

ORIGINAL RESEARCH PAPER		Oral Medicine
"MANAGEMENT OF TEMPOROMANDIBULAR DISORDERS USING OCCLUSAL SPLINTS: A SYSTEMATIC REVIEW"		KEY WORDS: Temporomandibular disorders, myofascial pain, occlusal splints, occlusal appliance, systematic review.
Dr. Komali Garlapati	MDS, Professor And HOD, Department Of Oral Medicine And Radiology, Panineeya Mahavidyalaya Institute Of Dental Sciences And Research Centre, Kamala Nagar, Road Number -5, Chaitanyapuri, Dilsukhnagar, Telangana – 500060.	
Dr. Anuja Kammari*	MDS, Senior Lecturer, Department Of Oral Medicine And Radiology, Sri Balaji Dental College And Hospital, Yenkapally Village, Moinabad Mandal, Telangana – 500075. *Corresponding Author	
Dr. Akula Sarika	MDS, Senior Lecturer, Department Of Conservative Dentistry And Endodontics, Panineeya Mahavidyalaya Institute Of Dental Sciences And Research Centre, Kamala Nagar, Road Number -5, Chaitanyapuri, Dilsukhnagar, Telangana – 500060.	
Dr. Malligere Basavaraju Sowbhagya	MDS, Professor, Department Of Oral Medicine And Radiology, Rajarajeswari Dental College, Bangalore.560074	
Dr. Gaurav Sharma	Assistant Professor, Department Of Oral Medicine And Radiology, NSVK Sri Venkateshwara Dental College And Hospital, Bangalore.	
Dr. Pratima Soni	MDS, Consultant Oral Medicine And Radiologist, Private Dental Practitioner, Hyderabad.	
ABSTRACT	Aim & Background: Temporomandibular disorder (TMD) is a condition with symptoms that include pain, clicking, noise, grating in the jaw joint, or problems in chewing or opening the jaw and is one of the most frequent causes of facial pain. Many therapies have been mentioned in the literature for their management. Occlusal splint therapy is one of the non-invasive treatment modalities. The objective of this study is to review the data from randomized controlled studies about the efficacy of occlusal splint therapy in treating temporomandibular disorders. Materials And Methods: A systematic literature search was done using databases PubMed/Medline, Research Gate, Google Scholar, Cochrane Library, Embase, Science Direct, and EBSCO for published studies from 1982 to March 2024 in the treatment of TMD by occlusal splints. Results And Conclusion: A total of 39 randomized controlled trials were included in this review, corresponding to 1,984 participants, and a majority of studies gave evidence of occlusal splint therapy being beneficial.	

INTRODUCTION:

The temporomandibular joint is a complex joint with complex movements. TMDs are a group of disorders with multifactorial etiology with varied signs and symptoms.^[1] Temporomandibular disorder is a collective term that represents several clinical problems that include conditions of the masticatory musculature, the temporomandibular joint, and associated structures.^[2] TMD is the most common facial pain of non-dental origin.^[3] The signs and symptoms of TMD include pain, joint noises (clicking, crepitus), limited jaw movements, and headache.^[4] TMD is prevalent in people aged 20 - 40 years, and most of them are women.^[2,5] Since the TMJ's kinesiology is complex, managing these disorders has become a new challenge to the clinician. Various methods are adopted from a long but did not give a reasonably satisfactory outcome.^[1] The different methods of management of TMD include self-care, behavioral therapy, patient education, ultrasound therapy, acupuncture, short wave diathermy laser, jaw exercises, biofeedback, occlusal splint therapy, pharmacotherapy, occlusal adjustment, surgical intervention, and combined therapy.^[4] Among them, occlusal splint therapy is most commonly used to treat TMD as it is a simple, reversible, and noninvasive method.^[6] There are various types of occlusal splints reported in the literature having their indications and functions. TMDs is a broader terminology that constitutes various disorders, and this review aims to evaluate occlusal splint therapy in the management of symptomatic TMDs causing myalgia, arthralgia, and mixed type (myalgia and arthralgia).

MATERIALS AND METHODS:

The study included all the randomized control trials published from 1982 to January 2022 comparing occlusal splints in managing temporomandibular disorders with the control group and or other occlusal appliances, irrespective of age and gender. Criteria considered are pain on palpation of the temporomandibular joint, masticatory muscles, restriction or deviation of mandibular movement, joint sounds, and headache and were selected from the databases such as Research Gate, Google Scholar, Cochrane Library, PubMed/ Medline, Embase, Science Direct and EBSCO using key words management of TMD, randomized control trials temporomandibular disorders, temporomandibular disorders, occlusal splints. **(Figure:1)**

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(n = 2,979)] --> B[Records after removing studies with irrelevant titles and only abstracts available  
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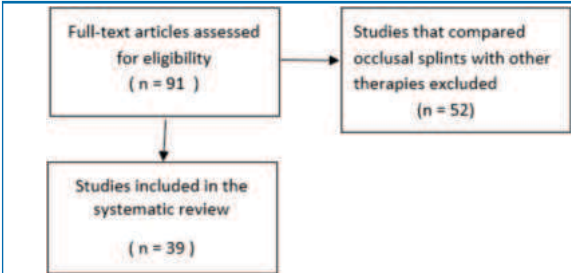


Figure 1: Study Flow Chart

Eligibility Criteria:

The eligibility criteria include randomized control trials comparing different types of occlusal splints, patients diagnosed with TMD, and articles in English. Studies excluded are trials comparing occlusal splints with different therapy, articles with irrelevant titles, studies with only abstracts available, non-randomized control trials, review articles and case reports.

Data Extraction And Quality Assessment:

Two authors (AK and AS) reviewed and retrieved data from the eligible articles, and a third author (KG) was involved if any discrepancies existed. Data collected from each study include author, year of publication, the number of participants who completed the study, age, duration of the study, diagnostic criteria used, diagnosis of the patients, and study groups. The quality of evidence of the studies was measured using Hadorn et al. criteria.^[7]

TMD Diagnostic Criteria:

Different studies considered different classification systems based on the system followed at that period and understanding of the associated symptoms. Hence a uniform standardization is not practical within the limits of this study. However, considering the symptoms, signs, and clinical examination findings, the disorders were grouped based on the pain's location as causing myalgia, arthralgia, and mixed type (myalgia and arthralgia) and to evaluate the efficacy of occlusal splint therapy instituted. Following criteria and

1 a) Studies showing inclusion of patients diagnosed with arthralgia

Author/ year	No. of participants completed the study	Age	Duratio n	Diagnostic criteria	Diagnosis of patients included	Study groups	Result
Lundh H et al (1985) ^[8]	70	30yrs (Median)	8weeks	Clinical examination	Disc displacement with reduction	1) Anterior repositioning splint 2) Flat occlusal splint 3) Control group: without treatment	Anterior repositioning splint was more effective
Lundh H et al (1988) ^[9]	63	13-74 yrs	6months	Clinical examination	Disc displacement with reduction	1) Silver onlays to maintain disk repositioning 2) Flat occlusal maxillary splint 3) Untreated controls	Disk-repositioning onlays were effective in reducing pain and dysfunction associated with disk displacement with reduction but the symptoms, returned when the onlays were removed after 6 months.
Lundh H et al (1992) ^[37]	51	14-61yrs	12months	Arthrography	Disc displacement without reduction	1) Flat occlusal splint 2) Untreated controls	No statistically significant benefit of flat occlusal splints was identified.
Ekberg E et al (1998) ^[10]	60	13-76yrs	10weeks	Clinical examination	Capsulitis/ synovitis	1) Treatment group: Stabilization appliance 2) Control group: designed with palatal coverage and clasps on maxillary teeth	Both the appliances had an effect on TMD pain but an improvement of frequency and intensity of tmj pain are significantly more in stabilization appliance group.
Fayed MM et al	9	18-30yrs	3 months	1) Clinical examination	Anterior disc displacement with	1) Canine protected splint 2) Anterior	Both splints were effective in eliminating pain and

classification systems were followed in the trials included in the present study: Clinical examination^[8-19], RDC/TMD^[1,20-36], arthrography^[37], Magnetic Resonance Imaging^[11,12,14,15,19,22], AAOP^[18,38-41], Helkimo index^[18,38], DC/TMD^[42,43], International Headache Society criteria^[39,44], Fonseca patient history index^[45].

Outcomes Measured:

The pain was measured using a visual analog scale (VAS), electromyographic index activity, Modified Symptom Severity Index (Mod-SSI), Muscle palpation, Pressure algometer, and Helkimo score. Other outcomes measured were depression, quality of life, and jaw opening. The primary outcome of this review is the evaluation of pain, and the secondary outcome is the elimination or reduction in joint noises (click sounds) after occlusal splint therapy.

RESULTS:

The study included 39 studies, and all the studies were randomized control trials. The total number of participants included in the trials is 1,984, with a range of 9 to 200 participants and the majority are females.

All the studies included in this review have used different types of occlusal appliances and were evaluated based on expected outcomes such as pain and other clinical symptoms. There are 30 studies showing the comparison of occlusal splints with other types of occlusal splints and/ controls. The characteristics of these studies are mentioned in Table 1 (Table 1a: patients diagnosed with arthralgia, Table 1b: patients diagnosed with myalgia, Table 1c: patients diagnosed with both arthralgia and myalgia). A total of 9 studies compared the efficacy of hard occlusal splints with soft occlusal splints/ liquid oral splints and these studies are enumerated in Table 2 (Table 2a: patients diagnosed with myalgia, Table 2b: patients diagnosed with both arthralgia and myalgia).

Table 1: Characteristics of studies comparing occlusal splints with other types of occlusal splints and untreated controls.

(2004) ^[11]				n 2) Magnetic Resonance Imaging	reduction	repositioning splint	clicking and the canine protected splint was found superior to anterior repositioning splint.
Tecco S et al (2004) ^[12]	50	14- 63yrs	8months	1)Clinical examination 2) Magnetic Resonance Imaging	Internal disc derangement	1) Anterior repositioning splint (AR splint) 2)Full arch maxillary stabilization splint (FAMS) 3)Control group (Untreated patients)	- AR splint is more effective in decreasing pain. Joint noises decreased over time with no significant difference among the groups.
Conti PC et al (2005) ^[13]	52	31.8yrs (mean)	1year	Clinical examination	Disc displacement with reduction	1)Stabilization splint 2)Anterior repositioning splint 3)Control group: No treatment	Controlled partial use of anterior repositioning splints was more beneficial.
Tecco et al (2006) ^[14]	50	14- 63yrs	6months	1)Clinical examination 2)Magnetic Resonance Imaging	Internal derangement	1)Anterior Repositioning (AR) splint 2) SVED (Sagittal Vertical Extrusion Device) and a MORA (Mandibular Anterior Repositioning Splint) 3)No treatment (Control Group)	Use of two splints seems to be as effective as an AR maxillary splint.
Conti PC et al (2006) ^[20]	57	29.9yrs (mean)	6months	RDC/TMD	1)Disc displacement 2)Arthralgia	1) Bilateral balanced guidance stabilization splint 2)Canine guidance splint 3)Non occluding splint	There was no influence of guidance type used but occlusal splints were better than non occluding splint.
Tecco et al (2010) ^[15]	50	14.3 to 63.4 yrs	6 months	1)Clinical examination 2)Magnetic Resonance Imaging	Anterior disk displacement with reduction	1)Anterior Repositioning splint 2)Fixed orthodontic appliance 3)No treatment (Control Group)	Use of a fixed orthodontic appliance seems to be as effective as the use of an anterior repositioning maxillary splint in the treatment of both joint and muscle pain, but not in the treatment of joint noise.
Conti PC et al (2015) ^[21]	33	(mean) Group 1-38.35 yrs Group 2- 38.4 yrs Group 3- 46 yrs	6months	RDC/TMD	1)Disc displacement with reduction 2)Arthralgia	1)Anterior repositioning splints + counselling 2)Nociceptive Trigeminal Inhibition Clenching Suppression System Devices + 3) counseling for behavioral changes and self-care(control group)	Combined therapy seems to produce good improvement, but use of NTI-tss could increase TMJ sounds.
Algabri et al (2017) ^[22]	30	30.2yrs	3 months	1)RDC/T MD 2)Magnetic resonance imaging	Disc displacement with reduction	1) CAD/CAM splint 2)Conventional stabilization splint	Both the splints are similarly effective but patient's satisfaction is more with CAD/CAM occlusal splints.
Kilic K et al (2018) ^[23]	50	20- 40yrs	3months	RDC/TMD	Reduced disc displacement	1)Anterior repositioning splint 2) Stabilization splint 3)Control group	Both splints were effective.
Altaweel AA et al (2020) ^[19]	23	18- 40yrs	6 months	1)Clinical examination 2)Magnetic Resonance Imaging	Anterior disk displacement without reduction	1) Stabilization splint 2) Distraction splint 3) Arthrocentesis plus sodium hyaluronate injection and stabilization splint 4) Arthrocentesis plus sodium hyaluronate injection and distraction splint	Both types of splints were found to be beneficial without statistical differences, and simultaneous use of arthrocentesis and occlusal splint reduces pain and improves function more quickly and efficiently.

1 b) studies showing inclusion of patients diagnosed with myalgia

Author/ year	No.of participants completed the study	Age	Duratio n	Diagnostic criteria	Diagnosis of patients included	Study groups	Result
Dao et al (1994) ^[24]	59	16-45yrs	10weeks	RDC/TMD	Myofascial pain	1) Passive control: stabilizing occlusal splint (worn only 30min at each appointment) 2) Active control: palatal splint (worn 24h/day) 3) Treatment group: Full stabilizing occlusal splint (worn 24hr/day)	There was a significant decrease in pain and improvement in the quality of life in all 3 groups. There was no significant difference between groups in any of the variables.
Raphael KG et al (2001) ^[25]	63	33.7 yrs (mean)	6 weeks	RDC/TMD	Myofascial pain	1) maxillary, flat-plane, hard acrylic splint (active) 2) palatal splint	There was improvement in patients with local pain who received active splint but no improvement was observed in patients with wide spread pain.
Gavish A et al (2002) ^[26]	37	16-45yrs	8weeks	RDC/TMD	Myofascial pain	1)Michigan type stabilization appliance 2)Control group: No treatment	The splint group showed a statistically significant reduction in pain intensity, in mean muscle sensitivity to palpation and the pain experienced during the chewing test and there was no change in the control group.
Ekberg EC et al (2003) ^[27]	60	14-56yrs	10weeks	RDC/TMD	Myofascial pain	1) Stabilization appliance 2) Non occlusal appliance	Stabilization appliance is more effective as frequency and intensity of pain were significantly improved.
Ekberg EC et al (2004) ^[16]	59	Mean age - 29yrs	12 months	Clinical examination	Myofascial pain	1)Stabilization appliance 2)Control appliance (palatal coverage and clasps on maxillary teeth) 3)Mixed group (control appliance followed by stabilization appliance)	Use of Stabilization appliance is beneficial
Al Quran FA et al (2006) ^[17]	114	15-62yrs	3months	Basic chair side examination	Myogenous TMD	1)Full arch stabilization splint 2)Anterior midline point stop device (AMPS) 3)Control group (No treatment)	Both splints were beneficial and no significant difference was found
Doepel et al (2011) ^[28]	49	≥18yrs	12months	RDC/TMD	Myofascial pain	1)Prefabricated oral appliance 2)Stabilization appliance	Prefabricated appliance is as effective as stabilization appliance.
Daif (2012) ^[18]	40	22-46yrs	6months	1)AAOP 2)Clinical examination 3)Helkimo index	Myofascial pain	1)Flat plane occlusal splint group 2)Control group	Occlusal splint therapy could alleviate the signs and symptoms of TMD patients with myofascial pain
Fei-yu Z et al (2013) ^[29]	36	16-57yrs	1month	RDC/TMD	Myofascial pain	1) Occlusal splints (Stabilization splint) 2)Non occluding palatal splints	There was elimination or improvement of signs and symptoms of TMD patients with myofascial pain with the use of occlusal splints.
Deregibus A et al (2021) ^[42]	40	22-56 yrs	6 months	DC/TMD	Myofascial pain	1)Michigan occlusal splint 2)Mandibular occlusal splint	A 6-month occlusal splint treatment does not appear to significantly reduce myofascial pain in patients with muscle-related TMD, regardless of whether the treatment is based on the upper or lower arch.

1 c) studies showing inclusion of patients diagnosed with both arthralgia and myalgia (mixed TMD)

Auth or/ Year	No. of participants completed the study	Age	Duration	Diagnostic criteria	Diagnosis of patients included	Study groups	Result
Kuttila M et al (2002) ^[38]	34	25-65 yrs	10 weeks	1) Criteria defined by De Leeuw et al. 2) American Academy of Orofacial pain 3) Helkimo clinical dysfunction score	1) Arthrogenous, 2) Myogenous 3) Combined arthrogenous and myogenous TMD.	1) Stabilization splint 2) Non occluding palatal splint	stabilization splint is more effective than the palatal splint.
Wassell RW (2004) ^[44]	72	(mean age) Group 1 -37.9 yrs Group 2 - 35.9 yrs	6 weeks	International Headache Society Criteria	1) Reflex splinting 2) Disc displacement with reduction 3) Myofascial pain 4) capsulitis 5) osteoarthritis 6) Rheumatoid arthritis	1) Stabilizing splints (SS) 2) Non occluding control splints (CS)	No significant difference was found between 2 groups
Jokstad A et al (2005) ^[30]	38	37yrs(mean)	3months	RDC/TMD	1) Myofascial pain 2) Disc displacement	1) Conventional stabilization splint (Michigan type) 2) NTI splint (Nociceptive Trigeminal Inhibition)	-There was no difference in treatment efficacy of both splints and there was reduction of muscle tenderness but no change for TMJ tenderness.
Wassell RW (2006) ^[39]	52	19-65yrs	3 months	1) International Headache Society 2) American Academy of Orofacial Pain	1) Reflex splinting 2) Myofascial pain 3) Disc displacement with reduction 4) Capsulitis 5) Osteoarthritis 6) Rheumatoid arthritis	1) Stabilizing splints (SS) 2) Non occluding control splints (CS)	Both splints were effective and no significant difference was observed.
Caria P et al (2014) ^[31]	30	29(mean)	4weeks	RDC/TMD	Myogenic or mixed TMD	1) Control group 2) Michigan Occlusal splint (MOS) 3) Planas appliance	Planas appliance was more efficient in reduction of pain compared to Michigan Occlusal Splint.
Vrbancic et al (2019) ^[43]	30	Group 1: 38.89 ±11.79 Group 2: 32.66 ± 11.48 (mean)	6months	DC/TMD	1) Disc displacement (DD) 2) Myofascial pain (MP)	1) Stabilization splint (SS) 2) Placebo splint (PS)	Stabilization Splint was more effective than placebo Splint in reducing spontaneous pain.

Table 2: Studies comparing hard occlusal splints with soft occlusal splints / liquid occlusal splints

2a) Studies showing inclusion of patients diagnosed with myalgia

Author/ year	No. of participants completed the study	Age	Duration	Diagnostic criteria	Diagnosis of patients included	Study groups	Result
Alencar JR F et al (2009) ^[40]	42	18-65yrs	90days	AAOP	Myofascial pain	1) Hard occlusal splints 2) Soft occlusal splints 3) Non occluding occlusal splints	All the splints were effective irrespective of splint design or type of material.
Meshramkar R et al (2015) ^[1]	30	18-65yrs	90days	RDC/TMD	Myofascial pain	1) Hard occlusal splints 2) Soft occlusal splints	Both splints were effective but hard splint was more effective than a soft splint.
Amin A et al (2016) ^[32]	45	18-65yrs	3 months	RDC/TMD	Myofascial pain	1) Hard splint 2) Soft splint 3) Liquid oral splint	3 types of splints were effective but hard splints were more superior compared to other types

Giannakopoulos (2018) ^[33]	42	Group 1: 28.2 ± 6.4 Group 2: 24.7 ± 3.4	3 months	RDC/TMD	Myofascial pain	1)Sensorimotor Training 2)Conventional Michigan splint treatment	In both groups pain reduction was achieved and no significant difference was found.
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2b) Studies showing inclusion of patients diagnosed with arthralgia and myalgia (mixed TMD)

Author/ year	No. of participants completed the study	Age	Duration	Diagnostic criteria	Diagnosis of patients included	Study groups	Result
Pettengill C et al (1998) ^[34]	18	More than 18yrs	10-15 weeks	RDC/TMD	1)Myofascial pain 2)Disc displacement with reduction 3) Osteoarthritis 4) TMJ inflammation	1)Hard stabilizing appliance 2)Soft stabilizing appliance	Both appliances performed the same in reducing masticatory muscle pain.
Truelove E et al (2006) ^[35]	200	18 - 60yrs	12 months	RDC/TMD	1)Myofascial pain 2)Arthralgia 3)Disc displacement with reduction	1) Usual treatment (UT): dentist prescribed, conservative and reversible self - care strategies 2) UT + fabrication of a hard acrylic flat plane maxillary splint (HS) 3) UT + soft thermoplastic vinyl splint (SS)	No significant difference was observed among the groups at baseline (BL) or any follow-up in TMD-related pain levels or other common signs and symptoms of TMD.
Paula Gomes et al (2014) ^[45]	60	18- 40yrs	4weeks	Fonseca patient history index	1)Temporomandibular disorder 2)Bruxism	1) Massage group 2)Conventional occlusal splint (Michigan splint) group 3) Combination of massage and conventional occlusal splint group 4) Silicone occlusal splint group	Combination of massage and conventional occlusal splint group showed greater improvement.
Seifeldin S et al (2015) ^[41]	50	24- 47yrs	4months	American Academy of Orofacial Pain	1)Myofascial pain dysfunction 2)Anterior disc displacement with reduction and negative locked jaw	1)Soft occlusal splint 2)Hard occlusal splint	Both types of splints were effective but soft occlusal splints showed greater effect.
Giannakopoulos et al (2016) ^[36]	36	41.6 ±16.7	2 weeks	RDC/TMD	1)Myofascial pain 2)Myofascial pain with limited opening 3)Arthralgia 4)Disc displacement without reduction without limited opening 5)Disc displacement with reduction	1)Prefabricated oral splints with water-filled elastic pads (AqualizerVR) 2)Vacuum-formed co-polyester oral splints 3)Michigan-type hard splints	All the splints were pain-reducing and vacuum-formed splint is cost effective and time effective.

DISCUSSION

Occlusal Splint is defined as a removable artificial occlusal surface used for diagnosis or therapy affecting the mandible's relationship to the maxillae.^[4] There are various types of occlusal splints reported in the literature having their indications and functions. Occlusal appliances are classified in consonance with Okeson include Stabilization appliance, Anterior repositioning appliances, Anterior bite plane, Posterior bite plane, Pivoting appliance, Soft/resilient appliance, Hard splint,^[46] and Classification of occlusal appliances in consonance with Dawson include Permissive splints/ muscle deprogrammer, Directive splints/ non-permissive splints, Pseudo permissive splints (e.g., Soft splints,Hydrostatic splint).^[4]

The occlusal appliance's mechanism of action is by occlusal disengagement, restoring the vertical dimension of occlusion, relaxing the muscles, unloading the joints, and TMJ repositioning. They are the deprogrammers or jaw repositioners to establish ideal maxillomandibular relationships.^[4]

Comparison of occlusal splints and / controls

Stabilization splint (SS): Also known as the Tanner appliance, the Michigan splint, the Fox appliance, the centric relation appliance, Flat plane stabilization appliance, the gnathologic splint, and superior repositioning splint. It is a hard acrylic splint providing a temporary and removable ideal occlusion. The use of stabilization splint therapy

produces neuromuscular balance as it provides an ideal occlusion and reduces abnormal muscle activity. As outlined by the American Academy of Orofacial pain guidelines, the purpose of this appliance is to "protect the teeth, provide joint stabilization, relax the elevator muscles, redistribute the occlusal forces and decrease bruxism." It is the most widely used type of occlusal splint and has the least adverse effects on oral structures when appropriately fabricated. The indications of these appliances are conditions like myospasms or myositis, muscle hyperactivity, and parafunctional activity due to increased levels of emotional stress, retrodiscitis, and condylar disc irregularities.^[4,23,47,48]

Stabilization splint was compared with untreated controls in a study by Lundh H et al.^[37] in arthralgia patients, which showed no statistically significant benefit of the flat occlusal splint, but in studies done by Daif^[18] and Gavish A et al.,^[26] myalgia patients showed a better response in stabilization splint group than that of untreated controls. A study by Lundh H et al.^[9] disc repositioning Onlays was useful compared to flat occlusal maxillary splints and untreated controls in arthralgia patients. Ekberg E et al.^[10,16,27] compared a stabilization appliance with an appliance designed with palatal coverage and clasps on maxillary teeth in arthralgia patients, myalgia patients, and a stabilization appliance with a non-occlusal appliance in myalgia patients. In contrast, stabilization splints were compared with non-occluding splints in myalgia patients by Fei-yu Z et al.^[29] and in myalgia, arthralgia, and both arthralgia and myalgia patients by kuttilla M et al.^[38] and stabilization splint were found more effective than the control group in all these studies.

A study was done by Raphael KG et al.^[28] on myalgia patients, and the maxillary, flat-plane, hard acrylic splint was found useful in patients with local pain, but no improvement in patients with widespread pain. In a study done by Doepel et al.^[26] the prefabricated oral appliance is as useful as a stabilization splint in treating myalgia patients.

Jokstad A et al.^[30] compared stabilization splint with NTI (nociceptive trigeminal inhibition) splint in the mixed type of patients, but there was no significant difference in the groups. Planas appliance was better than Michigan splint in a mixed type of patients in the study by Caria P et al.^[31]. Wassell RW^[39,44] compared stabilization splint with non-occluding control splint in the mixed TMD patients, and no significant difference between the groups. Vrbancovic et al.^[43] compared stabilization splints with placebo splints in a mixed group of patients and found that stabilization splints were beneficial.

There was no significant difference in pain and improvement in the quality of life in a study comparing stabilization splint worn 24hr/day with passive control stabilizing occlusal splint worn only 30min at each appointment and also active control palatal splint worn 24hr/day in myalgia patients.^[24] Occluding splints were better than non-occluding splints in arthralgia patients comparing bilateral balance guidance stabilization splints with canine guidance splints and non-occluding splints.^[20] In a study of patients with myalgia, stabilization splints compared with anterior midline point stop device and no treatment control group, splints are beneficial than the control group.^[17]

In a study done in arthralgia patients by Altaweel AA et al.^[19] both stabilization splint and distraction splint were beneficial, and simultaneous use of arthrocentesis and occlusal splint proven more effective in reducing pain and improving function. No improvement was observed in patients with myalgia, irrespective of whether the treatment is based on the Michigan occlusal splint or mandibular occlusal splint.^[42]

Effectiveness of CAD/CAM stabilization splint compared to conventional stabilization splint in the study by Algabri et al.^[22] in arthralgia patients, and both the splints are similarly

useful, but patients satisfaction is more with CAD/CAM occlusal splints.

Anterior Repositioning Splints

These splints encourage the mandible to assume a more anterior position to the centric occlusion and alter the maxillomandibular relationship to provide a more favorable condyle position in the fossa. As the joint loading decreases, there is a decrease in the joint inflammation and an increase in the range of mandibular movement, thereby decreasing symptoms and signs of TMJ disorder. With the long-term use of this appliance, there are permanent and irreversible occlusal changes, so this appliance should be used with caution and only for short periods. Indicated in the treatment of disc derangement disorders, Intermittent or chronic locking of the joint, and also in some inflammatory disorders.^[4,48]

Stabilization splint was compared with anterior repositioning splint in studies by Lundh H et al.^[8], Tecco S et al.^[12], Conti PC et al.^[13] which proved anterior repositioning splint was more effective than stabilization splint however in a study by Kilic K et al.^[23] concluded both anterior repositioning splint and stabilization splint were equally effective. Fayed MM et al.^[11] compared a canine-protected splint with an anterior repositioning splint, and both splints were useful, but the canine-protected splint was found superior. In all these studies^[8,11-13,23] patients had arthralgia.

In the study by Conti PC et al.,^[21] occlusal splints like anterior repositioning splint and NTI-tss or behavioral changes effectively managed arthralgia patients' pain. However, simultaneous use of occlusal splints appears to produce good improvement, and NTI-tss could increase TMJ sounds. In other studies by Tecco S et al., an Anterior Repositioning splint is as effective as the combined use of SVED (Sagittal Vertical Extrusion Device) and Mandibular Anterior Repositioning Splint^[14] and fixed orthodontic appliance therapy.^[15]

Hard occlusal appliance, Soft occlusal appliance, and Hydrostatic appliance

The hard appliance fabricated from the hard acrylic resin can be either self-cured or heat cured.^[4] The soft appliance is a device fabricated from a resilient material that is usually adapted to the maxillary teeth and indicated as a protective device for persons who are likely to receive trauma to their dental arches and also in Clenching and bruxism.^[48] Hydrostatic Appliance or liquid oral splint is an acrylic palatal appliance with a bilateral water-filled plastic chamber, and the patient's posterior teeth occlude with the water-filled chamber.^[4]

A total of 7 studies compared the efficacy of hard occlusal splints with soft occlusal splints. Out of these three studies included myalgia patients^[1,32,40] and four studies^[33,34,40,43] included mixed group. In the research work, both the appliances were equally effective.^[34,35,40] In studies by Meshramkar R et al.^[1] and Amin A et al.^[32] the hard splint was superior to the soft splint and liquid oral splint. A Study by Paula Gomes et al.^[45] showed improvement in the combination of massage and conventional occlusal splint(hard splint) group. However, Seifeldin S et al.^[41] concluded that soft occlusal splints were more efficient. In the studies by Giannakopoulos et al., sensorimotor training (by hydrostatic oral splint) and Michigan splint were effective in treating myalgia patients,^[33] and liquid oral splint, Vacuum-formed copolyester oral splints, and Michigan-type hard splints were effective in reducing pain in mixed type patients.^[36]

Limitations Of The Study:

Various randomized controlled trials comparing occlusal splints with pharmacotherapy, and alternative treatment modalities are available in the literature; but, they are not included as it is beyond the scope of this article.

CONCLUSION:

TMDs are multifactorial in origin. To date, conservative therapy has been the best treatment approach. This systematic review attempts to evaluate occlusal splints' efficacy in treating TMDs causing myalgia, arthralgia, and mixed type (myalgia and arthralgia) of pain considering only randomized control trials. Controversies related to TMDs are hovering for a long, and this review emphasizes the existing controversies related to management with occlusal splints, as evidence of treatment with occlusal splints is found to be equivocal. However, occlusal splint therapy was beneficial in most of the studies. The stabilization splint was effective in managing myofascial pain, and the anterior repositioning splint had superior efficacy compared to the stabilization splint in the management of anterior disc displacement with reduction with arthralgia. Although studies gave conflicting results, there is evidence of a hard splint being more beneficial than a soft splint in treating both myalgia and mixed TMD.

The authors would like to emphasize that management of these disorders requires a precise judgment of the condition and thorough knowledge of joint mechanics and its relation to occlusal relations and physiological mechanisms. Management of TMDs is a great challenge. Hence clinicians should have comprehensive knowledge of TMDs, i.e., diagnosis, investigations, and management, to institute precise treatment for the patient.

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