



EVALUATION OF THE LONG TERM EFFICACY OF SUPERIOR REPOSITIONING SPLINTS IN TEMPOROMANDIBULAR JOINT ANTERIOR DISC DISPLACEMENT WITH REDUCTION

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ABSTRACT

The aim of this study is to evaluate the efficacy of the use of superior repositioning splints in the management of Temporomandibular Joint Anterior Disc Displacement with Reduction cases in a one-year follow-up. The study included 60 patients who were selected from the TMJ outpatient clinic of the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Assiut University and all were treated with a superior repositioning splint. The entire sample was examined using unassisted mouth opening and the Visual Analogue Scale (VAS). The records were taken at three time points, pre-treatment (before using the splint), after 6 months and after 12 months of using the splint. There was a considerable significant improvement in the visual analogue scale report and the range of unassisted mouth opening. It was concluded that the use of superior repositioning splints is an effective strategy in the treatment of Temporomandibular Joint Anterior Disc Displacement with Reduction.

KEYWORDS: Temporomandibular joint, TMD, superior repositioning splint, SRS

INTRODUCTION

Temporomandibular joint disorders manifest in different abnormal conditions that typically involve issues with the condyle-disc complex. These issues usually arise due to changes in the normal relationship between the articular disc and the condylar head ^[1,2]. The Diagnostic Criteria

for Temporomandibular Disorders (DC/TMD) classifies articular disc displacements into four categories. Disc displacement with reduction, disc displacement with reduction and intermittent locking, disc displacement without reduction and limited opening, and disc displacement without reduction and without limited opening are examples of these types ^[3].

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TMJ pain and tenderness to palpation, restricted mandibular movements, and the presence of joint sounds are the most common signs and symptoms associated with internal derangement disorders [4,5]. Although the relationship between disc/condyle position is often a topic of discussion, it is well established that disc displacements are linked to pain and dysfunction in most patients. Interestingly, 30% to 35% of patients with disc displacements do not exhibit any symptoms [6,7].

The most typical disorder of the condyle-disc complex is anterior disc displacement with reduction (ADDwR) [8,9,10]. As per the DC/TMD, ADDwR is a biomechanical disorder within the joint capsule. In this disorder, the disc is anteriorly positioned in relation to the condylar head when the mouth is in the closed position. However, upon opening of the mouth, the disc reduces, causing clicking, popping, or snapping noises [3]. Moreover, when the disc is anteriorly displaced, elongation, stretching, and even damage of the ligaments in the rear disc occur thus pain is considered a comorbid symptom in this scenario [11,12].

Many different treatment modalities have been suggested for patients with TMJ internal derangement disorders some of them are conservative and reversible, while others are more invasive. Among conservative means, Occlusal splints, physiotherapy, muscle-relaxing appliances, and pharmacological interventions have been used for many years with successful treatment outcomes [5,13,14,15,16].

Occlusal splints are regarded as a significant therapy technique for TMD, with stability splints being the most common type. [4,17,18]. The exact therapeutic effects and mechanisms of action of occlusal splints for TMD management are not entirely clear. However, it is believed that a combination of peripheral, central, and behavioral modifications contribute to improving symptoms. Furthermore, occlusal splints have been shown to reduce muscular activity, improve occlusal stability, increase the

vertical dimension of occlusion, improve cognitive awareness, and have a placebo effect. [4,13,19-22].

Due to the numerous potential benefits associated with their use, occlusal splints have gained widespread popularity worldwide for controlling joint pain and/or noises. They have proven to be useful tools in managing temporomandibular joint (TMJ) derangement disorders [20], however, the long-term efficacy of the occlusal splints is still a point of debate.

Based on that, our study aimed to assess the long-term efficacy of the superior repositioning splint in patients with anterior disc displacement with reduction at six-month and twelve-month follow-up schedules by evaluating unassisted mouth opening and the intensity of pain.

PATIENTS AND METHODS

Sample

A Prospective study in which Sixty patients of both genders with age ranges from 16 to 55 years were recruited and selected from the TMJ outpatient clinic at Assiut University's School of Dentistry's Department of Oral and Maxillofacial Surgery.

Each participant provided written informed consent prior to their enrollment in this study.

Inclusion criteria (*Patients demonstrating the main diagnostic features of ADDwR*):

1. The presence of clicking during opening, with or without reciprocal clicking during closing.
2. Unilateral or bilateral pain on palpation of the TMJ.
3. A magnetic resonance imaging study revealed the presence of ADDwR.

Exclusion Criteria:

1. Patients with main diagnostic features of anterior disc displacement without reduction (closed lock phenomena preceded by a history of clicking)

2. Any systemic diseases such as rheumatoid arthritis.
3. Participants with a history of recent trauma to the temporomandibular joint.
4. Previous TMJ surgery.

A maxillary arch impression was taken. The impression was then used to create a working cast with a proper copy of maxillary teeth up to the vestibule. A 2 mm hard sheet was then vacuum-pressed onto the cast and cut to the required shape. (**Figure 1**).



Fig. (1): A 2 mm hard splint trimmed to the desired shape.

After checking the fitting, retention, and stability of the appliance inside the patient's mouth, one mm thickness of self-cure acrylic resin was added to the occlusal surface of the appliance to fill the indentations and make even contact. In the same appointment, occlusal adjustments were made to the splint. Once equal and even contact was achieved on all teeth in the flat occlusal surface, the splint was delivered to the patient. (**Figure 2**).

The patients were instructed to wear the splint for 24 hours except during meals, maintain a soft fluid diet, and apply hot fomentations throughout the whole duration of the treatment. Follow-up visits were performed at two weeks, one, and three months.



Fig. (2): A well-fitting maxillary flat occlusal splint with stable contacts. Frontal image

All patients were recalled at six months, and twelve months from the date of splint delivery. Inter-incisal unassisted mouth opening was measured using a graduated ruler (**Figure 3**) and the intensity of pain was evaluated using a Visual Analogue Scale (VAS).



Fig. (3): measuring unassisted mouth opening (inter-incisal) using a graduated ruler.

Statistical analysis:

All statistical tests were done using R version 4.2.1 (Core Team, 2022). A one-way ANOVA model was used to predict the effects of SRS on the TMJs of the patients regarding their unassisted mouth opening and pain.

An alpha of 0.01 was used to determine significance. The assumptions of normality and homoscedasticity of residuals were tested and were not violated; hence no data transformation was applied. Significant results were further analyzed with

Tukey HSD post-hoc tests to separate means.

RESULTS

Unassisted mouth opening:

The unassisted mouth opening was evaluated using a graduated ruler at six months, and twelve months from the date of splint delivery.

Based on the One-way ANOVA model, unassisted mouth opening showed a significant increase after using the SRS ($F_{2,177} = 42.78, P < 0.001$, Figure 4).

Using Tukey HSD post-hoc tests inter-group comparisons were done.

TABLE (1): A significant increase in the range of the unassisted mouth opening was found when comparing each time interval to the other.

	Difference	Lower	Upper	P value
Six months - initial	3.416	2.073	4.759	0.00001
Twelve months - initial	5.166	3.823	6.509	0.00001
Twelve months – six months	1.750	0.407	3.092	0.0067

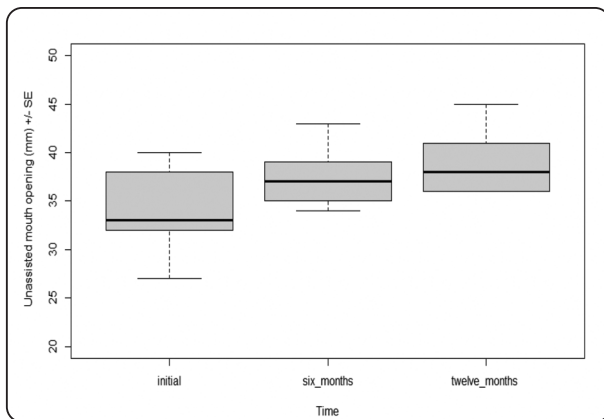


Fig. (4): There was a significant increase in the range of the unassisted mouth opening after six months ($p < 0.0001$) and remained significant after twelve months ($p < 0.0001$).

The intensity of pain:

The intensity of pain was evaluated using a Visual Analogue Scale (VAS) at six months, and twelve months from the date of splint delivery.

Based on the One-way ANOVA model, pain values showed a significant reduction after using the SRS ($F_{2,177} = 1030, P < 0.001$, Figure 5).

Using Tukey HSD post-hoc tests inter-group comparisons were done.

TABLE (2): A significant decrease in pain intensity was found when comparing each time interval to the other.

	Difference	Lower	Upper	P value
Six months - initial	-5.450	-5.806	-5.093	0.00001
Twelve months - initial	-6.316	-6.673	-5.960	0.00001
Twelve months – six months	-0.866	-1.223	-0.510	0.00001

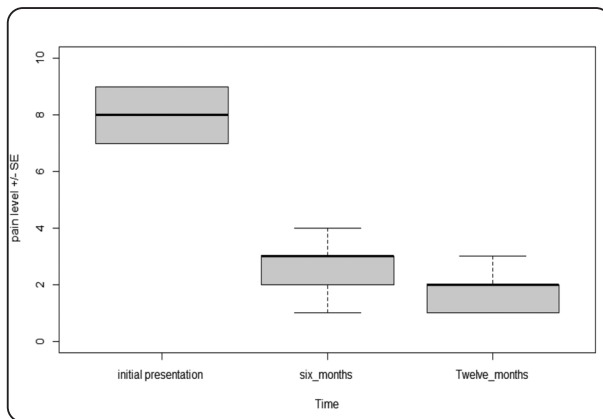


Fig. (5): There was a significant reduction in pain intensity after six months ($p < 0.0001$) and remained significant after twelve months ($p < 0.0001$).

DISCUSSION

The most prevalent derangement of the condyle-disc complex is disc displacement with reduction [23]. Factors such as trauma, bruxism, stress, masticatory muscle contraction, and aberrant occlusion can all cause disc ligament elongation and, as a result, disc displacements and excessive load within the temporomandibular joints and retro-discal tissues.^[11,24-27]

Physical therapy, medication, counseling, and occlusal treatment have all been advocated as ways for treating TMJ problems. Occlusal splints are an important component of these therapeutic techniques due to their non-invasive and conservative nature.^[28,29] Despite significant research, the effectiveness of this method in recapturing the disc, reducing discomfort, and eliminating joint noise, as well as an appropriate design and wearing protocol, have yet to be identified^[30,31].

The present study evaluates the long-term treatment efficiency of superior repositioning splints for the treatment of anterior disc displacement with reduction of the TMJ. Sixty patients of both genders with ages ranging from 16 to 55 years participated in the study. The parameters evaluated are the maximum unassisted mouth opening using a graduated ruler and the pain in the TMJ region using the Visual Analogue Scale (VAS) at six-month and twelve-month intervals.

Our results showed that there was a significant increase in the range of the unassisted mouth opening after six months ($p < 0.0001$) and remained significant after twelve months ($p < 0.0001$) in addition, there was a significant reduction in pain intensity after six months ($p < 0.0001$) and remained significant after twelve months ($p < 0.0001$).

Two limitations in our study, the clinical outcomes were not correlated with Magnetic resonance imaging and our results were not compared to a control group.

The long-term efficacy of occlusal appliances in treating TMDs is debatable thus the short and long-term efficacy should be taken into consideration by the authors in their studies. According to the American Association for Dental Research (AADR), evidence-based treatment plans and long-term relief should outline all occlusal splint treatment policies^[32].

A variety of old and recent clinical trials and systematic reviews have discussed and proven the efficacy of occlusal splint therapy in reducing pain intensity and enhancing function in patients with painful TMDs at different follow-up schedules.

Malgorzata Pihut et al conducted a prospective study to assess the effectiveness of anterior repositioning splints in managing pain related to TMJ disc displacement with reduction in 112 male and female patients. The patients were evaluated for pain levels before treatment and at follow-up visits one month and four months after treatment using the Verbal Numerical Rating Scale. The authors found that anterior repositioning splints were effective in reducing pain associated with TMJ disc displacement with reduction^[33].

Schiffman et al. and Haketa et al. conducted randomized clinical trials that demonstrated the effectiveness of occlusal splint therapy for recapturing displaced discs and reducing pain levels in patients with intra-articular TMJ disorders. The authors compared occlusal splint therapy with other conservative and surgical treatments and found all to be effective in managing these disorders^[34, 35].

Alkhatari et al conducted a search for randomized clinical trials published until April 2020, comparing the effectiveness of stabilization appliances in patients with painful TMDs to non-occluding appliances (active placebo) and untreated controls (passive placebo). The findings showed that stabilization appliances resulted in a significant decrease in pain intensity compared to the other groups. Although there was no statistically significant difference in pain intensity between stabilization and non-occluding appliances, more participants reported pain improvement with stabilization appliances than with non-occluding appliances or no treatment. The authors concluded that the effectiveness of stabilization appliances is not just due to the placebo effect^[36].

Zhang et al. conducted a meta-analysis study and found that occlusal appliances can be helpful in improving the maximum mouth opening and reducing pain intensity. Friction et al. also conducted a meta-analysis and systematic review of 47 publications, including 44 randomized controlled trials,

and concluded that occlusal splints are effective in treating TMDs. However, they noted that the type and duration of the TMDs and the length of therapy may affect the results^[37, 38].

Furthermore, Ekberg et al. indicated that the use of a stabilizing appliance to relieve signs and symptoms in individuals with TMD could last for six to twelve months.^[20]

Buchta et al. assessed TMJ discomfort with VAS in 35 patients with temporomandibular joint disorders before and after muscle stretching with occlusal splint therapy. They concluded that the intensity of discomfort is greatly reduced subsequently.^[39]

Wahlund et al. reported in a randomized control study of 64 teenagers aged 12 to 19 years that there was a substantially larger reduction in the frequency and intensity of pain for patients treated with occlusal appliances compared to the control group after a 6-month occlusal appliance therapy^[40].

The results in the previous studies were comparable with our results that the occlusal appliances are effective in relieving pain in patients with internal derangement disorders, however, we can claim that there is heterogeneity among these studies regarding follow-up schedules, the means of assessment, and the selection of age group.

Other studies, on the other hand, have shown outcomes that contradict our findings. According to a study conducted by Lundh et al., the occlusal splint was successful in lowering pain intensity and enhancing mouth opening in the short term. However, there was no statistically significant effect of a flat occlusal splint over non-treatment control patients in the long-term follow-up^[41].

Pficer et al conducted a study in which they searched for randomized controlled trials comparing stabilization splints with non-occluding splints, physiotherapy, behavioral therapy, counseling, and no treatment. They conducted the search up to October 2016 in MEDLINE, Web of Science, and

EMBASE for relevant studies in any language. Outcome variables were evaluated in short-term (less than 3 months) and long-term follow-up (more than 3 months). Pain intensity is estimated by any recognized validated pain scale: visual analogue scale (VAS), numeric rating scale (NRS), characteristic pain intensity (CPI), and pain severity score (PSS). Results showed that stabilization splints provided short-term improvements for patients with TMDs. In long-term follow-up, the effect is comparable with other therapy techniques ^[42].

Another study was done to evaluate the effectiveness of occlusal splints in reducing pain intensity in patients with TMDs during both short- and long-term treatment. Regarding the short-term results, the occlusal splint therapy showed to be more effective in the reduction of pain when compared to the control group; however, in long-term studies, it becomes insignificant ^[43].

These findings are inconsistent with our results as these studies have demonstrated that occlusal splints used for the treatment of patients with TMDs resulted in positive short-term outcomes, however, in long-term follow-ups, its efficacy was comparable to other treatment modalities.

CONCLUSION

Given the limitations of the study, it can be concluded the superior repositioning splint (SRS) offers long-term efficacy in reducing pain intensity and improving maximum mouth opening in patients with temporomandibular joint anterior disc displacement with reduction.

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