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REVIEW

Stabilization Splint Compared to other Occlusal Splints in the Management of TMD – A Systematic Review and Meta-analysis of Randomized Control trials.

Gauri Patil,[a], Naisargi Shah[b], Shruti Gil[c], Rahul Malu[d], Priya Pungle[e], Nikhil Bhanushali[f]

ABSTRACT

Background. There is no comprehensive evidence comparing the effectiveness of stabilization splints to other occlusal splints in the management of temporomandibular disorders (TMD). While splints, including stabilization splints, are commonly used as a noninvasive treatment approach for TMD, the exact mechanisms and their effectiveness in managing these conditions remain an area of concern.

Aim. The aim of this systematic review and meta-analysis was to evaluate the effectiveness of stabilization splint compared to other occlusal splints in the management of temporomandibular disorders.

Material and methods. A comprehensive search of PubMed, Cochrane Library, and Ebsco database was conducted to identify eligible randomized controlled trials (RCTs). The outcomes were Improvement in TMD symptoms and a decrease in Pain intensity, tenderness, maximum mouth opening, clicking sound, etc. The meta-analysis, accompanied by a random effect model and 95% credible intervals, was calculated.

Results. Thirteen RCTs (n=599 participants receiving splints for temporomandibular disorders) were included. Stabilization splints were compared with other occlusal splints in this review. There was a statistically significant difference seen between the change in pain intensities from baseline in stabilization splint group as compared to other types of splint groups. The results indicated that the stabilization splint group was more effective at reducing pain intensity over time than the various occlusal splint groups. In contrast, there was no notable difference in the change of maximum mouth opening from the baseline within the stabilization splint group when compared to other types of splints. Both splint groups demonstrated a comparable increase in maximum mouth opening over time.

Conclusions. Stabilization showed a greater decrease in pain intensity from baseline than other occlusal splints..

Key words: Temporomandibular Disorders, Occlusal Splint, Stabilization splint, Pain intensity, range of movement, joint sounds

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INTRODUCTION

Temporomandibular disorder (TMD) refers to a condition affecting the temporomandibular joint (TMJ), associated muscles, and the nervous system. Those experiencing TMD often report a persistent, dull pain in the areas surrounding the TMJ and muscles. This discomfort is commonly linked with difficulties in opening the mouth, pain during chewing, muscle tenderness, and headaches.[1-3]

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The rate of TMD prevalence varies globally, ranging between 25-50%.[1] TMD results from a complex interaction of multiple risk factors, rather than just one specific cause. These disorders affect the masticatory system and can lead to significant pain and dysfunction. The etiology of TMD is multifactorial, involving biological, psychological, and mechanical factors that contribute to its onset and chronicity. The management of TMD has evolved significantly, with treatment strategies generally categorized into three distinct approaches: non-invasive, minimally invasive, and invasive interventions.[4,5]

There are several predictable treatment modalities for the management of TMD. A treatment plan for different types of TMD should adhere to a defined protocol, beginning with conservative methods such as physical therapy, medication, and splint therapy. More invasive treatments, like comprehensive occlusal rehabilitation and surgeries for the TMJ, should only be considered if these initial approaches do not yield results. Since invasive therapies are irreversible, they should be seen as a last option.[3] Typically, minimally invasive treatments consist of interarticular injections and arthrocentesis, while invasive options involve arthroplasty and TMJ replacement. Non-invasive methods are the most commonly preferred due to their safety and ease of use.[6] One of the challenges faced by clinicians in treating TMDs is selecting the appropriate type of splint. However, some research indicates that the effectiveness of splint therapy may rely less on the specific design of the splint and more on the primary disruption of established neuromuscular reflexes resulting from partial disengagement between the maxillary and mandibular teeth.[3,5]

Many types of occlusal appliances are suggested for the management of TMD. The two most frequently used out of all the appliances are 1) Stabilization splint and 2) Anterior repositioning splint. A stabilization appliance is mainly designed to alleviate muscle discomfort and is also referred to as a muscle relaxation device.

Typically, this appliance is crafted for the maxillary arch, ensuring an occlusal alignment that is deemed optimal for the individual.[6] When fitted, it positions the condyles in their most musculoskeletally stable centric position while the teeth make even and simultaneous contact.[6] The primary aim of the stabilization appliance is to resolve any orthopedic instability between the occlusal and joint positions, thereby eliminating this instability as a contributing factor to TMD.

A wide variety of occlusal splints have been documented in the literature. Occlusal splints are beneficial for reducing stress, decreasing muscle activity, and preventing deleterious effects due to temporomandibular disorders or bruxism. Also, the primary goal of occlusal splints is to protect the temporomandibular disc from dysfunction, which may lead to displacement.[6,8] There are several systematic reviews published stating the effects of occlusal splints in temporomandibular disorders. However, none of these systematic reviews have specifically covered the comparison of the effectiveness of stabilization splints when compared to other splints.

Thus, the purpose of this study is to evaluate the effectiveness of stabilization splint as compared with other occlusal splints in the management of temporomandibular disorders. This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines 2020 (i.e., the PRISMA statement). [7]

MATERIALS AND METHODS

The systematic review and meta-analysis was conducted as per the preferred reporting items of the systematic reviews and meta-analysis (PRISMA) guidelines stated by healthcare interventions. The focused question was, “Is the stabilization splint effective in the management of temporomandibular disorder compared to other occlusal splint therapy?” The question of the current systematic review and meta-analysis was adopted to follow the PICOS criteria (population, intervention, comparison, outcome, study design) where

P: Studies with TMJ-related disorders involving stabilization splint and different occlusal splint treatments for TMDs affecting the muscle, joint, or both, using one of the following treatment modalities.

I: Randomized control trials with stabilization splints to manage patients with temporomandibular disorders.

C: Randomized controlled trials with other occlusal splints for managing patients with temporomandibular disorders.

O: Improvement in TMD symptoms and decrease in Pain intensity, tenderness, mouth opening clicking sound, etc.

Eligible participants met the criteria for myofascial pain based on the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD). Two reviewers conducted an independent electronic search across the PubMed, Ebsco, and Cochrane databases spanning the years 2000 to 2024. Additionally, a scoping review was performed. Following this, a protocol was developed based on the findings of the scoping review and subsequently registered on the PROSPERO website. The registration number for this protocol is CRD42024575442. The references of relevant articles were examined to identify studies for inclusion in the review. The criteria for inclusion and exclusion are given in the (Table 1) below.

Table 1. Inclusion and Exclusion Criteria

INCLUSION CRITERIA	• Studies evaluating the effect of stabilization splint as compared to other occlusal splints by randomized control trials. • Only randomized controlled trials with stabilization splint as one of the comparison groups in the trial. • Clinical trials will be included in this systematic review evaluating the effectiveness of stabilization splint as compared to other occlusal splint for management of temporomandibular disorders. • Randomized control trials treating temporomandibular disorders patients. • Articles published in English language only will be considered. • Articles published from the year 2000 to 2024 will be considered in the study. • Patients diagnosed with TMD using well-established diagnostic criteria (DC/TMD or RDC/TMD); including an occlusal splint group and a proper control group.
EXCLUSION CRITERIA	• Non-randomized controlled trial studies. • Studies comparing some different types of splints were not considered in the systematic review. • Studies which are case reports, case series, review articles or surveys. • studies that included subjects who had received treatment for TMD prior to the study • studies that included animal and ex-vivo studies • Patients with recent history of acute injury or any surgical treatment of TMJ and any form of therapy (including counseling, medication) administered concomitantly with splints. • Articles which are not in English language. • Studies having surgical intervention.

After removing the duplicates by using reference management software (Mendeley), the references were then reported to the systematic review software manager (RevMan 5.4) for study selection. The screening procedure was conducted separately by two reviewers (G.P., R.M.), who examined the titles and abstracts of the articles that were retrieved. They also independently reviewed the full texts of the chosen studies and included those that met the criteria outlined in Table 1. The collected data included the author, year of publication, study design, study model, sample size, comparison group, intervention group, outcomes, scales used to measure these outcomes, software employed, and the tests of analysis (differences between the two groups) and (differences between baseline and end-of-follow-up factors) (see table 2). Any disagreements between the reviewers were settled by reaching a consensus. A third reviewer, N.S., was consulted in cases of conflicting views regarding the selection process and data extraction.

Table 2. Characteristics of included Randomized controlled trials

OUTCOME	1- pain intensity 2-pain related disability. 3- depressive and anxiety symptoms 4- biochemical stress markers	1- pain intensity 2-physical functioning 3-emotional functioning 4-overall improvement, adverse events	1-pain using vas scale, 2-joint sounds 3-muscle tenderness on palpation	1-CMO, MMO, 2-TMJ clicking and tenderness 3-Pain intensity	1-pain intensity 2-mouth opening	1- Pain intensity 2-overall improvement 3-physical functioning 4-emotional functioning	1-joint and muscle tenderness 2-pain by vas scale 3- jaw opening	1- pain intensities 2-salivary measures associated with stress and self-reported psychological distress	1- pain using VAS scale 2-active mouth opening 3-tenderness	1- TMJ tenderness 2-functional problems (limits in range of mandibular motion, deviation in movements, pain during movement, TMJ noise)	1-Joint noise 2-joint pain 3-intensity of pain	1-spontaneous pain, OHIP-14) 2-MCO, MMO 3-PSS, GCPS 4- jaw functional limitation scale	1-pain intensity 2-muscle tenderness 3-TMJ tenderness 4-interincisal opening, 5-TMJ clicks and headaches.
GROUPS	G1-stabilisation splint group G2- placebo splint group	G1- prefabricated appliance (Relax) G2- stabilisation splint	G1- modified acrylic stabilization balanced splint G2- nonoccluding splint	G1- centric stabilization splint (CSS). G2- ARA conventional group and soft splint grops	G1- RA.DI.CA splint therapy G2- stabilisation splints	G1- 32 pts with prefabricated oral appliance G2- 33 pt with stabilisation appliance	G1- Stabilization splint (michigan type) G2- NTI tss splint	G1- Michigan-type bite splint G2- placebo palatine splint	G1- centric splint G2- distraction splint	G1- Stabilisation splint G2- pivot splint	G1- stabilization splint G2- anterior positioning splint	G1- stabilisation splint (SS) G2- placebo splint (PS)	G1- 34 stabilization splint G2- 38 control splint
POPULATION	chronic tmd patients	patients diagnosed with TMJ arthralgia	people with signs of disk displacement and TMJ pain	Patients exhibiting TMJ disc displacement with reduction	Patients with anterior disc displacement without reduction	Patients with chronic TMD pain	TMD patient	TMD patients	Patient with anterior disc displacement without reduction	tmj with anterior disc displacement without reduction	TMJ pain and dysfunction	patients diagnosed with chronic tmd	
DIAGNOSTIC CRITERIA	(RDC/TMD)	(RDC/TMD)	(RDC/TMD).	RDC-TMD criteria	DC/TMD Criteria	RDC /TMD	RDC/TMD	RDC/TMD	RDC/TMD	RDC/TMD	RDC/TMD	(DC/TMD)	the American Academy of Orofacial Pain)
SAMPLE SIZE	34 pts	48	57	30	30	65	40	25	74	40	50	34	72
STUDY DESIGN	RCT	RCT	RCT	Single-blind RCT	single-blind randomized study	Singles blinded RCT	double-blind randomized parallel trial	RCT	RCT	prospective rct	RCT	RCT	RCT
AUTHOR (PUBLICATION YEAR)	Alajbeg IZ et al (2020)	Christidis N et al (2014)	Conti PC et al (2006)	Devi J et al (2017)	Di Giacomo P et al (2022)	Doepel M et al (2012)	Jokstad A et al (2005)	Klepzig K et al (2024)	Schmitter M et al (2005)	Stiesch- scholz et al (2005)	Tecco S et al (2003)	Vrbanovic E et al (2019)	Wassell RW et al (2006)
SR. NO.	1	2	3	4	5	6	7	8	9	10	11	12	13

TEST OF ANALYSIS (BETWEEN BASELINE DATA AND FOLLOW-UP	ANOVA	Friedman analysis of variance (ANOVA)		Friedman test - intragroup comparison. Wilcoxon signed-rank test - significance of difference	ANCOVA	Mcnemar's test and Wilcoxon signed- ranks test	Wilcoxon signed ranks tests, paired t test	ANOVAs	Wilcoxon signed rank test	Non-parametric Wilcoxon test	Friedman's two-way analysis and Wilcoxon's signed rank test	Students t test and anova test	ANOVA or x^2 test
TEST OF ANALYSIS (DIFFERENCES BETWEEN GROUPS)	Student's T-test and chi-square test	Chi-square test and mann-whitney u tesT	Friedman test and x^2 test	Kruskal-wallis test -intergroup difference, Pearson Chi-square test - intergroup comparison	Student's T- test	Chi-square and Mann Whitney u test	Fisher exact test, Student's t test, and Mann - Whitney Utest	Independent sample t-test and Fisher's exact test	logistic regression test	Non-parametric Wilcoxon – mann-Whitney Utest	Pearson's chi-square and fisher exact test, Kruskal-wallis and Dunnett test	Shapiro wilk test	ANOVA or x^2 test
SOFTWARE USED	Statistica 13.4.0 software packages	Sigma plot 11.0		SPSS	SPSS 27.0	SPSS 16.0		SPSS 22		SPSS 15	SPSS 9.0	Statistica 13.4.0	Statistical spreadsheet
RESULTS	1- Significant difference seen 2- significant difference seen in number of disability 3- no significant difference in anxiety	1- 30% reduction of pain intensity was reported at the 6-month follow-up; and 41.7% in both groups at 12 months. 2- At the 12-month follow-up, pain intensity had decreased, and physical function had improved in both groups without significant group differences. 3- Emotional function did not change.	1-the mean improvement in VAS was 52.7 mm (83.4%) for group I, 58.5 mm (86 %) for group II and 35.5 mm (56.6%) for group III. We found a significant difference between groups II and III.2-the reduction in joint sounds was more pronounced for group II, we found no significant differences among the groups. 3- Reduction in muscle tenderness on palpation was similar for the whole sample.	Statistically significant differences between pre- and post-treatment mean ranks in CMO, MMO, VAS pain score, and TE integral in the right and left TMJs in all three groups.	There was a significant increase in maximum jaw opening and a reduction in pain in both groups ($p < 0.05$), except for neck pain in Group II.	1- no significant difference seen between groups in pain reduction, was observed at 6- and 12-month follow-up compared with baseline. 2- Overall improvement was observed in groups at the 12-month follow-up. 3,4- the scores for NSPhS and depression decreased significantly within groups.	A reduction of muscle tenderness upon palpation and self-reported TMD-related pain and headache and an improved jaw opening was seen in both splint groups. There were no changes for TM joint tenderness.	Over therapy reductions in pain intensity and morning cortisol were more pronounced in those patients starting immediately with the Michigan splint, while psychological distress decreased similarly in both groups.	The improvements in mouth opening, pain on chewing, pain during other functions, pain at rest, functional limitation on chewing, and other functions were significant in both groups. However, the logistic regression test suggested that patients using centric splints were treated more successfully than the others	No statistically significant difference seen between the groups	A significantly lower intensity of pain was experienced by the AR splint patients after two months of treatment.	After 6 months, significant changes seen between the groups in spontaneous pain,with greater reduction in SS compared to the PS group. MCO values differed significantly between the two treatment groups, with greater overall values in the SS compared to the PS group.	At six weeks, mean improvements were noted for all outcome criteria, but less so for clicking. There were no significant differences between splints.
MEASURING SCALE FOR OUTCOME FACTORS	levels of OS biomarkers in saliva, VAS scale	Vas scale jaw opening in mm	levels of OS biomarkers in saliva, VAS scale	Vas scale,	VNS (verbal numeric scale)	VAS scale, jaw function limitation scale,gcp severity,	visual analog scale	VAS scale	VAS scale	VAS scale	visual analogue scale	VAS scale, JFLS scale, OHIP-14	VAS scale
TIME	6 months	12 months	6months	1st, 2nd, 6th, and 10th week.	6 MONTHS	12 months	2 and 6 weeks and 3 months	3 weeks		3 months		6 months	1 year follow up

To evaluate the quality and assess the risk of bias, the Cochrane Collaboration tool was utilized. For the meta-analysis, pain intensity and maximum mouth opening values were evaluated and processed using RevMan 5.4. Both reviewers independently examined the data and assessed the methodological quality and risk of bias. Forest plot was made that compared the pain intensities and maximum mouth opening values, which changed from the baseline of stabilization splint and other types of splints. There was no subgroup analysis done for this review. Fixed effect model is applied when there are fewer than 3 studies included in the meta-analysis and the random effect model was applied when there are more than 4 studies included in the analysis. So, we applied random effect model for both pain intensity and maximum mouth opening outcomes.

RESULTS

The search conducted among 3 databases found 220 articles: 55 on PubMed, 91 on Ebsco and 67 on Cochrane. Fifty-three duplicates and nine articles in other languages were eliminated from the review. From 158 articles, 107 were discarded based on title and abstract screening. Out of the remaining 51 articles, 28 were not accessible. Thus, only 23 articles were assessed for eligibility, and 10 were excluded from the review because they did not meet the inclusion criteria. Hence, a total of 13 articles were included in the review process. Figure 1 shows the selection process via the PRISMA flowchart.

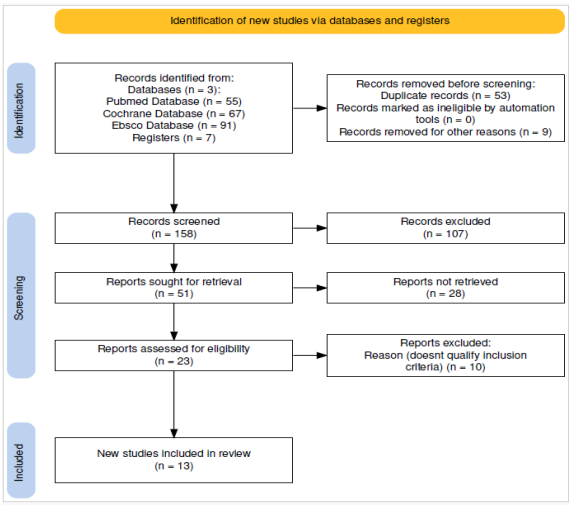
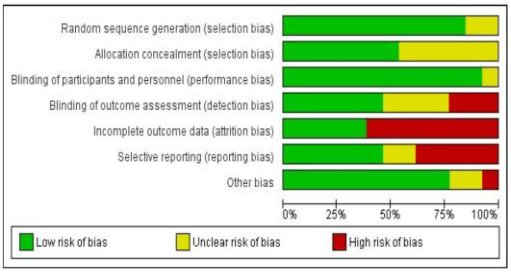


Figure 1. Prisma flow diagram

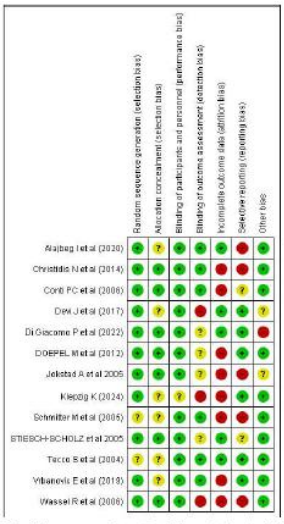
The 13 selected studies (Table 2) constitute all randomized controlled trials. All the participants were diagnosed with only one diagnostic criteria (RDC/TMD). Their sample sizes varied from 10 to 38 per group, with the majority of the studies having a sample size of 20. Most of the studies compared stabilization splints with different types of occlusal splints. All the studies used pain intensity, mouth opening, and tenderness outcome factors for evaluating the accuracy. Other measures were also used for evaluation, but were not included in this analysis.

Studies that presented the same sample at different follow-ups were analyzed only once. All the included studies evaluated pain intensity scores. Further, 11 out of 13 studies evaluated maximum mouth opening, 7 out of 13 studies evaluated TMJ tenderness, 4 studies evaluated joint sounds. The quality of the study and risk of bias assessment are listed in Figures 2 and 3 below.



Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

Figure 2. Risk of bias graph for randomized controlled trials



Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

Figure 3. Risk of bias summary for randomized

The findings from the meta-analysis that compared pain intensity between stabilization splints and other forms of occlusal splints indicated that stabilization splints were more effective than the other types. The study only included mean and standard deviation values for pre-treatment and post-treatment measurements of stabilization splints alongside the various other splints. The information presented in the research illustrates the shift from the baseline. Thus, one can derive the mean change for each group by subtracting the final mean from the initial mean. Nonetheless, the data provided does not enable the calculation of the standard deviation of these changes. Additional information from the paper might assist in determining the standard deviation of the variations. [29]

7 studies that compared the effectiveness of stabilization splint compared to any other splint in temporomandibular joint disorders.(Conti PC et al[9], Doepel M et al[11], Jokstad A et al[12], Klepzig K et al[13], Schmitter M et al[14], Tecco S et al[16], Vrbanovic E et al[4], was excluded from meta-analysis due to missing data presented in the study regarding mean and standard deviation. 5 studies comparing the effectiveness of stabilization splint compared to other splints in temporomandibular joint disorders (Alajbeg IZ et al[8], Devi J et al[3], Di Giacomo P et al[10], Stiesch- scholz et al[15], Wassell RW et al[17]) were included for meta-analysis for pain intensity. 6 studies comparing the effectiveness of stabilization splint compared to other splints in temporomandibular joint disorders (Alajbeg IZ et al[8], Christidis N et al[2], Devi J et al[3], Di Giacomo P et al[10], Stiesch- scholz et al[15], Wassell RW et al[17]) were included for meta-analysis for maximum mouth opening. The Review Manager software (Version 5.4.1) was used to perform meta-analysis. Mean values and standard deviations for pain intensity and maximum mouth opening were included for the analysis.

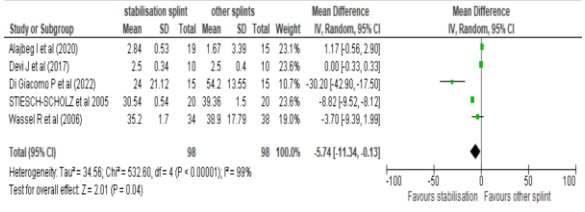


Figure 4. Forest plot of results for pain intensity comparison between stabilization splint and other types of occlusal splint.

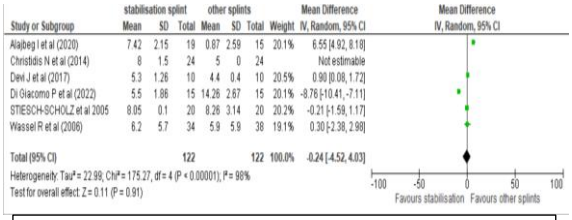


Figure 5. Forest plot of results for maximum mouth opening comparison between stabilization splint and other types of occlusal splint.

The findings derived from the meta-analysis that evaluates the pain intensity associated with stabilization splints in comparison to various other occlusal splints indicate a superior efficacy of stabilization splints in contrast to their counterparts. The study exclusively presented mean and standard deviation values pertaining to the pre- and post-treatment outcomes of stabilization splints alongside other splint modalities. The data articulated within the investigation illustrates a modification from baseline measurements.

DISCUSSION

Temporomandibular disorders (TMD) represent a complex interplay of pathological factors that significantly impact individuals' oral health and quality of life. Among the myriad contributors to TMD are mental health influences, the relationship of dental occlusion, joint overload, and habitual behaviors detrimental to jaw function.[21] Despite the widespread use of occlusal splints as a primary treatment modality, evidence indicates that this approach may fall short in addressing the non-occlusal factors that underlie many cases of TMD. Contemporary clinical research endeavors have increasingly endorsed physiotherapy as a potentially more efficacious primary treatment approach, thereby indicating a significant shift in the management paradigm of temporomandibular disorders (TMD). This evolving understanding underscores the importance of a holistic approach to treatment, one that considers the multifactorial nature of TMD and the integration of physiotherapeutic interventions into standard care protocols. [22]

The treatment of temporomandibular joint disorders remains a multifaceted area of study within current literature, reflecting the complexity of the condition itself. The current investigations

have demonstrated favorable outcomes of stabilization splints in comparison to alternative splints utilized in the therapeutic management of temporomandibular disorders (TMD).[5,9] According to the findings reported by Conti PC et al[9]., it appears that temporomandibular joint (TMJ) discomfort and clicking sounds tend to diminish over time, irrespective of the specific type of splints employed. Furthermore, Conti PC et al[9] also ascertained that stabilization splints facilitated a more rapid alleviation of symptoms in contrast to non-occluding splints when evaluating participants' pain assessments and tenderness of the TMJ upon palpation. [9]

The comprehensive examination of the research pertaining to the treatment of temporomandibular joint disorders (TMD), with a particular emphasis on stabilization splints (SS) and various alternative therapeutic modalities, elucidates a profound comprehension of the effectiveness and implementation of these interventions. Although stabilization splints have been extensively acknowledged for their efficacy in mitigating symptoms associated with TMD, including pain and functional impairments, the extant literature delineates a range of outcomes that necessitate a customized approach to therapeutic interventions.

Several studies indicate that stabilization splint (SS) can effectively reduce pain and improve jaw mobility, with some patients reporting significant relief over both short and long-term periods. However, the variability in individual responses to splint therapy suggests that not all patients will benefit equally from this intervention. This underscores the importance of considering patient-specific factors, including age, severity of symptoms, and underlying dental conditions, when designing treatment plans. According to Christidis et al. (2), the application of stabilization splints (SS) exhibited a notable decrease in pain intensity over the course of time, with 62.5% of the patient population indicating a 30% reduction at the 10-week follow-up; however, no statistically significant disparities were noted among the various treatment groups. Devi J et al[3] also concluded that there was a significant difference seen between pre- and post-treatment mean ranks in CMO, MMO, and VAS scale. The effectiveness of stabilization splints (SS) in reducing pain and improving function in patients with temporomandibular disorders (TMD) has been supported by multiple studies, indicating a potential therapeutic benefit over placebo splints (PS) in certain contexts, although the differences may not always be statistically significant. [15,17]

The severity of TMD has been demonstrated to con nect with psychological characteristics,
including anxiety and depression, indicating that tre ating these psychological aspects may improve trea tment results (Scholz et al., Alajbeg et al., 2008).[15,8] The heterogeneity of patient populations in TMD studies complicates the interpretation of results, as variations in pain types and psychological profiles can influence treatment efficacy.[10,2] A strong framework for assessing treatment outcom es is provided by the use of validated assessment in struments, such as the Visual Analog Scale (VAS), Graded Chronic Pain Scale (GCPS), and Jaw Funct ion Limitation Scale (JFLS20). This enables a thoro ugh understanding of both pain and functional limit ations.[11,17]

The aim of this systematic review and meta-analysis was to evaluate the effectiveness of stabilization splints compared to other types of occlusal splints, focusing on pain intensity and maximum mouth opening variables. The differences between the values before and after treatment were assessed, with mean changes and standard deviations calculated based on the provided data. All studies utilized pre- and post-operative measurements for assessment. Pain intensity and maximum mouth opening were the specific metrics evaluated. The risk of bias in the studies included was evaluated using the Cochrane Collaboration's tool, which indicated a generally high risk of bias and low quality of evidence. The studies reported a higher number of dropouts, and fewer outcome factors were considered. Additionally, there was a significant risk of bias in the selection process due to inadequate allocation methods. Therefore, a greater number of randomized controlled trials should be conducted, adhering to appropriate randomization protocols.

Five studies comparing the effectiveness of stabilization splint compared to other splints in temporomandibular joint disorders (Alajbeg IZ et al, Devi J et al, Di Giacomo P et al, Stiesch- scholz et al, Wassell RW et al) were included for meta-

analysis for pain intensity. 6 studies comparing the effectiveness of stabilization splint compared to other splints in temporomandibular joint disorders (Alajbeg IZ et al, Christidis N et al, Devi J et al, Di Giacomo P et al, Stiesch- scholz et al, Wassell RW et al) were included for meta-analysis for maximum mouth opening.

Six included studies were homogenous in their study design and outcome variables. Hence, a quantitative analysis by means of a meta-analysis was planned. A meta-analysis is a structured approach used to evaluate and integrate statistical data derived from the findings of independent studies that pertain to the same subject. The results of the quantitative analysis have been provided in the form of forest plots for easy visualization. (fig 3 and 4).

The results of the meta-analysis for the five studies [3,8,11,15,18] comparing pre- and post-treatment pain intensities between stabilization and other types of splints showed a greater effectiveness with stabilization splint. The comparison of maximum mouth opening before and after treatment between stabilization splints and other types of occlusal splints, as assessed in six studies 2,3,8,11,15,18, demonstrated no statistically significant difference between the two groups. Therefore, this systematic review indicates that stabilization splints are generally more effective than the other occlusal splints used for temporomandibular joint disorders

LIMITATIONS

The current analysis has several limitations: -

- The search for this study was limited to articles published in the English language.
- There has been no search for relevant literature in grey literature, which may have led to a mild selection bias.
- Exclusion and inclusion criteria, duration, type of TMD splint used and other characteristics varied among the studies, so pooling of the data could not be done for these studies.
- The results of this systematic review should be applied with caution to the clinical scenario.
- We recommend further studies: 1) More multicenter RCTs should be performed. 2) compare the effect of various occlusal splint designs and materials, and 4) report as per the CONSORT statement to obtain high-quality evidence. In addition, a consensus approach to evaluate TMD as per DC/TMD or RDC/TMD must be adopted for further accurate quantitative analysis.

CONCLUSION

Within the limitations of this systematic review, the following conclusions could be drawn:

- The effectiveness of stabilisation splint was better compared to other occlusal splints for the use of temporomandibular joint disorders.
- All the studies included showed an overall high risk of bias, indicating a low quality of evidence. Hence, more randomized controlled trials should be conducted with high levels of evidence.
- On a meta-analysis, a statistically significant difference was seen between the change in pain intensities from baseline in the stabilization splint group as compared to other types of splint group. It concluded that the stabilization splint group showed more effectiveness in decreasing the pain intensity overtime as compared to other occlusal splint groups.

On a meta-analysis, no significant difference was found between the change in maximum mouth opening from baseline in the stabilization splint group as compared to other types of splint groups. It concluded that both the splint groups showed the same amount of increase in maximum mouth opening overtime.

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