

Effectivity of Occlusal Splint for TMD Treatment in Child and Adolescent

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Abstract

Temporomandibular joint disorder is a term for a group of musculoskeletal disorders and neuromuscular conditions that includes several clinical signs and symptoms involving the mastication muscles, temporomandibular joint, and related structures. The reported prevalence of temporomandibular joint disorders in infants, children, and adolescents varies widely in the literature. Occlusal splint is one type of oral splint that is often used to treat temporomandibular joint disorders.

The purpose of this literature review is to analyze the effectiveness of occlusal splints for treating temporomandibular joint disorders in children and adolescents.

Data collection was carried out by searching and analyzing literature from the electronic data site Pubmed, Wiley Online Library, Science Direct and manual search on the publication period from 2011 to 2021. Systematic data search using keywords: Temporomandibular joint disorders, children, adolescents, occlusal splints, treatment of temporomandibular joint disorders.

The occlusal splint is an effective device for treating temporomandibular joint disorders with symptoms of myofascial pain and TMD with a history of trauma. Occlusal splints are not effective for disc displacement of the temporomandibular joint due to Class II malocclusion in adolescents.

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Introduction

Temporomandibular joint disorder (TMD) is a collective term for a group of musculoskeletal and neuromuscular conditions that includes several clinical signs and symptoms involving the muscles of mastication, the temporomandibular joint (TMJ), and related structures.¹ Several researchers and clinicians define temporomandibular joint disorders as functional disorders of the masticatory system^{2,3} including masticatory muscle disorders, degenerative TMJ disorders and inflammation and displacement of the temporomandibular joint discs.^{4,5}

Temporomandibular joint disorder (TMD) is the main cause of non-odontogenic pain in orofacial area.^{2,4,6} Most of data show that the prevalence of signs and symptoms of temporomandibular joint disorders increases with age.^{7,8} One study noted that 5–9% of children aged 10 and 15 years reported symptoms associated with more severe temporomandibular joint disorders. Another study found 4.2% of adolescents aged 12-19 years reported temporomandibular joint pain. A study in children with primary dentition found that 34% of patients had signs and/or symptoms of temporomandibular joint disorders. Another study using the diagnostic criteria for temporomandibular joint disorders (TMD) showed a prevalence of 11.9% of temporomandibular joint disorders in adolescents.¹

Symptoms of TMD are often not realized by the patients, but if left continuously, the symptoms can get worse⁹, in the form of pain

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when opening the mouth, headache, and pain in the ear.¹⁰ The prevalence of clinical symptoms of TMD in children and adolescents most often is clicking and jaw locking. While other clinical symptoms are rarely found or not reported.¹¹ Many children and adolescents diagnosed with TMD will experience adaptive psychological changes during craniofacial growth and development. The late in diagnosis and treatment of TMD in children and adolescents can cause irreversible damage to the intracapsular structures of the TMJ, triggering craniofacial developmental abnormalities and pain in the TMJ area.¹¹

The main goals of therapy for temporomandibular joint disorders are to improve function, reduce pain, and improve quality of life. Simple, conservative, and reversible types of therapy have been found to be effective in reducing most of the symptoms of TMD in children.^{12,13} One of TMD therapy is by using occlusal splint. An occlusal splint is a removable appliance used for the diagnosis or treatment of affecting the relationship of the mandible to the maxilla. These devices can be used for occlusal stabilization in the treatment of TMJ disorders or to prevent tooth wear. The purpose of using an occlusal splint is to provide orthopedic stability to the TMJ. This stability alters the patient's temporary occlusion and can be used to decrease parafunctional activity.¹⁴

The purpose of writing this literature review is to discuss the effectiveness of the use of occlusal splint devices for the treatment of TMD in children and adolescents.

Materials and methods

Data source

Data collection was carried out by searching and analyzing literature from the electronic data site Pubmed, Wiley Online Library, Science Direct and manual searches in the publication time range from 2011 to 2021. Systematic data search using keywords: Temporomandibular joint disorders, children, adolescent, occlusal splint, treatment of temporomandibular joint disorders.

Criteria

Inclusion criteria: Articles published in the period 2011 – 2021, available online and previously published, and relating to the use of occlusal splints for the treatment of

temporomandibular joint disorders in children and adolescents.

Exclusion criteria: 1) inaccessible articles, 2) articles discussing the treatment of TMD disorders due to Jovenile Idiopathic Arthritis (JIA), craniofacial abnormalities, and neuromuscular disorders, and 3) article in the form of literature and systematic reviews.

Search Method

Pubmed
Science Direct
Wiley Online Library
Manual / Hand search

Search Details

Keywords: "Temporomandibular disorder" and "Occlusal splint" and "Treatment Temporomandibular Disorder" and "Children" and "Adolescence".

Data Collection and Data Analysis

The author takes articles through an electronic database according to keywords. The articles taken are articles from the last 10 years (2011 – 2021). The author assesses the title and abstract of the research resulting from the search. The authors assessed the full-text articles to determine that the studies met the inclusion criteria. The studies that met the inclusion criteria then underwent quality assessment and data extraction. Furthermore, the data obtained as follows:

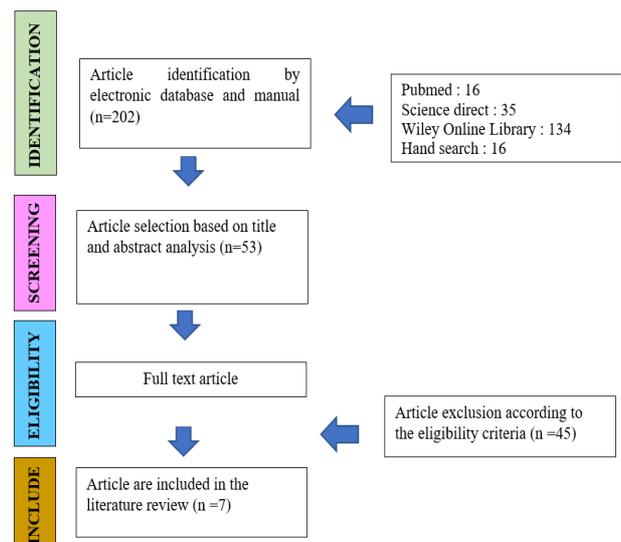


Figure 1. Flow of the search for journals for inclusion in the literature review.

Results

Temporomandibular Joint Disorders

Temporomandibular joint disorder (TMD) is a collective term for a group of musculoskeletal and neuromuscular conditions that includes several clinical signs and symptoms involving the muscles of mastication, the temporomandibular joint (TMJ), and related structures.¹ Several researchers and clinicians define temporomandibular joint disorders as functional disorders of the masticatory system^{2,3} including masticatory muscle disorders, degenerative TMJ disorders and inflammation and displacement of the temporomandibular joint discs.^{4,5}

Broadly speaking, jaw joint disorders are divided into three categories, namely internal derangement, degenerative disorders, and Myofascial Pain Dysfunction (MPD). Internal structural damage is related to abnormal relationship of the articular disc to the mandibular condyle, fossa, and articular eminence.

Degenerative disorders are disorders due to the aging process of the jaw joint structure, while MPD is thought to be the main cause of joint pain associated with the muscles of mastication and the muscles around the head and neck.⁹

The etiology of TMD is complex and multifactorial.¹⁴ Factors that can increase the risk of TMD are called predisposing factors. Factors that cause the onset of TMD are called initiating factors. Factors that interfere with healing or promote the development of TMD are called perpetuating factors.^{1,15,16} The success of TMD treatment depends on identifying and controlling these causative factors.¹⁵

Changes that occur in the teeth, periodontal ligament, TMJ, or masticatory muscles can cause TMD.¹⁷ Systemic and psychosocial factors can reduce the adaptive capacity of the masticatory system and contribute to TMD.¹⁸

The etiological factors that contribute to TMD are as follows¹: *Macrotrauma*. Trauma to the chin area is common in children. This trauma has been reported to be a contributing factor to TMD in pediatric patients because it often causes fractures in the condylar area. Fractures that are not treated properly can cause TMD and facial abnormalities.¹⁹ *Microtrauma due to parafunctional activity*. Bruxism, clenching, hyperextension, and other repetitive habits

contribute to the development of TMD.²⁰ This habit can cause damage to cartilage, alteration of synovial fluid, and disorders in other joints. Occlusal anatomic factors and parafunctional activity are associated with TMD pain in children²¹ several studies have revealed that the amount, frequency, intensity, and duration affect the severity of TMD²² *Anatomical factors (skeletal and occlusal) and orthodontic treatment*. TMD can occur or increase as a result of orthodontic treatment. Changes in the dimensions of the freeway space at rest also result in occlusal changes and muscle spasm.

The malocclusions were skeletal anterior open bite, overjet more than 6-7 mm, skeletal class II malocclusion profile,²³ class III malocclusion, unilateral posterior crossbite, and posterior crossbite associated with TMD. The presence of class II and class III malocclusion cases was associated with a higher prevalence of TMD in adolescents.^{24,25} *Psychosocial factors*. Emotional stress is a predisposing factor for bad habits of bruxism and clenching. These bad habits contribute to orofacial pain. Several case-control studies indicate that stress and anxiety management can reduce signs and symptoms of TMD. Depression, anxiety, post-traumatic stress disorder, psychological stress, and sleep disorders can all affect TMD symptoms. Anxiety is strongly associated with TMD in adolescents.²⁴ *Systemic and pathological factors*. Systemic factors that cause TMD such as rheumatoid arthritis, systemic lupus erythematosus, juvenile idiopathic arthritis, and psoriatic arthritis.^{16,24,26} Pathological hyperplasia and the presence of condylar tumors can cause TMD.²⁷ *Genetic and hormonal factors*. Few studies have shown an association between genetic factors and TMD. Additional research suggests that TMJ pain is associated with the menstrual cycle.²⁸

The diagnosis of TMD is based on the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD)⁵. Medical history examination, clinical examination, and/or craniocervical or TMJ radiographs are needed to assist in establishing the diagnosis of TMD.¹⁸ Radiographic examination is recommended in cases of children who have a history of trauma, facial asymmetry, and have hard tissue crepitus during clinical examination.²⁹

Clinical examination of TMD includes³⁰: location of pain (pain that occurs is evaluated as ipsilateral or contralateral pain. Clinical

examination is carried out on masticatory muscles and or jaw function), mandibular Range of Motion (ROM) (examination of jaw opening measured in millimeters). Examination is done through independent vertical, lateral, and protrusive mouth opening movements without pain), TMJ sounds (sounds include clicking, and crepitations are checked through palpation during vertical, lateral, and protrusive movements), Tenderness in muscles and joints (pain examination). pressure is done by palpation of the area of muscles and joints).

Orofacial pain and headache are associated with a diagnosis of TMD pain associated with bruxism.⁴ The most common clinical presentation of TMD in children and adolescents is clicking and jaw locking. While other clinical symptoms are rarely found or not reported.¹¹

Research conducted by Emodi- Perlman found a significant relationship between TMD symptoms based on anamnesis (questionnaire answers) and TMD symptoms based on clinical examination. They also concluded that early screening for TMD in children should be assisted by parents.³¹

A study states that dentists feel less confident in making diagnostic, therapeutic and treatment decisions with interocclusal appliances, jaw exercises and TMD pharmacological interventions in children or adolescents compared to adults³² the percentage of children and adolescents who visit the dentist or therapist to treat TMD pain is still low, so public education is needed.⁴

The relevant statistics show that the symptoms of TMD first begin to occur specifically at puberty, in children and adolescents, and these symptoms are more prominent in girls than boys. This also coincided with the initiation of orthodontic therapy, which is accepted especially at a young age.³³ Malocclusion, as the diagnosis of orthodontic treatment is also the etiology of TMD.

A significant effect was found between cases of TMD and posterior crossbite, anterior open bite, Angle Class III malocclusion, and 6 mm maxillary overjet.¹⁶ Treatment of TMD in adults includes initial, reversible, non-invasive therapy (including self-guided management, physical therapy, pharmacotherapy, occlusal splint therapy, and psychological interventions).

While irreversible therapy includes occlusal therapy, complex pharmacotherapy, orthodontics, and surgery.³⁴ In pediatric patients, the AAPD recommends a reversible treatment to treat TMD in children and adolescents.¹

Occlusal Splint as a Treatment for Temporomandibular Joint Disorders

One of TMD therapy is by using occlusal splint. An occlusal splint or also known as a "bite splint" is a removable appliance made specifically of acrylic resin, covering the incisal to occlusal surfaces of the maxillary and mandibular teeth.^{35,36} This appliance can affect the relationship of the mandible to the maxilla. These devices are used for occlusal stabilization in the treatment of TMJ disorders or to prevent tooth wear. The purpose of using an occlusal splint is to provide orthopedic stability to the TMJ. This stability alters the patient's occlusion temporarily and can be used to decrease parafunctional activity. Occlusal splints are usually made of acrylic, which are attached to the occlusal and incisal surfaces of the teeth thereby creating precise contact with the opposing teeth.^{14,35}

This tool is used 24 hours a day for 3- 6 months. After the complaint has disappeared, permanent occlusal modifications should be made to obtain a longer effect. Some studies show that symptoms do not go away immediately when the splint is removed.⁹

Indications for the use of an occlusal splint¹⁴: growth modification during mixed dentition, restricted tooth movement eg in the treatment of arch expansion and malposition of individual teeth, retention after orthodontic treatment, addition to fixed orthodontic appliances, stopping or preventing abnormal orofacial habits, TMJ disorders, mandibular fractures

Contraindications to the use of an occlusal splint are¹⁴: severe skeletal discrepancy, severe bodily rotation required, vertical discrepancy, severe crowding of teeth, and very dense bone.

Types of occlusal splints:

Based on Okeson³⁷: orthopedic repositioning device, muscle relaxation device, soft appliance, anterior biteplane, pivot device

Based on Dawson³⁸: permissive splint, non permissive splint, pseudo permissive splint (like soft splint)

Based on the consistency³⁹: hard acrylic resin, soft or resilience occlusal appliances, and

a combination of hard acrylic resin and soft or resilience occlusal appliances.

Hard acrylic resin occlusal splints have several advantages over soft appliances. The hardness and resistance of acrylic resin allows for an easier and faster adjustment process, easy repair, more accurate installation of resin hard acrylic, more reliable fabrication method and longer service life, more stable color, less accumulation of food debris and more resistance longer than soft appliances. On the other hand, the adjustment process for soft appliances is more difficult and often results in an inadequate occlusal scheme. They are also more prone to wear over a longer period of time because they produce occlusal changes.³⁸

From an economic perspective, the use of hard acrylic resin occlusal splints is considered cheaper than the use of soft occlusal splints. Soft appliance is recommended to reduce the muscular and joint symptoms of TMD. A study using Electromyography (EMG) comparing the effects of hard acrylic resin and soft appliances on masseter and temporalis muscle activity, found that muscle activity was reduced more with hard acrylic resin occlusal splints, and occlusal appliances resulted in a slight increase in masseter and temporalis muscle activity.³⁹ The most common type of interocclusal appliance made for children/adolescents is the soft appliance type occlusal splint. The main reason is because children are still in their infancy, therefore dentists do not want to hinder the development of jaws and teeth in young children.³²

To obtain maximum benefit from the use of an occlusal splint, the dentist should make adjustments immediately after insertion, and perform periodic check-ups. Adjustment of this appliance should take into account the centric occlusal contacts of the anterior and posterior teeth. The design of the appliance must also match the position of the condyles during protrusive and parafunctional movements. Adjustments to the functional surface should be made periodically to control the tone of the masticatory muscles and restore the inflammatory condition of the temporomandibular joint.³⁵



Figure 2. Hard splint inserted in patient's mouth.

Sources: Amen, Anish; Meshramkar, Roseline; and Lekha, K. Comparative Evaluation of Clinical Performance of Different Kind of Occlusal Splint in Management of Myofascial Pain. Journal of Indian Prosthodontic Society. April – June, Vol. 16 Issue 2. 2016.



Figure 3. Soft splint inserted in patient's Mouth.

Sources: Amen, Anish; Meshramkar, Roseline; and Lekha, K. Comparative Evaluation of Clinical Performance of Different Kind of Occlusal Splint in Management of Myofascial Pain. Journal of Indian Prosthodontic Society. April – June, Vol. 16 Issue 2. 2016.



Figure 4. Liquid supported splint inserted in patient's mouth.

Sources: Amen, Anish; Meshramkar, Roseline; and Lekha, K. Comparative Evaluation of Clinical Performance of Different Kind of Occlusal Splint in Management of Myofascial Pain. Journal of Indian Prosthodontic Society. April-June, Vol. 16 Issue 2. 201.

Discussion

This literature review was created to discuss the effectiveness of treating temporomandibular joint disorders (TMD) in children and adolescents using occlusal splints. The data obtained were randomized clinical studies, case and control studies, and case reports. Available data mention the use of occlusal splints in patients with TMD with bruxism in children³⁰, comparison of occlusal splints with relaxation therapy guidelines for the treatment of TMD in adolescents^{40,41,42,43} the use of occlusal splints in TMD due to trauma in children⁴⁴, and occlusal therapy in juvenile class II malocclusion with temporomandibular joint displacement.⁴⁵

The use of occlusal splints to treat TMD with bruxism in children has been carried out by Restrepo et al (2011). Restrepo et al reported that the use of a rigid occlusal splint is inefficient for treating bruxism, but it can reduce deviation when opening the mouth.²⁹ Restrepo et al. reported that the use of a rigid occlusal splint is not efficient for treating bruxism, but can reduce deviation when opening the mouth.²⁹

Rigid occlusal splint is the most widely used therapy to treat bruxism in adults. This device is considered more economical and easier to use. This device can reduce parafunctional muscle activity thereby triggering relaxation, increasing vertical dimension, reducing pressure on the TMJ, protecting teeth from attrition, helping the condyle in a centric position, but also causing a placebo effect. However, there is little evidence to support the use of an occlusal splint in the primary dentition. The use of a rigid occlusal splint is well accepted by both the patient and their parents.²⁹

Three types of occlusal splints used to treat TMD with symptomatic myofascial pain were compared by.⁴⁶ Amin et al mentioned that the hard splint occlusal type proved to be very effective in a short period of time, followed by the liquid splint, then the soft splint. The occlusal hard splint device experienced changes in the surface after 7 days of use. The soft splint type occlusal device undergoes gradual changes from the beginning of installation and undergoes gradual changes after that.³⁹

Research conducted by Amin et al also suggested the use of occlusal splints for the treatment of myofascial pain. This device is considered a simple device with minimal side

effects, more cost-effective, non-invasive, and easier to use by patients. Based on these findings, he advised clinicians to use occlusal splints as a treatment protocol for patients with myofascial pain disorders.⁴⁶

Wahlund and Larsson (2015) stated that the use of clinically standardized occlusal splints for the treatment of TMD pain in adolescents was more effective than relaxation therapy guidelines when evaluating treatment. Adolescents who used daily occlusal splints showed better results. Occlusal splints are more cost effective.⁴²

Later in 2017, he also stated that occlusal splints were effective for treating adolescents with TMD disorder. Gender is also a predictor of treatment success. Boys respond more positively to treatment than girls. Girls who experience pain from TMD report more somatic symptoms and take more analgesics than boys. Adolescents treated with occlusal splints showed a better continuous healing process and less need for low-level health services than those using relaxation therapy guided care.^{43,40}

Arturo Garrocho-Rangel et al (2018) stated that the use of an occlusal splint is highly recommended for the treatment of TMD symptoms in the form of anterior disc shift with reduction in children and adolescents. Among the various types of treatment, the use of a soft occlusal splint can be recommended. This device can reduce muscular activity and is more comfortable for children. In addition, this therapy can reduce symptoms, change the distribution of traumatic forces, and establish neuromuscular harmony in the masticatory system.⁴⁴

Shen et al (2019) stated that the use of an occlusal splint was not effective in treating adolescents with cases of class II malocclusion accompanied by TMD in the form of disc displacement of the temporomandibular joint.⁴⁵

Kerstin Wahlund and Bo Larsson (2020) stated that the use of occlusal splints in adolescents who experienced TMD had lower post-therapy pain intensity than other TMD treatments.⁴¹ Although the occlusal splint has been used as the standard method for the treatment of TMD, although empirically weak, long-term studies have had significant results in terms of reducing myofascial pain due to TMD.³⁸

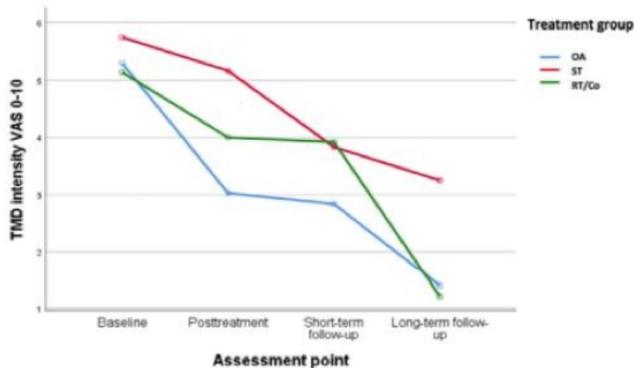


Figure 5. Changes in temporomandibular disorder (TMD) pain intensity across the four time points (baseline, posttreatment, short-, and long-term follow-up evaluations) by treatment condition. Figures (1-5) refer to mean values on the VAS 0–10 scale as reflected by repeated analysis of variance (ANOVA). OA, occlusal appliance; RT/Co, relaxation therapy/control condition; ST, sequential treatment.

Sources : Wahlund, Kerstin; and Larsson, Bo. The course of pain intensity and frequency of adolescents treated because of TMD : a long term follow up. Clinical and Experimental Dental Research Vol.6 407-414. 2020.

A study conducted by Christidis et.al, concluded that the use of occlusal devices combined with brief information appears to be the most effective and cost-effective treatment of TMD in adolescents.⁴⁷

Robin mentioned that the use of occlusal splints in children is very difficult, especially during the mixed dentition period, because it can interfere with the exfoliation of primary teeth so that it interferes with the eruption of permanent teeth. He also mentioned that if a child's TMD is caused by a malocclusion, then the treatment should be orthodontic treatment.⁴⁸ According to his reported case, dentist should follow up their patient during this treatment. With regular follow up, and know the eruption and exfoliation period of each teeth, these problems would be resolved.

Based on several studies in this literature review synthesis table, occlusal splints are effective for treating TMD in children and adolescents. Occlusal splint is a non-invasive TMD treatment with minimal side effects. Apart from cost-effectiveness reasons, the use of an occlusal splint is simpler, and acceptable to both the patient and their parents. Because of its easy and simple use, adolescents who use occlusal splints to treat TMD show a better healing

process than TMD treatment with other modalities. This is characterized by reduced complaints of myofascial pain due to TMD in long-term studies.

The recommended occlusal splint for children is an occlusal splint with a soft appliance type. There is still little evidence showing the effectiveness of using an occlusal splint in the primary dentition. Occlusal splints are even considered to interfere with the exfoliation of primary teeth so that they can interfere with the eruption of permanent teeth later.

Conclusions

Occlusal splints are effective in treating TMD with symptoms of myofascial pain in adolescents, but the use of occlusal splints during mixed dentition is considered quite difficult and can interfere with the exfoliation of primary teeth, thereby interfering with the eruption of permanent teeth.

Occlusal splints are also effective for treating TMD in children with a history of trauma. The recommended type of occlusal splint in this condition is a soft splint occlusal type.

Occlusal splints are not effective for treating disc displacement of the temporomandibular joint due to Class II malocclusion in adolescents.

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Declaration of Interest

The Authors have no conflict interest to declare.

NO.	JOURNAL & YEAR	AUTHOR	TITLE	OBJECTIVE	METHOD	RESULT
1	European Journal of Dentistry Vol. 5. 2011	Claudia C. Restrepo, Isabel Medinab Isabel Patiñob	Effect of Occlusal Splints on the Temporomandibular Disorders, Dental Wear and Anxiety of Bruxist Children	To evaluate the effectiveness of occlusal splints to reduce the signs and symptoms of temporomandibular disorders (TMD), dental wear and anxiety in a group of bruxist children	Randomized clinical trial	The use of rigid occlusal bite plates was not efficient in reducing the signs of bruxism as a whole but did reduce the deviation in mouth open
2	Journal of Oral & Facial Pain and Headache Volume 29 No. 1. 2015	Kerstin Wahlund, Bo Larsson	Treating Temporomandibular Disorders in Adolescents: A Randomized, Controlled, Sequential Comparison of Relaxation Training and Occlusal Appliance Therapy	To compare the effects of occlusal appliance therapy (OA) and therapist-guided relaxation training (RT) on temporomandibular disorder (TMD) pain in adolescents, thereby replicating a previous randomized controlled trial, and to explore whether additional therapy administered in a crossover sequential design improves treatment outcomes	Randomized clinical trial	The findings suggest that for adolescent with TMD pain, use of standardized clinical treatment with is OA is more effective than RT on self evaluation of treatment improvement. For non responders, subsequent crossover treatment might be useful to improve subjective TMD Pain.
3	Journal of Oral & Facial Pain and Headache Volume 31 No.3. 2017	Kerstin Wahlund, Bo Larsson	Predictors of Clinically Significant Outcome for Adolescents with Temporomandibular disorders	To evaluate and identify baseline characteristics of the adolescent patients included in two previous randomized controlled trials (RCTs) that may predict a clinically significant outcome after treatment of temporomandibular disorders (TMD) with an occlusal appliance (OA) or relaxation training (RT) in a clinical sample of adolescents	Randomized clinical trial	The findings of the present study showed that the commonly used treatment method of OA in clinical practice for adolescents suffering from TMD is effective, but also that gender emerged as the most consistent predictor of a clinically significant response across outcome measures. While a substantial proportion of individuals responded with a clinically significant improvement across different outcome measures, depending on the outcome measure used, about one-quarter to half of the sample were non-responders to the most effective treatment (OA) at both time points (treatment completion and 6-month follow-up). These results therefore underline that the effectiveness of treatment for adolescents suffering from TMD needs to be further improved, in particular for teenage girls suffering from the disorder. The findings should also be further tested in RCTs replicated at other sites, preferably with the inclusion of larger sample sizes
4	Acta Odontologica Scandinavica. 2017	Kerstin Wahlund, Bo Larsson	Long term treatment outcome for adolescence with TMD Pain	This study aims to evaluate long-term, self-perceived outcome in adulthood for individuals treated as adolescents for temporomandibular disorder (TMD) pain in two previous randomized controlled trials (RCTs)	Randomized clinical trial	Those treated with an OA had sought additional treatment significantly less often since the RCTs than ST and RT/Co-treated individual. Differential treatment effects were found in our extended follow-up study in that adolescents treated with an OA showed somewhat better, sustained improvement, with lower health care use over the extended follow-up period compared to those treated with the alternate method, RT/Co.
5	Hindawi. April. 2018	Arturo Garrocho-Rangel, Andrea Gomez-Gonzalez, Adriana Torre-Delgadillo, Socorro Ruiz-Rodríguez, and Amaury Pozos-Guillén	Case Report Pain Management Associated with Posttraumatic Unilateral Temporomandibular Joint Anterior Disc Displacement: A Case Report and Literature Review	The aim of the present article is to review the etiological risk factors and the general and oral management of anterior disc displacement with reduction caused by a chin trauma, and to describe the diagnostic process and the treatment provided to an affected 7-year-old girl.	Case report and Literature review	Occlusal splints are strongly recommended for the treatment of anterior disc displacement with reduction in children and adolescents. Among the different treatment options, the use of soft material-based occlusal splints can be recommended, as it device reduces the muscular activity, thus giving more comfort to the child; moreover, the therapy relieves symptoms, changes the distribution of traumatic forces, and establish a neuromuscular harmony in the masticatory system
6	Journal of Craniofacial Surgery Vol.30, No.1. 2019	Pei Shen, MS, Xiaohan Liu, MS, Qianyang Xie, MS, Shanyong Zhang, MD, and Chi Yang, MD	The Effect Evaluation of Functional Appliance Used for Class II Patients With Temporomandibular Joint Anterior Disc Displacement	The aim of this study was to explore the role of temporomandibular joint disc position in functional appliance treatment	Clinical Trial	Our results suggested that it is non-effective of functional appliance used for class II malocclusion adolescents with ADW/O and only a normal disc-condyle relationship benefits condyle growth by functional appliance. Thus it is important to reposition the disc as soon as possible
7	Clinical and Experimental Dental Research Vol.6 407-414. 2020	Kerstin Wahlund, Bo Larsson	The course of pain intensity and frequency of adolescents treated because of TMD : a long term follow up	To evaluate the course of pain intensity and frequency related to temporomandibular disorders (TMDs) 15 years (range 5-21 years) after having received TMD treatment as adolescents due to frequent (at least once a week) TMD pain in two controlled trials	Randomized clinical trial	A significantly higher proportion of participants treated with OA and in the combined RT/Co condition than those in the ST group, reported a frequency level of TMD pain less than once week at post-treatment and the long-term follow-up. Adolescents treated with OA showed significantly lower TMD pain intensity levels post-treatment than those in the other two treatment conditions. While no difference between the OA and the RT/Co conditions was found in the long-term follow-up, participants in these two conditions were significantly more improved than those in the ST group. Although OA has been used in clinical practice as a standard method for TMD treatment in adolescents, despite weak empirical support based primarily on findings in adult populations, the present long-term study including adolescents with predominantly myofascial pain showed that such treatment has significant clinical value in reducing these complaints

Table 1. Study descriptive data included.

NO.	JOURNAL & YEAR	AUTHOR	TITLE	NUMBER OF SAMPLE	TREATMENT DURATION
1	European Journal of Dentistry Vol. 5. 2011	Claudia C. Restrepo, Isabel Medinab Isabel Patiñob	Effect of Occlusal Splints on the Temporomandibular Disorders, Dental Wear and Anxiety of Bruxist Children	3 to 6 years old children with complete primary dentition, class I malocclusion and bruxist. The children were randomized into an experimental (n=19) and a control (n=17) group	The children in experimental group used rigid bite plates for two years period, until mixed dentition
2	Journal of Oral & Facial Pain and Headache Volume 29 No. 1. 2015	Kerstin Wahlund, Bo Larsson	Treating Temporomandibular Disorders in Adolescents: A Randomized, Controlled, Sequential Comparison of Relaxation Training and Occlusal Appliance Therapy	64 adolescents aged 12 to 19 years with TMD pain. The patients were randomly assigned to either Relaxation Therapy or Occlusal Appliance	The adolescents in OA group were asked to use the splint every night until posttreatment evaluation until their 6 month follow up. Patient in RT group received individual, clinic based treatment for 8 weekly session of 45 minutes each, representing a total of 6 hours of therapist time
3	Journal of Oral & Facial Pain and Headache Volume 31 No.3. 2017	Kerstin Wahlund, Bo Larsson	Predictors of Clinically Significant Outcome for Adolescents with Temporomandibular disorders	167 adolescents with frequent TMD Pain treated with OA, RT, or received information only (control)	Predictors of outcome were evaluated posttreatment for the whole sample and at 6 months follow up for participants from the first trial
4	Acta Odontologica Scandinavica. 2017	Kerstin Wahlund, Bo Larsson	Long term treatment outcome for adolescence with TMD Pain	116 subjects treated for frequent TMD pain in two separate RCTs 5-21 years previously. Treatment consisted of occlusal appliance (OA) (n=41) or relaxing training (RT) combined with information for the control group (n=50), compared to non responders receiving additional, sequential treatment (ST) in a crossover study (n=25)	Unknown
5	Hindawi. April. 2018	Arturo Garrocho-Rangel, Andrea Gomez-Gonzalez, Adriana Torre-Delgadillo, Socorro Ruiz-Rodríguez, and Amaury Pozos-Guillén	Case Report Pain Management Associated with Posttraumatic Unilateral Temporomandibular Joint Anterior Disc Displacement: A Case Report and Literature Review	The aim of the present article is to review the etiological risk factors and the general and oral management of anterior disc displacement with reduction caused by a chin trauma, and to describe the diagnostic process and the treatment provided to an affected 7-year-old girl.	The patients was instructed to use the splint at least 12 hours a day, especially overnight, and to activate the expansion screw once, two days a week, in order to compensate the natural maxilla traverse growth. The patient was scheduled regularly every two weeks. After 10 months follow-up cephalae attacks reported to be significant reduction.
6	Journal of Craniofacial Surgery Vol.30, No.1. 2019	Pei Shen, MS, Xiaohan Liu, MS, Qianyang Xie, MS, Shanyong Zhang, MD, and Chi Yang, MD	The Effect Evaluation of Functional Appliance Used for Class II Patients With Temporomandibular Joint Anterior Disc Displacement	8 patients who had 1 joint anterior disc displacement with reduction and the other joint anterior displacement without reduction	6 months
7	Clinical and Experimental Dental Research Vol.6 407-414. 2020	Kerstin Wahlund, Bo Larsson	The course of pain intensity and frequency of adolescents treated because of TMD : a long term follow up	167 individuals were then invited to participate in a long term follow-up evaluation	6 months

Table 2. Study descriptive data included.

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