A Systematic Review on the Proposed Methodologies for the Treatment of TMD Patients

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1 Introduction

Temporomandibular disorders are the illnesses that occasionally also cause discomfort in the TMJ and its surrounding structures in addition to the TMJ being dysfunctional. TMD affects up to 15–20% of the adult population, with greater occurrences occurring in women [1]. The best strategy for treating TMDs is still up for debate. Additionally, it has been noted that there aren't any systematic reviews or evidence-based treatment techniques for TMDs.

Therefore, a careful, systematic, and structured review is required, which is presented in this paper. This review aims to identify the reasons for the effectiveness and ineffectiveness of the proposed methodologies for the treatment of TMDs and to develop a novel, effective, and preventive approach for the treatment of TMDs (Table 1).

2 Methods

The present systematic review was undertaken in the following manner.

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Table 1 Search terms

1	Temporomandibular disorders, treatments
2	Temporomandibular disorders, conservative treatments
3	Temporomandibular disorders, occlusal splints
4	Temporomandibular disorders, intra-oral appliances
5	Temporomandibular disorders, treatments, occlusal splints
6	Temporomandibular disorders, treatments, intra-oral appliances
7	Temporomandibular disorders, treatments, mouth appliances
8	Temporomandibular joint, treatment
9	Temporomandibular disorders, temporomandibular joint, conservative treatment, mouth appliances
10	Temporomandibular joint, temporomandibular disorders, conservative treatments

3 Sources

A search of the literature to 3 July 2022 was undertaken of the following databases: science direct, PubMed and Cochrane.

4 Study Selection

All type of studies published in literature related to the conservative treatment of TMDs have been selected including randomised controlled trials (RCT), quasi-RCTs and non-RCTs. Table 2 represents the inclusion and exclusion criteria.

Table 2 Inclusion and exclusion criteria search

	Inclusion criteria	Exclusion criteria
Treatment type	Conservative treatments, mouth appliances, occlusal splints, behavioural therapy, no treatment	Surgical, pharmacological
Problem specification	TMD correction	Headaches, migraine, malocclusions
Sample size	Varying ($n < 5$ and $5 < n < 20$ and/or $20 < n < 60$ and/or $n > 60$	–
Language	English language only	Not in English language

5 Search Methodology

The search sequence is illustrated in Fig. 1. The studies which were excluded from the present study and the reason for their exclusion are presented in Table 3. The characteristics of included studies are presented in Table 4.

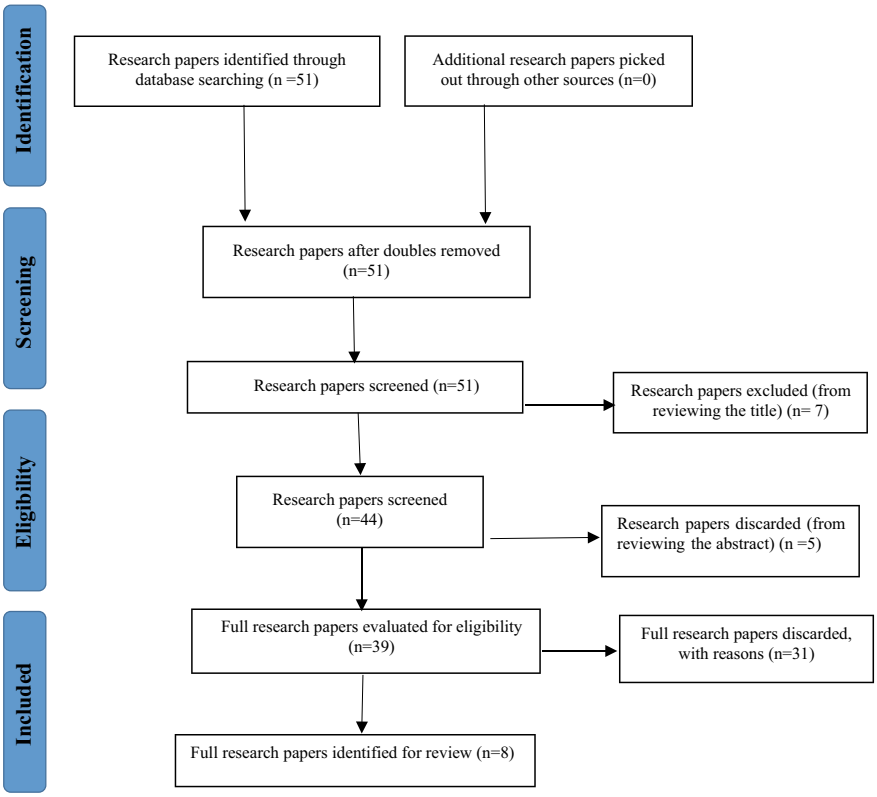

Fig. 1 Flow diagram

Table 3 Studies excluded from the present studies and the reason for their exclusion

Study	Reason for exclusion
He et al.	Cannot access and unable to obtain copy from author
Landa et al.	No inclusion criteria given

Table 4 Features of the included studies

S. No	Methods/study design	Age of the subjects	Participants, n =	Outcomes	Drawbacks of the studies	Gaps to be filled
Chang et al. [17]	Retrospective study	(15–72) years	109	The clicking index, maximum mouth opening and pain levels between the MFOS-treated and control groups demonstrated statistically significant differences in treatment outcomes	The study was unable to offer a solution for how to utilise MFOS or how to modify its design so that the device would be able to treat the disease even with the severity of the described factors	Design or modify the splint which should work even in dynamic conditions
Ferreira et al. [16]	Finite element stress analysis	Female (28 years)	1	Stress reduction arises from the use of occlusal splints in case of anterior disc displacement	Only one subject is included for the study. No clinical validation was not performed	The study's subject count should be sufficient to demonstrate the effectiveness of the device, and the latter should also function under dynamic conditions
Aldemir et al. [15]	Randomised control trials (RCT)	17 women and 9 men ($21 < n < 55$) years	35	The masseter muscle's length and thickness both significantly decreased, although there was no change in the interior echo-fibrillary structure or vascularization	Since stabilisation splints are irreversible, neither dentists nor physicians advise using them	Reversible intra-oral appliances should be used to treat TMDs, the device must function under dynamic situations, and last but not least, the study subjects need to be big enough to be effective

(continued)

Table 4 (continued)

S. No	Methods/study design	Age of the subjects	Participants, *n* =	Outcomes	Drawbacks of the studies	Gaps to be filled
Rodrigues et al. [14]	RCT	More than 18 years	40	LA and OS improve physical and emotional symptoms of TMDs with similar results	LA might produce radiation that could have an impact on the TMJ's dimensions and those of the structures around it	Device should be reversible and should be effective in treatment as well as in wearing
Conti et al. [13]	Double blind controlled randomised trials	Mean age 28.5 years	57	On the basis of visual analogue scale (VAS), both the occlusal splints were superior to non-occluding splint	None of the device was able to reduce the pain in the TMJ	Device must be design in such a way so that it gives the rid from the condition of TMDs and must be reversible
Calis et al. [8]	Non-RCT	Mean age 33.67 years	25	Patients who do not react to conventional treatments for TMDs can be successfully treated with a botulinum toxin injection	Out of 16 patients, only 9 responded successfully towards the treatment	One of the greatest conservative treatments for TMDs is occlusal splints with the optimum thickness

(continued)

Table 4 (continued)

S. No	Methods/study design	Age of the subjects	Participants, *n* =	Outcomes	Drawbacks of the studies	Gaps to be filled
Kalman et al.	3D FEA and computer aided engineering software (ANSYS)	–	Not mentioned	Comparing the hybrid occlusal splint mouthguard (HMG) to a traditional mouthguard, less stress was generated (MG)	Only used to protect teeth and oral facial structures, hybrid occlusal splint mouthguards are unable to treat other TMDs	Device should be able to prevent the injury to the teeth and oral facial structures as well as able to heal the TMDs
Gholampour et al. [6]	FEA was performed on 3D maxilla and mandible	21–49 years	37 (19 women and 18 men)	Splint greatly lowers the strains, serves as a stress dissipater and lessens TMJ deflection and deviation. due to bruxism	Developed occlusal splint able to reduce stresses generated due to bruxism only	Splint should not produce different outcomes when used on different patients, device should be reversible in nature and should be able to give results in dynamic conditions as well

6 Results

Thirty nine studies were identified for review. Eight studies met the inclusion criteria and were assessed using the primary and secondary outcome measures outlined. The results of each included study are summarised as follows:

a. *Studies comparing reversible occlusal splints to irreversible occlusal splints treatments*

Reversible occlusal splints and irreversible occlusal splints are available for healing the temporomandibular disorders. However, wide use of reversible occlusal splints over the irreversible splints have been reported in the literature because of not changing the bite of the patients. Studies showed that irreversible occlusal splints changes the bite of the patient, which is undesirable and dentists usually recommend less use of irreversible occlusal splint [3]. Also, one of the studies showed that using reversible splints is beneficial for the patient in healing the disorder with comfort and in less time and hence such occlusal splints are preferable over irreversible occlusal splints.

b. *Studies comparing occlusal splints of different thicknesses used for TMD correction*

A recent study looked at how well various splint thicknesses worked to correct anterior disc displacement without reduction, and various researchers have suggested that the optimum vertical occlusal splint can be the best for the therapy but none of them had shown that the what should be the value of optimum thickness of occlusal splint for the correction of TMDs [2]. A recent study shows that a 2 mm vertical occlusal splint thickness was the best thickness for the therapy but the method of study used was non-randomised trials. Therefore, controlled randomised trials are need to perform to identify the optimum thickness of the occlusal splint for healing the TMDs.

c. *Studies comparing different mouth appliances used for the treatment*

Contrary to occlusal splints, dentists and orthodontists are not interested in using other mouth appliances to treat TMD due to their irreversibility and discomfort when worn for an extended period of time [4].

d. *Studies comparing different mouth appliances, occlusal splints with behavioural therapy*

According to reports, the best treatment option for TMD patients among the available devices was an occlusal splint with the ideal vertical thickness, which was followed by no therapy [5].

e. *Studies comparing different methodologies to pharmacological therapy*

Occlusal splints are more common among patients and dentists in comparison with pharmaceutical therapy [6].

f. *Studies comparing wear patterns of different mouth appliances*

The research has revealed that the frequency with which various oral appliances are worn has a substantial effect on the healing of the condition [7].

7 Discussion

The current systematic study enables comparison of suggested treatment modalities for TMDs.

Results from studies comparing the use of occlusal splints to no therapy showed that utilising occlusal splints and no treatment had statistically significant results [8]. However, doctors and orthodontists advised against using occlusal splints as often as possible. Because no statistically significant difference was identified with the use of alternative intra-oral appliances for the repair of TMDs [9], and there has unfortunately been no evidence established to support their efficacy in comparison to occlusal splints.

8 Conclusions

Based on a detailed analysis of the literature that has been published, occlusal splints with the ideal vertical thicknesses are known to be beneficial in treating TMDs. Reversible occlusal splints are actually more successful and comfortable (from the patient's perspective) for treating TMDs than other mouth appliances and behavioural therapy.

9 Recommendations for Future Studies

The current study has brought attention to the necessity for more investigation into the precise causes and signs of TMDs. This requires a detailed and in-depth understanding of the biomechanics of both healthy and symptomatic TMJ participants. With the aid of FEM software, dentists and medical professionals will be able to better understand the biomechanics of the joint, including the positions or regions where stresses or forces appear to be at their highest or peak, as well as the critical stress areas. By assessing these points, precise causes and symptoms can be identified to a large extent, and on the basis of that patients can receive effective treatments and methodologies for the correction of TMDs.

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