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Case Report

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Manufacturing, Installation and Adjustment of Rigid Interocclusal Splint for Control of Bruxism and Orofacial Pain

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Abstract

Bruxism and orofacial muscle pain are common clinical conditions that may lead to tooth wear, muscle fatigue, and discomfort during mastication. Rigid occlusal splints, particularly those based on the Michigan occlusal splint design, are widely used to control these symptoms and protect the dentition. This case report describes a 20-year-old female patient who presented with persistent pain in the masseter and temporalis muscles, exacerbated during mastication, and muscle fatigue upon waking. After a detailed occlusal and radiographic examination, a diagnosis of probable sleep bruxism with mild tooth wear was established based on self-reported symptoms and clinical signs, without instrumental confirmation. Treatment involved obtaining impressions of the upper and lower arches, recording the centric relation with a Lucia JIG, mounting the plaster models in a semi-adjustable articulator, and fabricating a rigid splint from injectable acrylic resin (IvoBase®). The interocclusal splint was adjusted for optimal occlusal contact, ensuring patient comfort and promoting reduction of muscle tension. Pain intensity was assessed using a 100 mm visual analogue scale (VAS) and pain-related impact using the Graded Chronic Pain Scale – Revised (GCPS-R, v2.0). At baseline, the patient presented a VAS score of 45 mm and GCPS-R Grade I. After 7 days of nocturnal use, the VAS score decreased to 20 mm and the GCPS-R grade improved to Grade 0. At the 3-month follow-up, the pain-free status was maintained (VAS 0 mm, GCPS-R Grade 0), with good adherence and no adverse events. This case highlights the role of the rigid Michigan-type occlusal splint as an adjunct in the management of probable sleep bruxism, emphasising the importance of precise fabrication and adjustment for therapeutic success.

Keywords: Occlusal Splint, Sleep Bruxism, Rigid Splint, Michigan Occlusal Splint, Acrylic Resin.

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INTRODUCTION

Interocclusal splints are removable intraoral devices made to fully or partially cover the occlusal and incisal surfaces of the teeth, aiming to establish a stable occlusal contact with the teeth of the antagonist arch and improve the maxillomandibular relationship [1,2]. These splints, also known as occlusal splints, occlusal guards, night guards, interocclusal appliances or bruxism splints, have as their main objective to protect the teeth from wear and, consequently, to promote an adequate and comfortable occlusion [2]. Rigid splints are usually manufactured in thermally or chemically activated acrylic resins. Thermally activated acrylic resins (TAAR) are preferable due to several advantages over chemically activated acrylic resins (CAAR). Splints made in TAAR using dental muffle and pressing have a lower amount of residual monomer, which reduces the risk of allergic reactions in the patient, increasing the biotolerability of the device [3]. The polymerization process of TAAR is more efficient than that of CAAR, ensuring a more uniform polymerization, resulting in a device with better mechanical properties, less porosity and, consequently, greater durability [1,3,4].

A wide variety of temporomandibular disorders (TMD) can be helped or treated with interocclusal splints. Among these disorders is bruxism, in which masticatory muscle activity can occur during sleep (rhythmic or non-rhythmic activity) and while awake, respectively. According to the most recent international consensus, bruxism is defined as a repetitive masticatory muscle activity characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible, occurring during sleep or wakefulness [5-8]. The diagnosis is based on a grading system that considers the level of assessment: self-reported (possible

bruxism), clinical signs and symptoms (probable bruxism), and confirmed through instrumental methods such as electromyography or polysomnography (definite bruxism) [8,9]. In addition, occlusal splints offer significant benefits by reducing muscle tension, decreasing orofacial muscle activity for up to 180 days, preventing harmful effects caused by bruxism, such as teeth wear, protecting against dysfunctional tensions, and treating internal displacement of the temporomandibular joint discs. They are also effective in reducing the symptoms of TMDs, as well as relieving tension headaches, neck pain, and orofacial pain [10,11].

There are three main types of splints used to help treat occlusal problems and temporomandibular disorders: permissive, nonpermissive and pseudopermissive [2], each indicated according to the patient's individual needs. Permissive splints allow complete separation of the condyles with uniform tooth contact, aiming to achieve functional muscular balance and eliminate abnormal occlusal contacts by modifying the occlusion to control muscular activity [12]. They also allow unimpeded movement of the teeth in search of an occlusal relationship considered ideal for the patient. Among the permissive splints, the Michigan interocclusal splint stands out for its ability to provide occlusal stability, muscle relaxation, deprogramming of mandibular posture, and modification of the vertical dimension. Its main indication is for temporomandibular joint and muscle disorders, pain, severe bruxism, and diagnosis and treatment of occlusal trauma in any part of the masticatory system [2,12-14].

This study aims to describe the technique of fabrication, installation and intraoral adjustment of a rigid occlusal splint made of acrylic resin, based on the Michigan interocclusal splint, to aid in the treatment of probable sleep bruxism and orofacial muscle pain. The study seeks to highlight the advantages of the rigid device made of acrylic resin, using a technique that requires less adjustment and wear of the splint to achieve the desired occlusal parameters.

CASE REPORT

Patient Information

A 20-year-old female patient was previously examined by a dentist and came to the dental clinic complaining of persistent pain in the masseter and temporal muscles, reporting characteristics of muscle fatigue upon waking. An increase in this pain was also reported during chewing. The patient had no significant medical history contributing to the condition, was taking no regular medication, and reported no previous treatment for orofacial pain. At the first appointment, pain intensity was rated at 45 mm on a 100 mm visual analogue scale (VAS, 0 = no pain, 100 = worst imaginable pain) and pain-related impact was classified as Grade I (low-impact pain) on the Graded Chronic Pain Scale – Revised (GCPS-R, v2.0).

Clinical Findings

The patient's oral cavity and dentition were clinically and radiographically evaluated to determine the need for pre-treatment interventions. No periodontal problems, caries lesions or structural alterations were found, as confirmed by the panoramic imaging exam (Figure 1). Direct occlusal examination revealed an Angle class II occlusion resulting from unfinished orthodontic treatment, without overjet and with a 2 mm increase in overbite, with the upper anterior teeth overlapping the lower teeth. There were no significant signs of pathological dental attrition, only slight grade 1 wear facets on the lower molars, premolars and canines, and all third molars were partially erupted. Facial analysis showed no deviation of the dental midline in relation to the facial midline. Extraoral examination revealed muscle rigidity and increased pain sensitivity on palpation of the jaw elevator muscles (masseter and temporalis), as well as mild sensitivity in the facial mimic muscles (buccinator and orbicularis oris), with no crackling or popping in the TMJ during opening and closing movements.

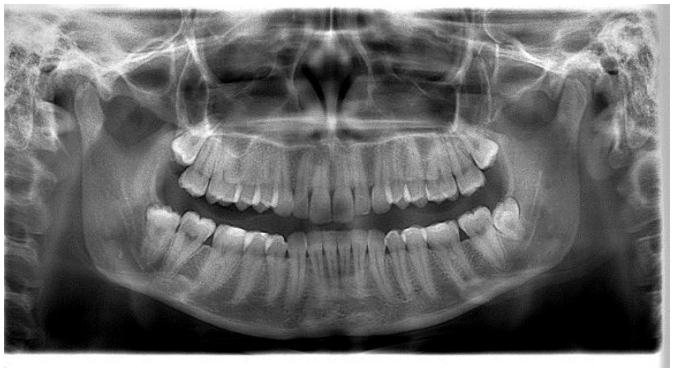

Figure 1: Pretreatment panoramic radiograph showing the absence of caries lesions, periodontal or structural alterations, and all third molars partially erupted

Diagnostic Assessment

The diagnostic workup included clinical examination and panoramic radiographic imaging. The panoramic radiograph confirmed the absence of periodontal problems, caries lesions or structural alterations, and showed all third molars partially erupted (Figure 1). No additional imaging or instrumental tests were performed.

Based on self-reported headaches upon waking, intraoral clinical findings (slight grade 1 wear facets on the lower molars, premolars and canines) and painful muscle sensitivity during extraoral examination, the diagnosis was established as probable sleep bruxism without severe dental attrition. According to the current international consensus grading system [8,9], this corresponds to the "probable" level, as the diagnosis was based on self-reported symptoms plus clinical signs, but was not confirmed through instrumental methods such as polysomnography or electromyography. The diagnosis was supported by the geared and adjusted occlusion resulting from previous orthodontic treatment, which indicates bruxism predominantly characterized by dental clenching rather than accentuated grinding. The absence of instrumental confirmation is acknowledged as a limitation of this report.

Therapeutic Intervention

Treatment involved obtaining detailed impressions of the upper and lower arches, recording the centric relation, mounting the plaster models in a semi-adjustable articulator (SAA), and fabricating and installing the rigid interocclusal splint.

Impressions and dental casts. The upper and lower arches were molded with Variotime® addition-polymerized silicone (Kulzer South America Ltda., Brazil) using a two-step technique (putty and light-body), after dental prophylaxis. Type IV stone casts (Herostone, Vigodent, Brazil) were fabricated with a 5 mm base and teardrop-shaped retentions for articulator mounting.

Occlusal record in centric relation. A Lucia Jaw Interference Guide (JIG) [15] was used as a neuromuscular reprogrammer, keeping the patient in disocclusion for 20 min. The JIG was fabricated directly in the mouth with chemically activated acrylic resin (Duralay, Reliance Dental Brasil, Brazil) and adjusted to a single contact point, with a posterior ramp allowing mandibular retraction. After 20 min of JIG use, the occlusal record in centric relation was obtained with addition-cured silicone (Variotime® Bite, Kulzer South America, Brazil) (Figure 2).

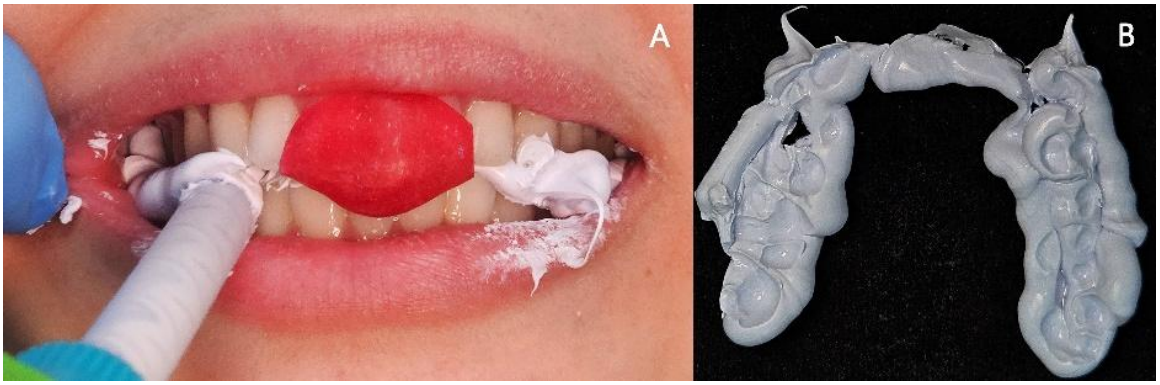

Figure 2 : Interocclusal record in centric relation. (A) Addition silicone applied with the mandible guided into centric relation after 20 min of Lucia JIG deprogramming; (B) centric relation record after removal from the mouth

Articulator mounting. The plaster models were mounted on a SAA using a facebow transfer. The upper model was fixed with type IV stone, and the lower model was positioned in occlusion with the centric relation record interposed. The SAA was adjusted with a 30° mandibular fossa inclination and a 15° Bennett angle as average values for eccentric movements.

Splint fabrication. The SAA incisal pin was adjusted to provide an interocclusal space of approximately 2.5 mm in the molar region. The splint was planned for the upper arch, waxed with type 7 wax on the plaster model, and the model was duplicated with laboratory silicone (Silikon Shore 22, ODONTOMEGA, Brazil). The wax-up was included in an IvoBase® flask (Ivoclar Vivadent, Brazil) and, after wax elimination, the transparent acrylic resin IvoBase® Hybrid was injected under 17 bar pressure with the muffle heated to 40 °C. These parameters provide superior mechanical strength and residual monomer below 1%. The splint was finished and adjusted on the articulator for uniform contact of all antagonist teeth in centric occlusion, with an anterior ramp for posterior disocclusion during excursive movements (anterior guidance in protrusion and canine guidance in laterality), and polished to a specular finish.

Installation and occlusal adjustment. The splint was disinfected with soap and water and immersed in 1% sodium hypochlorite for 10 min, then adapted to the patient's mouth (Figure 3). Its fit and comfort on the upper teeth were checked, small internal adjustments were made with an ogival tungsten bur in the vestibular areas of canines and premolars, followed by polishing. Occlusal contacts during closure were verified using a Muller clamp and carbon strip, with well-distributed markings and no excessively strong or isolated contacts (Figure 4A). Excursive movements were also checked, confirming anterior guidance in protrusion and canine guidance in laterality (Figure 4B–D). It is important to note that the splint had been adjusted on the SAA for a mandibular position in centric relation, while clinically the patient still presented occlusion influenced by habitual dental contacts, requiring a period of use to allow mandibular repositioning.

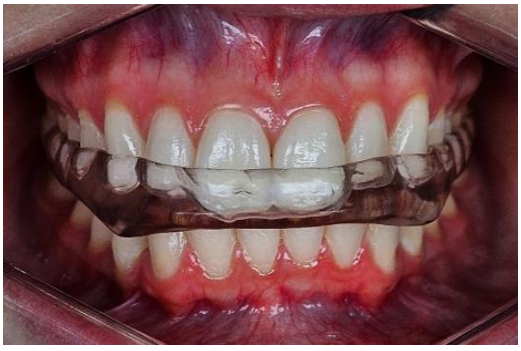

Figure 3: Rigid interocclusal splint adapted to the maxillary arch at the insertion appointment, showing uniform seating and marginal adaptation of the device

The patient was instructed to wear the splint during sleep and, in case of temporomandibular or orofacial discomfort, also during symptomatic periods of the day. When not in use, the device should be stored in a humidifier, after cleaning with a soft-bristled toothbrush and abrasive-free toothpaste.

Follow-up and Outcomes

The patient was followed up at two time points: 7 days and 3 months after starting nocturnal use of the splint. Pain intensity was assessed with the 100 mm VAS and pain-related impact with the GCPS-R (v2.0) at each visit, applying the same instruments used at baseline.

At the 7-day follow-up, the VAS score had decreased from 45 mm to 20 mm and the GCPS-R grade improved from Grade I to Grade 0. The patient reported a marked reduction in morning muscle fatigue and in pain during mastication, and no longer reported headaches upon waking. At this visit, a detailed occlusal adjustment of the splint was performed with the mandible and the elevator muscles in a more relaxed condition, confirming the neuromuscular reprogramming expected after the initial period of use: new premature contacts were identified and relieved, and the anterior and canine guidances were refined. The patient tolerated the device well, reported no difficulty in sleeping with the splint, and confirmed nightly use.

At the 3-month follow-up, the pain-free status was maintained, with a VAS score of 0 mm and GCPS-R Grade 0. Palpation of the masseter and temporalis muscles no longer elicited pain, and the patient reported no episodes of morning fatigue during the interval. Adherence to nocturnal use remained good, the splint showed no signs of fracture or significant wear, and its occlusal contacts required only minimal refinement. No adverse events, such as dental mobility, unintended occlusal changes, mucosal irritation or temporomandibular joint symptoms, were observed at any point during the follow-up period. The reduction in pain intensity from 45 mm at baseline to 0 mm at 3 months corresponds to a complete resolution of the reported pain and represents a clinically relevant improvement.

DISCUSSION

This case report described the clinical approach to the construction of a rigid Michigan-type occlusal splint applied in the treatment of a patient with probable sleep bruxism, resulting in muscle fatigue and pain during wakefulness. The interocclusal splint played a role in the treatment, assisting in the repositioning of the mandibular condyles to a more comfortable position [2,12,16] and promoting relaxation of the mandibular elevator muscles.

According to the 2025 international consensus, bruxism is recognized in two circadian forms: sleep bruxism and awake bruxism, and unlike

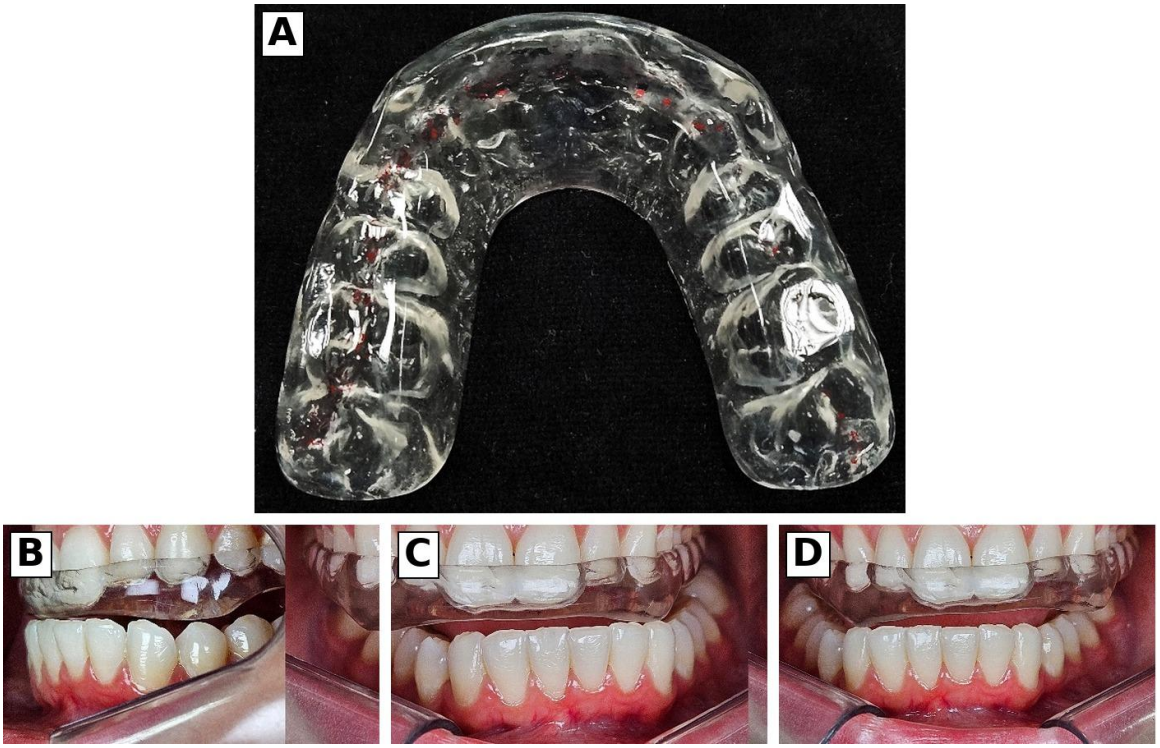

Figure 4: Occlusal adjustment of the splint in the patient's mouth. (A) Well-distributed occlusal contacts marked with carbon strip after intraoral adjustment; (B) anterior guidance in protrusion; (C) canine guidance in left laterotrusion; (D) canine guidance in right laterotrusion

Timeline

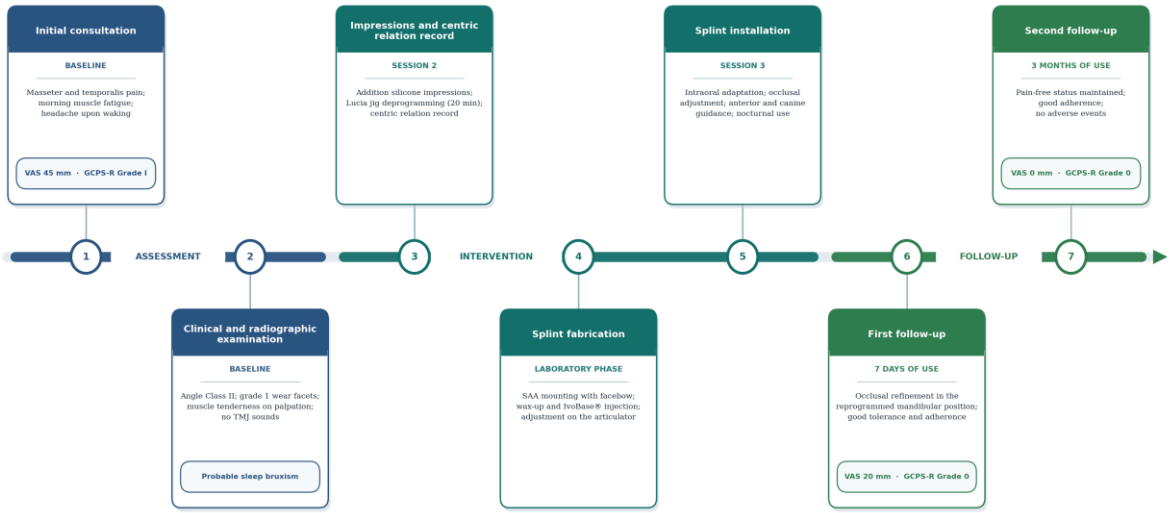

Figure 5: Timeline of clinical events, from the initial consultation to the 3-month follow-up, with the VAS and GCPS-R scores recorded at each assessment point

previous definitions, bruxism is classified as a behavior (masticatory muscle activity), not a disease [8]. This reconceptualization had already been anticipated by authors who questioned whether bruxism should be regarded as a disorder or as a behaviour that may, in some circumstances, serve a protective function, such as the significant increase in respiratory amplitude that precedes sleep bruxism episodes and may contribute to maintaining airway patency, particularly in patients with obstructive sleep breathing disorders [17,18]. In the present case, the diagnosis was classified as probable sleep bruxism, based on self-reported symptoms and clinical signs but without instrumental confirmation. This grading is clinically relevant, as the absence of polysomnographic or electromyographic confirmation means the diagnosis remains at the "probable" level, a limitation that should be acknowledged when interpreting the treatment outcome [8,9]. This aspect aligns with the current consensus recommendation that case reports of bruxism should explicitly state the diagnostic grading level.

In the case presented, the patient reported facial pain, headache, and muscle pain when chewing, but with minor dental wear and no clicking or crackling in the temporomandibular joint. This appears to be related to the early diagnosis of the disorder [19], which prevented the development of more serious complications, such as excessive teeth wear, damage to restorations, non-carious cervical lesions, displacement of articular discs with reduction, and TMD. Compared with previous reports, this case shares the clinical profile of young adult patients with predominantly clenching-type bruxism and mild dental wear, in whom early intervention with a rigid splint may prevent progression of muscular and articular complications [19,20].

Treatment of bruxism often involves the use of devices such as the occlusal splint described in this study [2,5,6,14,16], in conjunction with psychological or pharmacological approaches to manage stress and

improve sleep quality [21]. The occlusal adjustment performed on the splint, while mounted on an SAA, allowed all of the patient's posterior teeth to simultaneously touch the splint, keeping the jaw in centric relation [16], while the anterior teeth had a lighter contact. It is important to note that the adjustments made to the SAA do not manifest immediately when the splint is installed in the patient's mouth. Initially, the patient still has an occlusion influenced by dental contacts and muscles that may be fatigued or in an inadequate state of tone due to compensations [19,20]. After a period of use, established as 7 days in this study, a neuromuscular reprogramming occurs that repositions the mandible to a more comfortable position, believed to be the centric relation. In the present case, this was clinically evident at the first follow-up visit, when new premature contacts became detectable and were relieved, in parallel with a reduction of the VAS score from 45 mm to 20 mm. This reprogramming helps eliminate occlusal interferences, aiding in the repositioning of the condyles, preventing the perpetuation of unwanted muscular activity [16,22]. The splint was made with a smooth surface that allows occlusion in centric relation with free movements, facilitating mandibular repositioning [23]. Furthermore, the occlusal splint was adjusted to provide effective anterior and lateral guidance [13,14], where only the anterior teeth come into contact during lateral or protrusive movements, protecting the posterior teeth from oblique forces and excessive wear [23]. The anterior teeth have anatomical characteristics that make them more efficient in dealing with oblique loads, unlike the posterior teeth that can develop abfraction-type lesions when subjected to excessive oblique loads [24].

A critical aspect of this case is the choice of a rigid splint over a flexible one. Although patients may initially prefer flexible splints because they are more comfortable, these soft devices, such as those made of acetate or silicone, can intensify muscle activity [25-27]. When biting into a flexible splint, the material deforms, generating a sensation of compression that leads the central nervous system to increase the biting force to achieve a sensation of mandibular closure. This constant increase in force stimulates more intense muscle activation, worsening painful symptoms [26,27]. In contrast, rigid splints, such as the one used in this study, offer a stable and non-deformable surface, which helps to distribute occlusal forces evenly and reduce muscle activity, promoting relaxation of the muscles involved [2,6,25]. The favourable and sustained response observed here is consistent with the literature reporting that rigid splints are more effective in reducing muscle hyperactivity than soft splints, particularly in patients with clenching-predominant bruxism [25-27].

The main limitations of this report are the single-case design and the absence of instrumental confirmation of the bruxism diagnosis, which therefore remains at the "probable" level. In addition, the therapeutic outcome was assessed exclusively through validated patient-reported instruments (VAS and GCPS-R), without photographic or instrumental documentation of the post-treatment condition; this reflects the symptomatic nature of the outcome of interest (muscle pain and fatigue), which produces no visible clinical alteration, but should nonetheless be considered when interpreting the results. Although the 3-month follow-up demonstrated sustained pain-free status, longer follow-up periods are needed to evaluate long-term outcomes. Regular clinical follow-up, more frequent in the first months and then annually, is necessary to monitor mandibular repositioning and readapt the splint to material wear and teeth attrition, maintaining its therapeutic benefits over time.

Patient Perspective

The patient reported that the splint was comfortable to wear during sleep and noted a clear improvement in morning muscle fatigue and in pain during mastication after the first week of use, with complete resolution of the pain maintained at 3 months. She expressed satisfaction with the treatment and understanding of the need for continued nocturnal use and regular follow-up visits.

Informed Consent

Written informed consent was obtained from the patient for the treatment and for the publication of this case report, including the use of clinical photographs and radiographs. The patient was informed about the nature of the procedure, possible risks, benefits, and alternative treatment options.

CONCLUSION

The manufacturing and use of a rigid interocclusal splint, with precisely adjusted occlusal contacts, may assist as an adjunct in the management of probable sleep bruxism, as it redistributes masticatory forces and may help relieve muscle and joint pain. The neuromuscular deprogramming promoted by the device, eliminating occlusal interferences and protecting the dentition from wear, reinforces the importance of careful selection of the device type and accuracy in its fabrication and adjustment. In the present case, the splint was associated with a clinically relevant reduction in pain intensity (VAS from 45 mm to 0 mm) and in pain-related impact (GCPS-R from Grade I to Grade 0) over a 3-month follow-up.

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Authors' Contributions

II and DT were actively involved in the clinical management of the patient, contributed to case documentation through clinical photographs, and participated in manuscript drafting. MCGG de Almeida contributed to manuscript drafting and literature review. EM and MA assisted in the analysis and interpretation of the patient's clinical data, contributed to the writing of the manuscript, and critically reviewed its content. PFC revised the manuscript, corrected the English language, and provided important intellectual contributions. LH da Silva contributed to the clinical analysis, writing, and revision of the manuscript, supervised all stages of the project, and performed the final review. All authors read and approved the final version of the manuscript.

Ethics Statement

This study did not require approval from a Research Ethics Committee, as it consists of a single case report without experimental intervention and without patient identification. The requirement for ethics approval was waived according to institutional and national guidelines. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Data Availability Statement

The data that support the findings of this study are available and will be made available upon request.

Use of AI in Drafting of Manuscript

The authors declare that they have not used any generative AI/AI-assisted technologies in the writing of this manuscript.

Conflicts of Interest

The authors declared no conflict of interest.

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