# Effectiveness of Protrusive Splint in Disc Displacement with Reduction. A Systematic Review *

## Efectividad de la placa protrusiva en el desplazamiento del disco con reducción. Revisión sistemática

## Eficácia da placa protrusiva no deslocamento do disco com redução. Uma revisão sistemática

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## ABSTRACT

**Background**: Disc displacement with reduction is a condition of the temporomandibular joint (TMJ) characterized by joint noises, pain, and limited mandibular mobility. Treatments include protrusive splints aimed at repositioning the articular disc and alleviating symptoms. **Purpose**: To evaluate the efficacy of protrusive splints in repositioning the disc with reduction in the TMJ, diagnosed through magnetic resonance imaging, via a systematic literature review. **Methods**: A search was conducted in PubMed, Cochrane Library, Medline, and SciELO between June and July 2021, identifying 10 studies: 1

randomized controlled trial, 1 systematic review, and 8 cohort studies. **Results**: Five studies showed immediate success in disc repositioning, with success rates ranging from 83 % to 100 %. However, efficacy decreased over time: 75.5 % at 2 weeks, 74.5 % at 2 months, 25 % to 100 % at 3 months, 40.6 % to 84.3 % at 6 months, 75 % at 1 year, and 53.1 % at 2 years. **Conclusions**: Protrusive splints are effective in the short term for treating this condition, but evidence is insufficient to determine their long-term efficacy using magnetic resonance imaging.
**Keywords:** anterior displacement with reduction; dentistry; magnetic resonance; occlusion; occlusal splint; protrusive splint; prosthodontics; temporomandibular joint.

RESUMEN

**Antecedentes**: El desplazamiento de disco con reducción es una afección de la articulación temporomandibular (ATM) caracterizada por ruidos articulares, dolor y movilidad mandibular limitada. Los tratamientos incluyen placas protrusivas que buscan reposicionar el disco articular y aliviar los síntomas. **Objetivo**: Evaluar la eficacia de las placas protrusivas en el reposicionamiento del disco con reducción en la ATM, diagnosticado mediante resonancia magnética, a través de una revisión sistemática de la literatura. **Métodos**: Se realizó una búsqueda en PubMed, Cochrane Library, Medline y SciELO entre junio y julio de 2021, de la cual se identificaron 10 estudios: 1 ensayo controlado aleatorizado, 1 revisión sistemática y 8 estudios de cohorte. **Resultados**: Cinco estudios mostraron éxito inmediato en el reposicionamiento, con tasas de éxito del 83 % al 100 %. No obstante, la eficacia disminuyó con el tiempo: 75,5 % a las 2 semanas, 74,5 % a los 2 meses, 25 % a 100 % a los 3 meses, 40,6 % a 84,3 % a los 6 meses, 75 % al año, y 53,1 % a los 2 años. **Conclusiones**: Las placas protrusivas son eficaces a corto plazo para tratar esta condición, pero la evidencia no es suficiente para determinar su eficacia a largo plazo con resonancia magnética.
**Palabras clave:** articulación temporomandibular; desplazamiento anterior con reducción; oclusión; odontología; placa oclusal; placa protrusiva; prostodoncia; resonancia magnética

RESUMO

**Antecedentes**: O deslocamento do disco com redução é uma condição da articulação temporomandibular (ATM) caracterizada por sons articulares, dor e mobilidade limitada da mandíbula. Os tratamentos incluem placas protrusivas que buscam reposicionar o disco articular e aliviar os sintomas. **Objetivo**: Avaliar a eficácia das placas protrusivas no reposicionamento do disco com redução da ATM, diagnosticada por ressonância magnética, por meio de revisão sistemática da literatura. **Métodos**: Foi realizada uma busca no PubMed, Cochrane Library, Medline e SciELO entre junho e julho de 2021, dos quais foram identificados 10 estudos: 1 ensaio clínico randomizado, 1 revisão sistemática e 8 estudos de coorte. **Resultados**: Cinco estudos demonstraram sucesso imediato no reposicionamento, com taxas de sucesso de 83 % a 100 %. No entanto, a eficácia diminuiu ao longo do tempo: 75,5 % em 2 semanas, 74,5 % em 2 meses, 25 % para 100 % em 3 meses, 40,6 % para 84,3 % em 6 meses, 75 % ao ano e 53,1 % após 2 anos. **Conclusões**: As placas protrusivas são eficazes a curto prazo no tratamento desta condição, mas as evidências não são suficientes para determinar a sua eficácia a longo prazo com a ressonância magnética.
**Palavras-chave**: articulação temporomandibular; deslocamento anterior com redução; oclusão; odontologia; placa oclusal; placa protrusiva; prótese dentária; ressonância magnética

# INTRODUCTION

Temporomandibular joint (TMJ) disorders present various manifestations due to systemic, muscular, articular, psychological, and traumatic factors. Studies indicate that 75% of the global population experiences symptoms such as joint noises, deviation, limited opening, and mandibular locking, while 33% suffer from orofacial and mandibular pain. Disc displacement with reduction is the most common internal TMJ disorder. This intracapsular biomechanical condition is characterized by the anterior position of the disc relative to the mandibular condyle in a closed mouth, which repositions upon mouth opening, producing noises like clicking, crepitus, and popping. Factors such as trauma, TMJ anatomy, bruxism, stress, congenital conditions, masticatory muscle contracture, and abnormal dental occlusion can lead to ligament elongation, favoring disc displacements and excessive loading on the temporomandibular joints and retrodiscal tissues (1). According to Okeson's classification, this disorder belongs to the group of TMJ disorders, specifically in the condyle-disc complex alteration subdivision.

Additionally, the American Academy of Orofacial Pain classifies this condition within the joint disorders group, under the condyle-disc complex subdivision (2-6).

Disc displacements can be classified as partial or complete, depending on their extent. A presumptive diagnosis can be made by palpating the TMJ area during mandibular opening and closing movements, identifying the presence of noises or pain. This diagnosis should be confirmed through complementary examinations, such as magnetic resonance imaging (4).

One of the treatments used for disc displacement with reduction is the protrusive splint, also known as the anterior repositioning splint. These acrylic appliances aim to improve the condyle-fossa relationship, allowing the mandible to adopt an anterior position. Additionally, they help reduce pain and other symptoms associated with the disorder (1-7). The protrusive splint can also be managed through a progressive retrusion technique known as the "walking splint" or "walk down." This method involves gradually adjusting the ramp of the protrusive splint at specified intervals so that the condyle-fossa relationship guides the mandibular position. This approach achieves a satisfactory occlusal position upon completing the splint treatment (3-8).

The success rates for treatment with protrusive splints range from 40.6% to 64.8 3%, considering disc repositioning and symptom reduction. However, up to 59.1 % of cases may experience failure in capturing the temporomandibular articular disc (9,10). Additionally, depending on the duration of the condition and the patient's circumstances, disc displacement may progress to a non-reducing displacement, resulting in complete joint locking. This occurs because the ligaments and retrodiscal tissues exceed their elastic capacity, preventing the disc from returning to its correct anatomical position (4).

A research group conducted a meta-analysis of randomized clinical trials to compare different treatments for this condition. The results indicated no significant differences in pain intensity between groups using occlusal splints and those receiving low-intensity laser therapy. However, when comparing occlusal splints with conservative treatments, splints achieved greater pain reduction. The short-term effects of occlusal splints, both repositioning and stabilization types, are consistent with the findings of a previous systematic review on repositioning splints (11).

The effectiveness of the anterior repositioning splint remains a controversial topic due to the lack of consensus on its therapeutic management, including aspects such as usage, duration, and changes observed in magnetic resonance imaging before and after treatment. The use of this splint to treat disc displacement with reduction raises significant questions in current clinical practice. The controversy surrounding its effectiveness and application is reflected in specialized literature, where the quantity and quality of available studies are insufficient to draw definitive conclusions (3,4,8). In this context, the need arose to conduct a comprehensive systematic review to evaluate and synthesize the best available clinical evidence on this crucial topic in the management of temporomandibular disorders. Therefore, the purpose of this review was to analyze the effect of using the protrusive splint on disc repositioning with reduction in the TMJ, addressing the research question: What is the effect of using the protrusive splint in patients with anterior disc displacement with reduction?

This study significantly contributes to global knowledge on the management of disc displacement with reduction in the TMJ through the use of the protrusive splint. Its novelty lies in the rigorous application of the Critical Appraisal Skills Programme (CASP) questionnaire, an internationally recognized tool for systematically assessing the methodological quality of included studies. This approach helps identify existing research gaps and provides a robust synthesis of the available clinical evidence. Thus, it offers precise guidance to healthcare professionals for making informed therapeutic decisions in a field characterized by its complexity (12). By employing CASP, this study stands out for its solid methodological approach, allowing for a critical evaluation of the best available evidence. This strategy ensures the reliability and validity of the conclusions, emphasizing the global importance of the work in optimizing clinical practice and advancing knowledge on temporomandibular disorders (12).

## MATERIALS AND METHODS

In June and July 2021, an exhaustive search of electronic literature was conducted on the effect of the protrusive splint using databases such as PubMed, Cochrane Library Trials, SciELO, and Medline. In Cochrane, articles rated between "three to five stars" were selected. To meet the objective of the systematic review, both maxillary and mandibular protrusive splints were included. The search strategy employed English keywords such as "Temporomandibular joint," "Anterior displacement," "Magnetic resonance," "Protrusive splint," and "Occlusal splint," combined with the Boolean operators AND, OR, and NOT. No year limitation was set for the search.

The inclusion criteria considered articles in English and Spanish, meta-analyses, systematic reviews, prospective and retrospective cohort studies, randomized clinical trials, and scientific publications involving adult patients with a presumptive diagnosis of disc displacement with reduction. Conversely, the exclusion criteria included patients with a presumptive diagnosis of disc displacement without reduction, those with Class II malocclusion, and the use of neuromuscular relaxation or pivoting splints.

The article selection process was conducted in three stages: first, the relevance of the title was evaluated; second, the abstract's pertinence was analyzed; and finally, a full-text review was performed, comparing the content with the established inclusion criteria. To assess article quality, the CASP questionnaire was used. In cases of disagreement, a third reader, an expert in the field, intervened to resolve the issue. Articles selected based on the inclusion criteria underwent a critical appraisal using the CASP questionnaire to determine the validity of the presented results.

This study evaluated articles from cohort studies, systematic reviews, and randomized clinical trials. Each article was assessed with 10 to 12 questions, depending on the study type (Tables 1, 2, and 3). A score of 1 was assigned for a "yes" response, and a score of 0 for a "no" response. The quality of the articles was classified based on the score obtained: low (0-2), moderate-low (3-4), moderate (5-7), moderate-high (8-9), and high (10-12).

TABLE 1
CASP for Cohort Studies

| CASP Guidelines | Question | Score |
|---|---|---|
| 1 | Did the study address a clearly focused research question? | Yes (1) – No/Not clear(0) |
| 2 | Were participants randomly assigned to interventions? | Yes (1) – No/Not clear(0) |
| 3 | Were all participants who entered the study accounted for at the conclusion of the study? | Yes (1) – No/Not clear(0) |
| 4 | Were participants “blinded” to the intervention they were given? | Yes (1) – No/Not clear (0) |
| | Were the researchers “blinded” to the intervention they were giving to the participants? | Yes (1) – No/Not clear (0) |
| | Were the people who assessed/analyzed the outcomes “blinded”? | Yes (1) – No/Not clear(0) |
| 5 | Were the study groups similar at the start of the randomized controlled trial? | Yes (1) – No/Not clear(0) |
| 6 | Apart from the experimental intervention, did each study group receive the same level of care (i.e., were they treated equally)? | Yes (1) – No/Not clear(0) |
| 7 | Were the effects of the intervention comprehensively reported? | Yes (1) – No/Not clear(0) |
| 8 | Was the precision of the intervention estimate or treatment effect reported? | Yes (1) – No/Not clear(0) |

| | | |
|---|---|---|
| 9 | Do the benefits of the experimental intervention outweigh the harms and costs? | Yes (1) – No/Not clear(0) |
| 10 | Can the results be applied to your local population/in your context? | Yes (1) – No/Not clear(0) |
| 11 | Would the experimental intervention provide greater value to the people in your care than any of the existing interventions? | Yes (1) – No/Not clear(0) |

Source: the authors.

TABLE 2
CASP for Randomized Controlled Clinical Trials

| CASP Guidelines | Question | Score |
|---|---|---|
| 1 | Was the study focused on the topic? | Yes (1) – No/ Not clear (0) |
| 2 | Was the cohort study selected in an acceptable manner? | Yes (1) – No/ Not clear (0) |
| 3 | Was the exposure accurately measured to minimize bias? | Yes (1) – No/ Not clear (0) |
| 4 | Was the outcome accurately measured to minimize bias? | Yes (1) – No/ Not clear (0) |
| 5 | Have the authors identified all important confounders? | Yes (1) – No/ Not clear (0) |
| 6 | Have the authors accounted for confounders in the design and/or analysis? | Yes (1) – No/ Not clear (0) |
| 7 | ¿What are the results of the study? | Yes (1) – No/ Not clear (0) |
| 8 | How accurate are the results? | Yes (1) – No/ Not clear (0) |
| 9 | Do you believe the results? | Yes (1) – No/ Not clear (0) |
| 10 | Can the results be applied to the local population? | Yes (1) – No/ Not clear (0) |
| 11 | Do the results of the study fit with other available evidence? | Yes (1) – No/ Not clear (0) |
| 12 | What are the implications of this study for practice? (Is the study clinically relevant?) | Yes (1) – No/ Not clear (0) |

Source: the authors

TABLE 3
CASP Systematic Reviews

| CASP Guidelines | Question | Score |
|---|---|---|
| 1 | Did the review address a clearly focused question? | Yes (1) – No/ Not clear (0) |
| 2 | Did the authors search for the right type of articles? | Yes (1) – No/ Not clear (0) |
| 3 | Were all important and relevant studies included? | Yes (1) – No/ Not clear (0) |
| 4 | Did the review authors do enough to assess the quality of the included studies? | Yes (1) – No/ Not clear (0) |
| 5 | Have the results of the review been combined – was it reasonable to do so? | Yes (1) – No/ Not clear (0) |
| 6 | What are the overall results of the review? | Yes (1) – No/ Not clear (0) |
| 7 | How precise are the results? | Yes (1) – No/ Not clear (0) |
| 8 | Can the results be applied to the local population? | Yes (1) – No/ Not clear (0) |
| 9 | Were all important outcomes considered? | Yes (1) – No/ Not clear (0) |
| 10 | Are the benefits worth the harm and costs of the studies? | Yes (1) – No/ Not clear (0) |

Source: the authors.

# RESULTS

## Literature Search

A total of 1,304 titles were identified. After removing duplicates, 344 articles were excluded. Following the title analysis, 796 articles were discarded, leaving 164 documents for abstract review. Subsequently, 137 articles were excluded after reviewing their abstracts. Of the remaining 27 articles, a full-text reading, evaluation, and analysis were conducted, resulting in 10 articles selected for the systematic review, as shown in Figure 1.

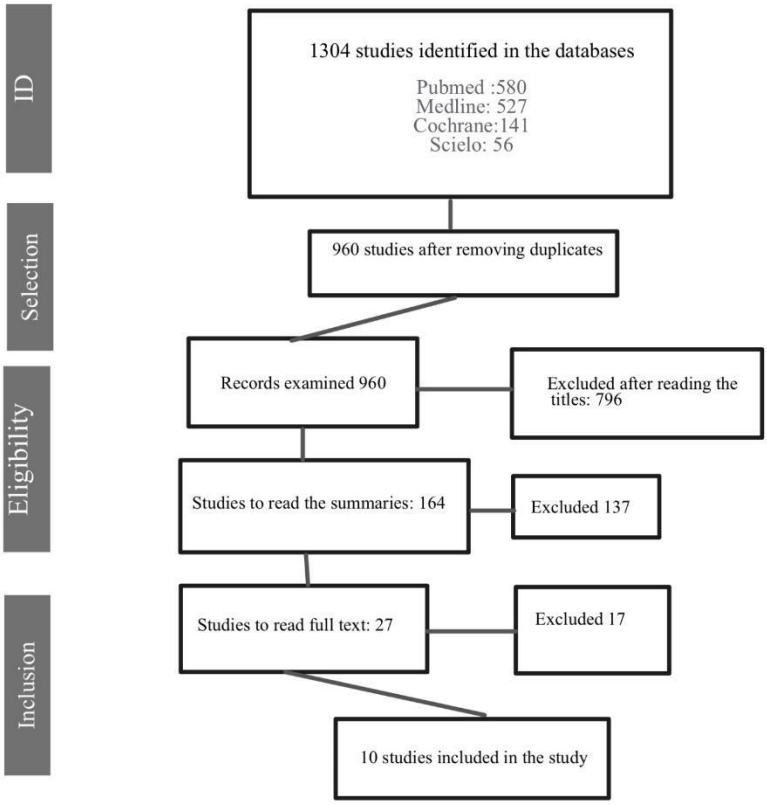


FIGURE 1
Flowchart for the Article Selection Process

## Description of Studies

According to the parameters of the CASP questionnaire, the included studies scored between 4 and 12. Two studies (20 %) were classified as moderate-low quality, four studies (40 %) as moderate quality, one study (10 %) as moderate-high quality, and three studies (30 %) as high quality. The selected studies analyzed disc displacement with reduction using magnetic resonance imaging for diagnosis and evaluated the outcomes of using the anterior repositioning splint. A synthesis of these studies is presented in Tables 4 and 5, detailing the evaluation of all included articles.

The studies evaluated joint recapture immediately after inserting the protrusive splint, using magnetic resonance imaging taken before and after its placement. These findings are inconclusive for research

purposes, as they only demonstrate that the splint can recapture the disc while in use, but not definitively (Figure 2). However, eight studies re-evaluated the outcomes at different time points, providing insights into the effectiveness of the protrusive splint over time. The results, presented in Figure 3, indicate that the splint's success decreases over time, and the disc tends to return to its initial position once its use is discontinued (9,10,13-16).

In six analyzed studies, most patients were women, with a mean age of 25 years, except for one study where the mean age was 41 years (9). In the first study by Kurita, *et al.* (16), 55 out of 74 participants were women; in the second, 28 out of 39; and in the third, 34 out of 45. In the study by Simmons and Gibbs (17), 57 out of 58 participants were women. Meanwhile, in the study by Shen, *et al.* (18), 144 individuals participated, of whom 107 were women. This last study reported that disc recapture was 76.79% in women, compared to 87.01% in men.

TABLE 4
Synthesis of the Studies Included in this Review

| Authors. Year | CASP rating | Study design | Place | Number of patients | Number of joints | Age of patients | Localiz. **** | Usage Time | Repos. | Reeval. ** | Sympt.* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kurita, et al. 1998 (15) | 11 (High) | Cohort | Japan. University | Initial: 74<br>Women: 55<br>Men:19<br>With RM: 41 | Starting: 82<br><br>Con RM: 47 | 14-56 years | Jaw | 2 months interruption only when eating and brushing the mouth. | Clinically:<br>Full: 45 (54.9%)<br>Partial: 17 (20.7%)<br>Null: 20 (24.4%)<br><br>With RM: 47<br>Complete: 35 (74.5%).<br>Partial: 7 (14.9%).<br>Null: 5 (10.6%) | No | Not assessed |
| Kurita, et al. 1998 (16) | 6 (Moderate-Low) | Cohort | Japan. University | 39<br>Women: 28<br>Men: 11 | 45 | Average: 25.9 years<br>Range: 14-56. | Jaw | 1 or 2 weeks later, MRI was performed | With RM: 45<br><br>Full: 34 (75.5%)<br>Partial: 7 (15.5%)<br>Null: 4 (8.8%) | No | Patients reported improvement in symptoms. |
| Shen, et al. 2019 (18) | 12 (High) | Cohort | China. University | 144<br>Women: 107<br>Men: 37 | 210 | 9-53 years | Upper maxilla | 24 hours for 6 months.<br>1 mm of acrylic was removed every 4 weeks | Success 177 (84.3%)<br>No recapture: 33 (15.7%)<br><br>Success by age:<br>-Under 20 years: 84.72%<br>-21-35 years: 84.21%.<br>-Over 36 years of age: 77.78%<br><br>Success according to gender:<br>Men: 87.01%.<br>Women: 76.79%. | 3-6 months: 84.8%<br><br>7-12 months: 75.0%<br><br>13-24 months: 75.0%<br><br>More than 24 months: 53.1% | Not assessed |
| Kurita, et al. 2001 (13) | 10 (High-moderate) | Cohort | Japan. University | 45<br>Women: 34<br>Men: 11 | 51<br><br>With reduction: 32<br><br>No reduction: 19 | Average: 25 years<br>Range: 14-56 years | Jaw | 24 hours a day for 2 months they took off the splint when brushing their teeth and eating | General (with and without reduction)<br>Success: 45<br>Failure: 6<br><br>With reduction<br>Success 32<br>Failure: 0<br><br>No reduction:<br>Success:13<br>Failure: 6 | No | Patients with joints that did not reposition revealed decreased joint clicking, joint blockage, and pain. |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Eberhard, et al. 2002 (1) | 7 (Moderate) | Cohort | University of Vienna, Austria | 30 patients | 52 joints:<br><br>10 normal.<br>18 anterior disc displacements with reduction<br>4 Previous partial displacement of the disc with reduction.<br>7 Disc displacements without reduction.<br>13 Disc displacement without reduction with osteoarthritis. | Not specified | Upper maxilla | 24 hours. | 15/ 18 anterior disc offsets with reduction<br><br>2/4 Partial anterior displacement of the disc with reduction.<br><br>0/7 Disc displacements without reduction.<br><br>0/13 Disc displacement without reduction with osteoarthritis. | Symptoms after 1 week, without MRI | Symptoms decreased significantly. |
| Guo, et al. 2021 (19) | 4 (Moderate-low) | Systematic review | China. Huazhong University of Science and Technology | 2 studies:<br>-Shen, et al (2019)= included in this study.<br>-Chen, et al. (2017) = included in this study. | 242 joints in total. | -- | Upper maxilla | -- | -- | -- | -- |
| Simmons & Gibbs, 1997 (17) | 7 (Moderate) | Cohort | USA. University | 58<br>Women: 57<br>Men: 1<br><br>Displacement with reduction: 36 | 116<br><br>Displacement with reduction: 53<br><br>- Unreduced offset: 43 | Age ranges 19-69.<br><br>Median age: 41<br>Age: 39.5 | Lower maxilla | NOT specified | Articulations with displacement:<br>-Complete: 48 (91%)<br>-Best position, but not recapture: 3 (6%).<br><br>Joints without reduction:<br>-Best Position: 12<br>-No change: 31 | No | Not assessed |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | - Unreduced offset: 29 | | | | | | | |
| Chen, et al. 2017 (9) | 12 (High) | Cohort | China. Peking University | 22 Women 13 Men 9 | 32 | Age range from 15 to 27 years old | Upper maxilla | 3 months of use, use for 24H, can only be removed for brushing. They were summoned monthly.<br><br>At the end of 3 months, splints were worn only when sleeping | 32/32 100% success. ) | After 6 months with MRI, with open and closed mouth.<br><br>13/32 remained successful (40.6%). | Joint symptoms of clicking and intermittent blockage resolved as well as the pain, but over time the joint sounds returned. |
| Fayed, et al. 2004 (20) | 7 (Moderate) | Randomized controlled trial | Egypt. Cairo University | 14<br><br>2 random groups:<br>- 7 Anterior Repositioning Splint<br>-7 Canine Protection Splint | Unspecified | Age range: 18 to 30 years old | Upper maxilla<br><br>2 groups: Previous repositioning Splint Canine protection splint | 24 hours for 3 months of use (except brushing or eating)<br><br>Evaluated every 2 weeks | 9 subjects were evaluated, 5 did not undergo MRI.<br><br>- 4 Previous repositioning Splint 25%<br><br>-5 Splint with 40% canine protection. | No | Two splints were effective in eliminating joint symptoms (joint pain and clicking). |
| Simmons & Gibbs, 1995 (15) | 5 (Moderate) | Cohort | USA. University of Tennessee | 17 patients | 26 joints | Not specified | Upper maxilla<br><br>Jaw | 24 hours | Post- Splint resonance imaging 25/26 (96%). | 9 months in a range of 6-12 months, without MRI | Improvement of symptoms: Bilateral disc recapture: 89%.<br>No bilateral disc recapture: 65%<br>Unilateral recapture: 72% |

* Symptomatology. ** Reevaluation. *** Repositioning. **** Localization.
Source: the authors.

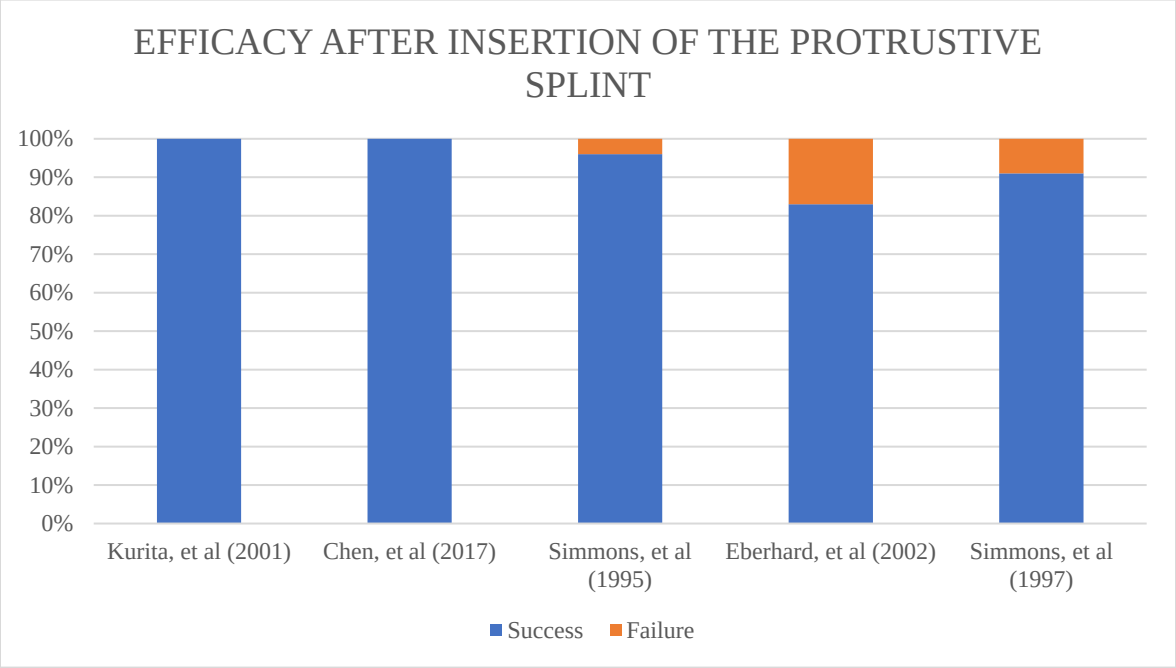


FIGURE 2
Efficacy after Insertion of the Protrusive Splint
Source: the authors.

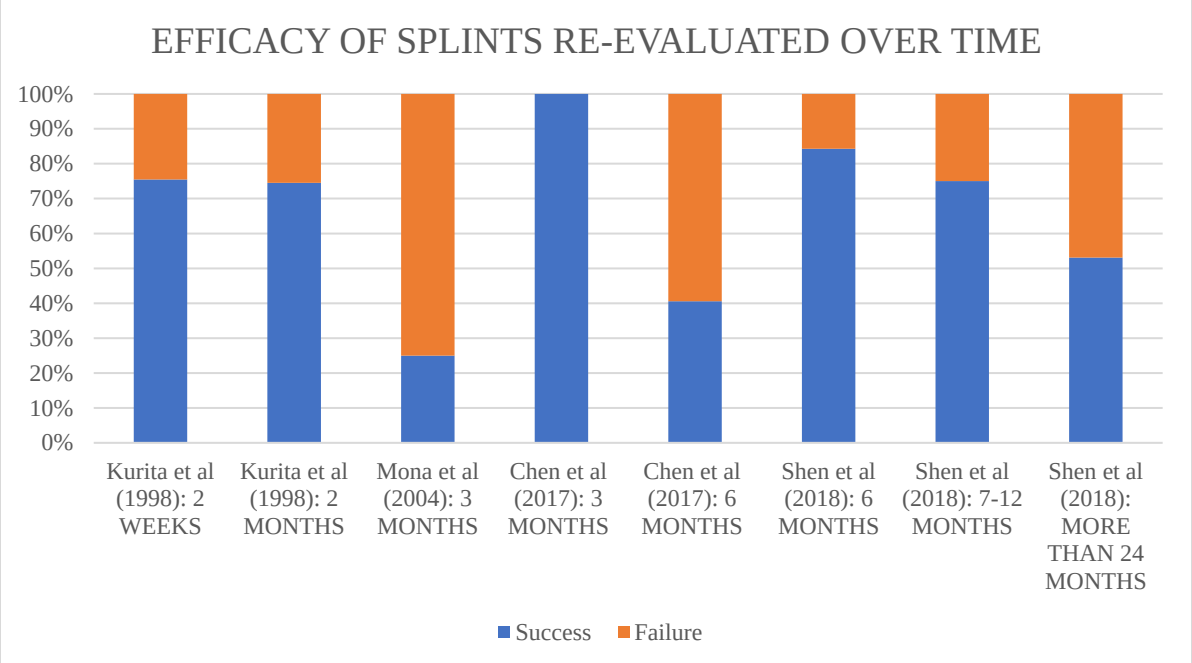


FIGURE 3
Effectiveness of the Protrusive Plate Reassessed over Time
Source: the authors.

## DISCUSSION

Currently, many patients suffer from anterior disc displacement with reduction. However, there is no clear consensus among healthcare professionals on a predictable and effective treatment. The literature

suggests that the use of a protrusive or anterior repositioning splint, which provides mechanical unloading and an anti-inflammatory effect on the joint, may be beneficial (2,6,10). This systematic review analyzed the available literature to evaluate the effect of using the protrusive splint in patients with this condition.

The focus of dentistry has evolved significantly over time. In the past, an integral approach encompassing all aspects of dental health was prioritized. Currently, the emphasis has shifted toward cosmetic dentistry, leading to a neglect of important parameters in the diagnosis of joint pathologies and their potential treatments (9,18).

Classical literature widely supports the effectiveness of the protrusive splint in treating anterior disc displacement with reduction. However, recent literature confirming this effectiveness is limited. The studies included in this review comprise cohorts, randomized clinical trials, and systematic reviews. Cohort studies analyzed the use of the splint over different periods. In a randomized clinical trial, participants were divided into two groups to compare the efficacy of the protrusive splint with that of canine guidance splints, with reevaluations every two weeks. This study concluded that the canine guidance splint was more effective than the protrusive splint, suggesting that other types of splints might be equally effective for patients (9,18).

The method employed was based on an exhaustive search of the available literature to analyze the effectiveness of the protrusive splint. Ten easily accessible articles were selected. The CASP questionnaire used in the study demonstrated several strengths. It provided a clear and structured framework that facilitated the critical evaluation of the included studies. Its questions guided the evaluator through the key elements of each investigation, ensuring a detailed and comprehensive review. Additionally, the questionnaire includes specific versions for different types of studies, such as systematic reviews, allowing for a more precise evaluation tailored to the nature of each investigation (12).

The CASP questionnaire is a free and accessible online tool designed for use by both healthcare professionals and students. It facilitates application at different levels of training by posing detailed and specific questions. Additionally, it promotes the development of critical thinking and strengthens analytical skills, making it a valuable resource for evaluating scientific research (12). However, the CASP questionnaire has some limitations. The interpretation of questions and answers can be subjective, allowing different evaluators to reach varying conclusions. Furthermore, it does not assign specific weights to each question, which could result in less precise evaluations and an insufficient representation of the validity of the obtained results (12).

Regarding the localization of the protrusive splint, studies indicated that splints placed on the upper jaw tended to be more effective than those on the lower jaw. This could be explained by the fact that, in the analyzed studies, upper splints were used for periods of 3 to 6 months, whereas lower splints were only employed for a maximum of 2 months. Therefore, it cannot be determined with certainty whether the greater efficacy is due to the splint's location or the duration of use by the patient (9,18).

This review highlights the need for further evidence and research on the management of anterior disc displacement with reduction, as there is still no clear consensus on the most appropriate treatment (9,13,15).

All the studies evaluated in this review indicate that, even if the disc does not fully reposition, most patients who used the splint experienced a significant reduction in pain symptoms. This finding is crucial as it improves patients' quality of life and positions this treatment as a viable option (9,13,18).

It is important to emphasize that magnetic resonance imaging should be the diagnostic method of choice to determine disc displacement with reduction. Presumptive diagnoses are unreliable, and the only way to accurately confirm or rule out this pathology is through this complementary examination (9,11,13,16).

This review demonstrates that the anterior repositioning splint is effective in repositioning the disc in cases of displacement with reduction. Kurita, *et al.* (2001) (13) confirmed through magnetic resonance imaging before and after treatment that anterior disc repositioning occurs when the patient uses the splint.

These results align with the findings of Chen, *et al.* (9), who reported 100 % effectiveness in cases of displacement with reduction (9). Similarly, Eberhard, *et al.* (2002) (1) indicated an 83 % success rate in disc recapture following splint use. Additionally, Simmons and Gibbs concluded in their two studies (14,17) that splint use in displacements with reduction achieved effectiveness rates of 91 % and 96 %, respectively.

These findings indicate that the repositioning splint demonstrates high efficacy in cases of displacement with reduction, showing immediate results after its use. However, it is important to note that these data reflect only short-term outcomes, which may limit their utility in evaluating the long-term effectiveness of the treatment (14).

Several studies evaluated the efficacy of the repositioning splint over specific periods following its insertion using magnetic resonance imaging. In 1998, Kurita, *et al.* (15) reported complete disc recapture in 75.5 % of cases after two weeks of continuous splint use for 24 hours, partial recapture in 15.5 %, and failure in 8.8 %. In the same year, Kurita, *et al.* (16) obtained similar results after two months of use, with complete success in 74.5 %, partial success in 14.9 %, and failure in 10.6 %. In 2018, Shen, *et al.* (18) demonstrated an initial success rate of 84.3 % at six months, but this percentage declined over time, reaching 75 % between 7-12 months and significantly reducing to 53.1 % at 24 months. This was the only study to perform a long-term reevaluation. In 2017, Chen, *et al.* (9) reported 100 % success at three months after splint use, but this percentage dropped to 40.6 % in a six-month reevaluation. These findings suggest that the anterior repositioning splint is effective in the short term, but the disc tends to return to its initial position over time (9).

Among the evaluated studies, most patients were women, suggesting that this gender is more affected by disc displacement with reduction. This is evidenced in the works of Kurita, *et al.* (14), Simmons and Gibbs (16), and Shen, *et al.* (18).

Regarding age, Shen, *et al.* (18) reported the success of disc recapture at six months across different age ranges. In participants under 20 years old, the success rate was 84.72 %; in the 21–35 age group, 84.21 %; and in those over 36 years, 77.78 %. Although these differences are not significant, it can be concluded that disc repositioning is more successful in younger patients.

In 2004, Fayed, *et al.* (20) published a randomized controlled trial evaluating disc repositioning with reduction at three months using the anterior repositioning splint. They determined its effectiveness to be 25 %, indicating that the treatment does not demonstrate significant efficacy.

In the study by Fayed, *et al.* (20), occlusal splint therapy was shown to significantly improve disc position and clinical symptoms in patients with anterior disc displacement, as evidenced by magnetic resonance imaging. These findings support the use of intraoral devices, such as occlusal splints, in managing disc displacement, highlighting their efficacy in alleviating pain and improving mandibular function. Additionally, considering the complementary use of neuromuscular relaxation splints, it is suggested that combining both therapeutic strategies could provide a comprehensive and effective approach to treating anterior disc displacement with reduction (19).

## CONCLUSIONS

The heterogeneity in the treatment of disc displacement with reduction varied according to the duration of use, the method of application, and the localization of the protrusive splint across the different study groups.

Anterior disc displacement with reduction can be treated with a protrusive splint. However, the available evidence is insufficient to determine its long-term efficacy.

The available evidence on the subject remains limited, as classical literature prevails over recent research.

The protrusive splint, whether in the upper or lower jaw, demonstrated successful outcomes in the reviewed studies.

Given the limited sample size of 10 articles, the conclusions of this study should be interpreted with caution. The small number of included studies restricts the generalizability of the findings and may not fully reflect the diversity of the available evidence. While the results provide valuable insights, the literature remains inconclusive due to this limitation. Additional research with clinical applications is recommended to expand knowledge on the subject.

## RECOMMENDATIONS

It is recommended to establish a consensus defining the duration, method of use, and localization of the protrusive splint. This would enable researchers studying the topic to obtain more accurate and comparable results in their studies.

It is crucial to conduct long-term studies to evaluate the sustained efficacy of the protrusive splint, which would allow for the development of more accurate and reliable clinical practice recommendations. Future studies should include reevaluations of disc position using magnetic resonance imaging at least two years after discontinuing the use of the protrusive splint. In this review, the reevaluations in the included studies were limited to a maximum period of six months post-treatment.

Randomized clinical trials comparing the efficacy of the anterior repositioning splint in the upper and lower jaws are necessary. Such studies would help determine which location offers better outcomes, providing more robust and specific evidence to optimize its use in clinical practice.

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* Original research.

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