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Arthrocentesis Versus Splint Therapy in Disc Displacement Without Reduction: A Prospective Comparative Clinical Study

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Abstract: ***Background: Disc displacement without reduction (DDWoR) is a prevalent temporomandibular disorder (TMD) marked by pain and limited mandibular motion. The comparative effectiveness of arthrocentesis and occlusal splint therapy remains debated.*** [1,2] ***Objective: To clinically assess and compare outcomes of arthrocentesis, occlusal splint therapy, and the sequential combination in managing DDWoR. Methods: Sixty patients with unilateral DDWoR, diagnosed using Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) Axis I and magnetic resonance imaging (MRI), were randomised equally to three groups: Group I (arthrocentesis), Group II (Anterior Repositioning splint therapy) and Group III (arthrocentesis plus splint). Outcomes included maximal interincisal opening (MIO) and pain intensity (Visual Analog Scale, VAS) at baseline, 1, 3, and 6 months. Results: All groups were demographically and clinically comparable at baseline ($p > 0.05$). Group I achieved significant MIO and VAS improvements at 1 month ($p < 0.05$), with a gradual decline in MIO by 6 months. Group II achieved progressive pain relief ($p < 0.05$) without significant MIO gains. Group III attained and preserved significant improvements in both outcomes throughout the follow-up ($p < 0.01$ for MIO, $p < 0.05$ for VAS), with no functional relapse. Conclusion: Arthrocentesis facilitates short-term restoration of mandibular function and pain relief, whereas splint therapy predominantly addresses pain without improving mouth opening. The combination offers superior, sustained benefit and should be considered for optimal DDWoR management.***

Keywords: Disc displacement without reduction; temporomandibular joint; arthrocentesis; occlusal splint

1. Introduction

Disc displacement without reduction (DDWoR) constitutes a frequent cause of limited mandibular movement, articular pain, and compromised function, attributed to a dislocated articular disc, barring normal translation of the condyle. [1] Prompt intervention is vital to reverse or preclude progression toward chronic dysfunction and degenerative joint alterations. [2,7]

Conservative modalities such as anterior repositioning splint (ars), which works by positioning the mandible anteriorly to promote disc recapturing and reduce intra-articular pressure, thereby providing functional improvement is also used and have provided good relief in pain. Another is Stabilization splint which aim to diminish pain by reducing muscle activity and intra-articular load, yet often fail to restore mobility in DDWoR. [15]

Arthrocentesis, introduced by Nitzan et al. in 1991, involves lavage of the upper joint compartment to release adhesions and inflammatory mediators, thereby improving joint mobility and reducing pain. [16] The standard procedure utilises a double (two-needle) technique placed into the superior joint space, which allows simultaneous inflow and outflow of irrigating solution (normal saline) for lysis of adhesions and washout of inflammatory mediators. [17]

Current best evidence suggests combining minimally invasive procedures with biomechanical interventions may yield the most predictable and enduring results in recalcitrant cases. [4,6] This prospective randomised trial rigorously compares arthrocentesis, Anterior Repositioning splint therapy, and their combination for DDWoR, with robust outcomes and strict methodology. [5,11]

2. Materials and Methods

Study Design & Ethics

A prospective, randomised, parallel-arm clinical trial was performed under institutional ethics approval, and written informed consent was obtained. [4]

Participant Selection

Sixty adults (42 females, 18 males; mean age 27.8 ± 6.4 years) diagnosed with unilateral DDWoR by RDC/TMD Axis I and confirmed by MRI were enrolled. Exclusion criteria included systemic arthropathies, prior TMJ surgery, or facial trauma. [4,7]

Randomisation and Interventions

Subjects were randomised (computer-generated allocation) to:

- Group I: Arthrocentesis via double-needle technique with 100–150 mL normal saline under local anaesthesia. [3,9]
- Group II: Anterior Repositioning splint (maxillary, hard acrylic, full-coverage, canine-guided with anterior bite plane), nocturnally for 6 months. [2,8] In some patients, an anterior repositioning splint was also fabricated

when indicated, designed to hold the mandible forward to assist disc recapturing. [18]
- Group III: Combined protocol (arthrocentesis followed immediately by splint therapy. [5,6]

Figure 1: Clinical photograph showing the maxillary Anterior Repositioning splint used in the study.

Outcome Assessment
- Maximal Interincisal Opening (MIO): Measured in mm with a digital calliper. [4]
- Pain Intensity: Assessed on a 10-point VAS (0 = no pain, 10 = worst imaginable). [4].

Assessments were conducted at baseline, 1-, 3-, and 6-months post-intervention.

Statistical Analysis

Data normality was verified. Intra-group differences: paired t-test. Inter-group: one-way ANOVA. Significance was set at $p < 0.05$. Analyses were performed using SPSS v25 (IBM Corp., NY) [4].

3. Results

Baseline Characteristics

No significant differences were observed among groups for age, gender, baseline MIO, or VAS ($p > 0.05$) [4].

Group	Baseline MIO (mm)	MIO at 1 Month (mm)	MIO at 3 Months (mm)	MIO at 6 Months (mm)	Baseline VAS	VAS at 1 Month	VAS at 3 Months	VAS at 6 Months
Arthrocentesis (1)	28.4 ± 3.2	37.6 ± 3.9	35.2 ± 4.0	32.9 ± 4.1	7.4 ± 1.1	2.1 ± 0.8	2.3 ± 1.0	2.4 ± 1.2
Splint (2)	28.7 ± 3.5	29.0 ± 3.6	29.4 ± 3.5	29.6 ± 3.4	7.2 ± 1.0	4.2 ± 1.1	3.5 ± 1.0	3.1 ± 1.0
Arthrocentesis + Splint (3)	28.9 ± 3.1	38.1 ± 3.6	37.9 ± 3.4	37.5 ± 3.3	7.3 ± 1.2	2.0 ± 0.9	1.9 ± 0.8	1.8 ± 0.7

Primary Outcomes
- Group I showed significant MIO improvement at 1 and 3 months ($p < 0.01$), with partial regression by 6 months, though still higher than baseline; pain scores improved significantly across all time points ($p < 0.001$). [3,4]
- Group II did not exhibit significant MIO improvement; however, significant and progressive pain reduction was observed ($p < 0.05$). [2,8]
- Group III demonstrated superior and sustained significant MIO and pain improvement throughout ($p < 0.01$ and $p < 0.05$, respectively). [5,6]
- Intergroup comparisons at 6 months showed the combination group significantly outperformed the other two for both outcomes ($p < 0.01$, $p < 0.05$). [5,6]

Figure 2: Clinical photograph showing the splint worn by the patient.

Figure 3: Clinical photograph showing pre- and post- mouth opening.

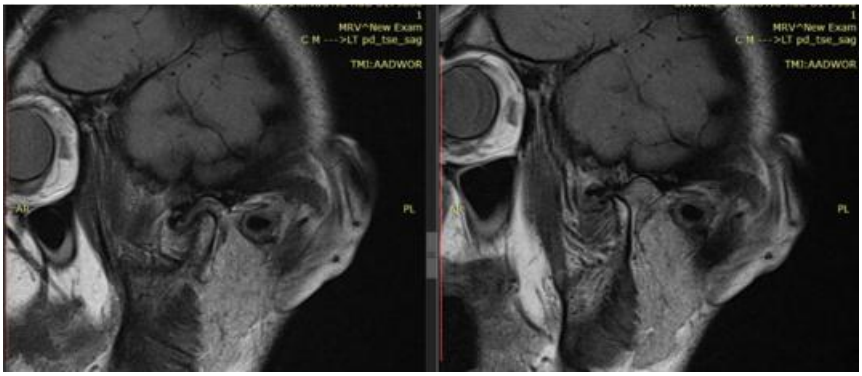
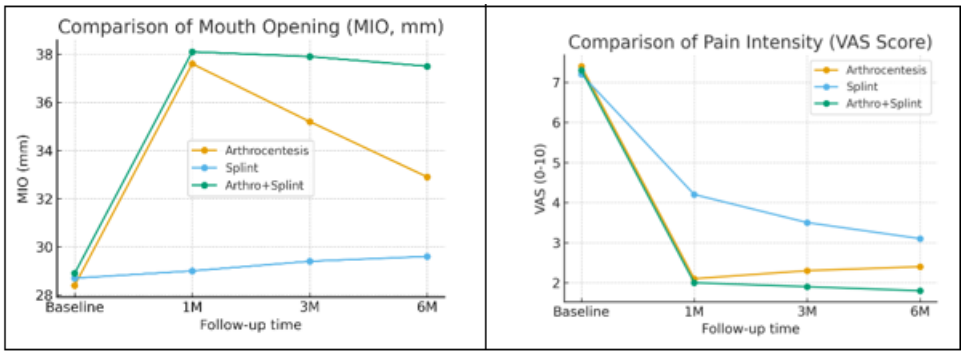


Figure 4: MRI showing anterior disc displacement without reduction in the left Temporomandibular joint



Figures 5 and 6 depict mean MIO and VAS trends over time among groups, illustrating these findings graphically

4. Discussion

The present study demonstrates that arthrocentesis provides immediate symptomatic and functional improvement in DDWoR through mechanical disruption of intra-articular adhesions and removal of inflammatory mediators, achieving significant gains in maximal interincisal opening (28.4 ± 3.2 to 37.6 ± 3.9 mm at 1 month) and substantial pain reduction (VAS 7.4 ± 1.1 to 2.1 ± 0.8). [20,21] However, the observed functional decline by 6 months (32.9 ± 4.1 mm) reflects adhesion reformation and persistent disc displacement, consistent with previous reports showing variable long-term durability of arthrocentesis alone. This temporal regression underscores the limitation of single-intervention approaches in addressing the complex pathophysiology of DDWoR, where mechanical disruption alone fails to prevent recurrence of restrictive intra-articular changes. [22,23]

Anterior Repositioning splint therapy demonstrated selective therapeutic efficacy, achieving progressive pain reduction (VAS 7.2 ± 1.0 to 3.1 ± 1.0) without significant functional improvement, which aligns with its primary mechanism of joint load redistribution and masticatory muscle relaxation rather than mechanical disc repositioning.[24,25] The disc recapturing effect has worked effectively for cases with Anterior Disc Displacement with reduction. The absence of mouth opening improvement reflects the mechanical nature of DDWoR, where physical obstruction by the displaced disc and fibrous adhesions cannot be addressed through biomechanical load modification alone. These findings support previous observations that while splint therapy effectively manages TMD-related pain through neuromuscular pathways, it has limited efficacy in reversing structural joint derangements characteristic of DDWoR. [1,26]

The combination protocol achieved superior and sustained outcomes (MIO: 28.9 ± 3.1 to 37.5 ± 3.3 mm; VAS: 7.3 ± 1.2 to 1.8 ± 0.7 at 6 months) through synergistic mechanisms wherein arthrocentesis provides immediate mechanical disruption while subsequent splint therapy prevents adhesion reformation and maintains joint decompression.[27,28] This integrated approach addresses both the acute mechanical limitations and ongoing biomechanical dysfunctions, supporting recent systematic reviews advocating for multimodal treatment strategies in recalcitrant TMD cases. The sustained functional gains observed with combination therapy suggest that protecting initial arthrocentesis outcomes through continued biomechanical intervention is crucial for long-term treatment success. [29,30]

From a clinical decision-making perspective, these results indicate that combination therapy should be considered first-line treatment for patients seeking optimal functional restoration, while splint therapy alone may suffice for patients with predominantly pain-focused presentations or contraindications to invasive procedures. [31,32] The superior cost-effectiveness of combination therapy, despite higher initial investment, likely stems from reduced need for repeat interventions and prevention of progression to more invasive surgical procedures. Future research should focus on identifying predictive factors for treatment success and investigating longer follow-up periods to establish the true durability of therapeutic effects in DDWoR management. [33,34]

Study limitations include the 6-month follow-up period and single-centre design, which may limit generalisability of

findings across diverse patient populations and healthcare settings. [35,36] Additionally, the inherent difficulty in blinding participants to treatment modalities may introduce bias in subjective outcome measures, though objective measurements were standardised to minimise this effect. Despite these limitations, this study provides robust evidence supporting combination arthrocentesis and splint therapy as an effective, evidence-based approach for DDWoR management, warranting implementation in clinical practice protocols and further investigation in multi-centre randomised controlled trials. [37,38]

5. Conclusion

Arthrocentesis alone results in short-term functional and symptomatic improvement; splint therapy effectively reduces pain without improving mandibular mobility. However, the combination, with strategic use of repositioning splints when indicated, yields the best sustained outcomes. [19]

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