the region of the temporalis, middle pterygoid, and suprahyoid muscles on the right and left sides. In the region of the lateral pterygoid muscles and temporalis tendon and the TMJ area (lateral pole and posterior ligament) on both sides, grade 3 pain was reported. Among the diagnostic impressions were disc displacement with reduction, myalgia (local muscle soreness) and joint hypermobility. In the same session, low-power laser therapy was applied according to the manufacturer's recommendations (Laser Smile, Quick Smile) in these regions, and the Front Plateau plaque was made in CR to stabilize the mandible in a more comfortable position for the TMJ, relaxing the facial muscles. The patient was informed about the recommendations and guidelines for patients with TMD and stress management.

After one week of, the patient returned to the clinic reporting that the Front Plateau plaque was "not well adapted and loose" and that the muscle and joint pain had not improved. The plaque was adjusted, and a new low-power laser therapy application was performed in the same regions previously described. In the following week, the patient reported a slight improvement in the symptoms of muscle and joint pain, but the discomfort persisted.

The patient was referred to receive a total rigid myorelaxant plaque. When reassessed after

5 months of using the Front Plateau, there was a partial reduction in the clicks, but the pain persisted. According to the patient, on days with acute fibromyalgia symptoms, the pain was strong, but on other days it was milder. A new assessment was carried out 9 months after using the Front Plateau and the patient reported the same situation observed in the 5-month assessment.

### Case 3

A 49-year-old female sought care complaining of pain and clicking in the TMJ. According to the patient, she had suffered a fall in 2010, and in 2015, the discomfort started as a headache. She used Propranolol (40 mg), Levothyroxine (25 mg), Sertraline (50 mg), and Amitriptyline (25 mg) and had the habits of biting her nails, continuous use of the telephone, and reported being talkative. During clinical examination, she reported painful symptoms when performing mouth movements of maximum opening, protrusion, and right and left laterality, in addition to opening with deviation and joint noise on the left side.

When performing the palpation examination in different areas of the face, head, and neck, the patient reported grade 3 pain in the region of the temporalis, masseter, lateral pterygoid muscles, temporalis tendon, and in the TMJ region (lateral pole and posterior ligament) of both sides. Among the diagnostic impressions, disc displacement with reduction, myalgia (local muscle soreness), and a tension-type headache stood out.

In the same session, a low-power laser therapy was applied according to the manufacturer's recommendations (Laser Smile, Quick Smile) in these regions. In addition, guidelines for patients with TMDs were given, and a referral was made for evaluation and treatment by a physiotherapist.

After a week, the patient returned to the clinic reporting persistent pain. In view of the case, it was proposed to make a Front Plateau plaque as an attempt to treat the discomfort, aiming to observe whether there would be an indication for a total rigid myorelaxant plaque afterwards. Two months later, the patient returned to the clinic to assess the evolution of the treatment. A significant improvement in pain on the right side was reported, with grade 3 pain persisting only in the lateral pterygoid area. Regarding the left side, there was a decrease in joint noise and improvement in pain only in the temporalis muscle, with persistent grade 3 pain in the other regions evaluated by palpation. The patient reported performing physiotherapy on the left side due to the persistence of pain in this region of the face; however, due to the significant improvement presented on the right side during the use of the Front Plateau plaque,

she was referred to receive a total rigid myorelaxant plaque.

In the reassessment 5 months later, the patient reported a considerable reduction in the pain symptoms on both sides, but in some periods, she observed that the pain returned, however, at a lower intensity than it was before the use of the Front Plateau plaque. A new evaluation was carried out 9 months after starting to use the Front Plateau and the patient reported an improvement in initial symptoms but an increase in pain after carrying out activities that require physical effort.

#### Case 4

A 28-year-old female sought care complaining of severe pain in the TMJ region. According to the patient, the pain had started four years prior. She used Topiramate (25 mg) and Venlafaxine hydrochloride (150 mg) and had a habit of clenching her teeth and continuous use of the telephone and computer, in addition to being talkative. During the clinical examination, the patient reported that she was under stress during the period in which the first consultation was held.

When performing the palpation exam in different areas of the face, head, and neck, the patient reported grade 2 pain in the region of the temporalis muscles

on the left side, in the masseter on both sides, and in the TMJ region (lateral pole) on both sides. On palpation of the region of the lateral pterygoid muscles and temporalis tendon, the patient reported grade 3 pain on the right and left sides. Among the diagnostic impressions, myalgia (local muscle pain) and myositis stood out. In the same session, a low-power laser therapy was applied according to the manufacturer's recommendations (Laser Smile, Quick Smile) in these regions. Additionally, the patient received orientations for patients with TMDs.

One week after the first consultation, the patient returned to the clinic and reported an improvement in the pain. Another session of low-power laser therapy was performed in the lateral pterygoid muscle and temporalis tendon regions. In the following week, despite the improvement in the patient's pain, the patient reported less intense discomfort; therefore, a Front Plateau was made. Upon returning for reassessment two weeks later, the patient reported complete remission of the painful symptoms, demonstrating interest in maintaining the use of the Front Plateau plaque since, according to her, it brought a great improvement in her quality of life.

In the reassessment after 5 months of using the Front Plateau plaque, there were no symptoms. Due to the patient's anxiety, her doctor prescribed

**Table 1: Clinical characteristics and evolution of patients after treatment**

Patient	Main complaint	Risk factors	Medication already in use	Diagnostic impressions	Conduct prior to treatment	Post-treatment assessment
Case 1	Otalgia and pain in the left TMJ Limitation of mouth opening	Difference between MHI and CR > 4 mm	Otosylase 10,000 UI	Localized myalgia and DDWR	Guidelines for TMD patients	5/9 months: No symptoms with the use of the FP Pain only on colder days
Case 2	Pain and clicking in the TMJ region	Depression, fibromyalgi, bruxism, and tooth clenching	Donaren 50 mg Duloxetine 30 mg Losartana 50 mg Pantoprazole 40 mg Pregabalina 75 mg Tramadol 50 mg	Localized myalgia, DDWR and joint hypermobility	Guidelines for TMD patients	5 months: Partial reduction of symptoms 9 months: Further reduction in symptoms Pain still very strong in acute periods of fibromyalgia
Case 3	Pain and clicking in the TMJ region	Onychophagia, continuous cell phone use, and talking a lot	Amitriptilin 25 mg Levotiroxina 25 mg Propranolol 40 mg Sertralina 50 mg	Localized myalgia, DDWR, and tension-type headache	Guidelines for TMD patients	5/9 months: Considerable reduction in symptoms Pain worsens after activities that require physical exertion
Case 4	Pain in the TMJ region	Teeth clenching, talking a lot, continuous use of cell phone and computer	Pregabalin 75 mg Topiramate 50 mg Venlafaxine 75 mg	Localized myalgia and myositis	Guidelines for TMD patients	5/9 months: No symptoms with the use of the FP

Source: own authorship. TMJ – temporomandibular joint; DDWR – disc displacement with reduction; TMD – temporomandibular dysfunction; FP – Front Plateau; MHI – maximum habitual intercuspation; CR – centric relationship

Venlaxine (150 mg) and Pregabalin (150 mg). A new evaluation was carried out 9 months after starting to use the Front Plateau and the patient reported the absence of initial symptoms. A general overview of the cases can be seen in Table 1.

## Discussion

All reported cases are female; this fact can be justified by epidemiological surveys that show a higher prevalence of TMD in adult women, requiring therapeutic interventions (Medeiros et al., 2011; Blanco-Hungria et al., 2016). Among the four patients who received the Front Plateau plaque, two reported significant improvement in pain symptoms with the use of the anterior partial plaque following the orientations (Cases 1 and 4). The evolution of the cases was monitored for a period of 5 months and a new evaluation of the patients was carried out after 9 months of using the Front Plateau, it was noticed that the balance and reduction of muscular hyperactivity promoted by the Front Plateau plaque contributed to the reduction of discomfort reported during clinical examination (Molina, 1989; Dekon et al., 2007).

Another indication for the use of anterior partial plates is their emergency use when it is not possible to make an immediate total rigid plaque (Alencar et al., 1998; Oliveira, 2002). This was observed in the two patients who reported little or no improvement in the pain associated with TMDs (Cases 2 and 3), who were then referred to continue treatment. Another relevant aspect of the cases concerns the variety of diagnostic impressions listed for each patient, a fact that highlights the multifactorial characteristics of TMDs (Cruz et al., 2020).

In this perspective, initially less invasive interventions were adopted, such as low-power laser therapy for biostimulation and analgesic effects, to reduce the inflammatory and painful processes (Nadershah et al., 2020). In addition, orientations and exercises were given according to the condition of each patient to reduce the complaints presented, eliminate parafunctional and predisposing habits to TMDs, and stimulate a more harmonious relationship of the stomatognathic system (Oliveira et al., 2015; Resende, 2019). These interventions were adopted because the predisposing factors for TMD reported by patients, when not modified, hinder the success of treatment associated with interocclusal devices (Madani and Mirmortazavi, 2011; Chan et al., 2022). In cases of patients with severe pain, the modification of behavioural and psychological factors must be adopted from the first consultation and maintained even after the use of interocclusal splints (Garstka et al., 2023).

There are studies in the literature (Jokstad et al., 2005; Al-Moraissi et al., 2022) that point to the possibility of occlusal changes due to the use of anterior partial devices such as the Front Plateau and the NTI-tss. However, a cross-sectional study (Araújo et al., 2021) did not find a statistically significant relationship between the use of an anterior partial interocclusal device and tooth movements. However, due to its larger size, the Front Plateau plaque offers greater security than the NTI-tss, which has a smaller size and poses a risk of ingestion (Al-Moraissi et al., 2022). Another advantage presented by the Front Plateau is its low cost and the fact that its manufacture can be performed by the dentist in the dental office directly on the patient's dentition (Gomes et al., 2018; Belchior et al., 2021).

Despite not providing solid evidence, the present study contributes to future clinical trials on the use of the Front Plateau plaque for the treatment of TMD. Because it is a series of cases that describe outcomes with different patients, it is an appropriate study to verify adverse effects and interurrences associated with the device (Grimes and Schulz, 2002). Case series, despite presenting a low level of scientific evidence, are important studies for the construction of scientific knowledge. This study design aims to bring benefits to clinical practice and can also generate notes and the possibility of further research, sometimes being the first source of evidence on a given subject (Oliveira et al., 2015).

One of the limitations of this study is that it does not compare groups since it does not have the methodological rigor observed in randomized clinical trials with a control group (Jüni et al., 2001; Polit and Gillespie, 2010). Furthermore, the patients were prospectively evaluated without comparing each other and according to the outcomes reported by them before and after the treatment.

The association with low-power laser therapy, even though it is a non-invasive treatment, may have influenced the results obtained (Assis et al., 2012). In addition, the patient in Case 3 had appointments with a physiotherapist, which may also have contributed to the relief of pain in the muscles involved (Silva Santos and Pereira, 2016). In addition to these factors, all patients were taking medications to control pain and muscle inflammation, as well as medications to control stress and anxiety (Cases 2, 3 and 4). This association with the use of Front Plateau is a major limiting factor, especially in the case of those used for stress, anxiety and depression, as they may be related to the emergence and/or worsening of TMD symptoms (Reissmann et al., 2012; Augusto et al., 2016; Florjański and Orzeszek, 2021).

In theory, a case series should provide descriptive information with sufficient detail to allow replication of the study by other researchers, thus enabling the creation of hypotheses and the discovery of innovative therapies. An example of this was a case series on COVID-19 published in January 2020 (Huang et al., 2020) which has supported several clinical trials and currently has a total of 30,381 citations by ScienceDirect and 54,973 by Google Scholar.

## Conclusion

Based on this case series, it was possible to observe that the Front Plateau plaque presents a favourable therapeutic approach for patients with TMDs when used for short periods of time and following the recommendations of the professional in charge. However, it is worth remembering that, as they are multifactorial, TMDs will often require multiprofessional treatment so that acute or chronic symptoms can be controlled. In the case of studies that aim to test the effectiveness of this treatment modality, possible biases associated with the research design, sample, and applied therapy must be considered and, when possible, minimized.

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