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Arthrocentesis Versus Rocabado Exercises on Temporomandibular Disc Displacement Without Reduction

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ABSTRACT

Background: Background: Temporomandibular joint disorders (TMD) are common, especially in females, causing pain and jaw dysfunction with significant impact on quality of life. Early diagnosis and effective management are essential to improve patient outcomes.

Aim of the study: This study was designed to evaluate and compare the effects of the Rocabado exercise protocol and arthrocentesis in patients diagnosed with temporomandibular joint (TMJ) disc displacement without reduction.

Methods: The study involved 68 patients with MRI-confirmed TMJ disc displacement without reduction, recruited from Qalyubia Governorate Hospitals with treatment sessions conducted between September 2022 and May 2024. Participants were randomly assigned to receive either arthrocentesis or an 8-week Rocabado exercise program. Pain and jaw movement were evaluated before and after treatment using the Visual Analogue Scale and Therabite Range of Motion scale.

Results: The study and control groups (N=34 each) were comparable in gender (study: 22F/12M; control: 17F/17M; p=0.220), affected side (study: 47.1% left; control: 55.8% left; p=1.000), and age (48.24 ± 5.6 vs. 47.24 ± 5.27 years; p=1.000). Both groups showed significant improvements in right lateral excursion (study: 0.85 ± 0.61 to 1.29 ± 0.52 mm; control: 1.53 ± 0.79 to 2.24 ± 0.65 mm; p=0.001), left lateral excursion (study: 1.12 ± 0.91 to 1.71 ± 0.68 mm; control: 1.47 ± 0.99 to 2.06 ± 0.85 mm; p=0.001), and pain reduction measured by VAS (study: 4.93 ± 1.04 to 1.24 ± 0.88; control: 5.93 ± 1.04 to 1.0 ± 0.88; p=0.001). The control group demonstrated superior improvements in lateral excursion and pain reduction compared to the study group, indicating greater functional and symptomatic benefits post-intervention.

Conclusion: This research fills a critical gap in the existing literature by providing evidence-based insights for clinicians in tailoring treatment strategies for TMD management. Future studies should explore long-term outcomes and patient satisfaction to further inform clinical practice. Both approaches have their merits; arthrocentesis is recommended for patients seeking rapid relief from pain and functional impairment, while Rocabado exercises are more suitable for long-term rehabilitation.

Keywords: *Arthrocentesis, Rocabado approach, VAS, Displacement without Reduction, Temporomandibular joint disorders (TMD).*

1. INTRODUCTION

Temporomandibular disorders (TMD) are common health problems that affect a significant portion of the population, with up to 12% experiencing symptoms. Women aged 20–50 years are disproportionately affected, with a prevalence of 6.3% in

females and 2.8% in males. (Geronimus et al., 2006) These disorders cause pain in the jaw muscles or the temporomandibular joint, resulting in limited jaw mobility and impacting daily life. TMD management often requires a collaborative effort from various healthcare professionals, including dentists, orthodontists, psychologists, physical therapists, and physicians. Notable treatments for TMD include arthrocentesis and Rocabado exercises, reflecting the need for a comprehensive approach to address its complex symptoms (Brooks-Wells & Jackson, 2024). Symptoms of TMD are relatively common, affecting up to 25% of the population, although only approximately 5% seek medical assistance (Murphy et al., 2013).

Arthrocentesis is a minimally invasive procedure that involves aspiration of synovial fluid from the TMJ to alleviate pain and improve joint function by reducing inflammation and facilitating better movement within the joint space patients (Klein et al., 2020; Schiffman et al., 2020). This technique is often considered a first-line treatment option for patients who are unresponsive to conservative therapies. It is typically performed by oral and maxillofacial surgeons (Purdue, 2024). Post-procedure, patients should limit joint activity for 4–8 hours and attend follow-ups to monitor for complications such as infection, hematoma, transient facial nerve injury, or limited mouth opening; these risks are minimized with proper technique and patient selection (Klein et al., 2020; Dimitroulis et al., 2019). Therapeutic injections of corticosteroids or hyaluronic acid after aspiration can further enhance outcomes (Gurung et al., 2021; Grossmann et al., 2019).

The Rocabado Technique encompasses a series of exercises designed to restore normal function through physical rehabilitation aimed at improving TMJ mechanics and muscle coordination. Developed by Dr. Carlos Rocabado, this approach emphasizes neuromuscular stabilization through specific exercises targeting postural alignment and jaw function (Rocabado et al., 2019). Rocabado 6 × 6 Exercises program consists of six specific exercises performed six times daily. Techniques involve non-thrust manipulations aimed at repositioning the articular disc within the TMJ during jaw movement (Wang & Zhang, 2023).

This study directly compared the Rocabado approach and TMJ arthrocentesis as treatments for disc displacement without reduction, addressing a significant research gap by evaluating these methods side by side for the first time. These findings aim to provide evidence-based recommendations to clinicians, enabling personalized treatment strategies that enhance patient outcomes. Moreover, this study establishes a foundation for future research on TMDs, supporting ongoing investigations in this critical area of health care.

2. SUBJECT AND METHODS

Subjects

The study comprised 68 patients aged 40 to 55 years diagnosed with temporomandibular joint (TMJ) disc displacement without reduction, as confirmed by magnetic resonance imaging (MRI). Inclusion criteria encompassed a sudden reduction in mandibular opening, an unassisted opening of 35 mm or less, an assisted opening exceeding the unassisted opening by at least 3 mm, a documented history of joint clicking followed by its cessation concurrent with the decreased opening, and symptom duration not exceeding three weeks. Exclusion criteria included the presence of other temporomandibular disorders such as myalgia, degenerative joint disease, or collagen vascular disease, as well as a history of significant mandibular trauma, dentofacial deformities, psychiatric disorders, or chronic headaches. Both male and female patients meeting these criteria were enrolled in the study.

Assessment procedure

Measurements were conducted at baseline (pre-intervention) and immediately following the completion of the 8-week intervention program (post-intervention) to ensure that observed changes could be directly attributed to the respective treatments. Assessment of temporomandibular joint (TMJ) function involved several key methods. Lateral excursion, which measures the distance between the incisor edges during lateral jaw movements, was evaluated using the Therabite range-of-motion scale. Pain intensity was assessed subjectively using the Visual Analog Scale (VAS), where patients rated their pain on a scale from 0 (no pain) to 10 (worst possible pain).

Treatment protocol

The Rocabado approach is a physiotherapeutic intervention specifically designed to address TMDs. This method integrates joint manipulation techniques that incorporate gentle gliding movements to enhance joint mobility and facilitate nutrient exchange combined with a structured "6×6" exercise program. Study group participants engaged in a structured exercise program and manipulation for over eight weeks. The mechanism of each exercise in the Rocabado 6x6 protocol is described in Table 1, highlighting components such as rest position of the tongue, scapular protraction correction, muscle engagement mechanism, control of TMJ rotation, rhythmic stabilization, axial extension, shoulder posture, and stabilized head, each contributing to improved posture, muscle relaxation, joint protection, and pain reduction (Wang & Zhang, 2023). The program included six types of exercises performed six times daily focusing on the following:

Table 1: Rocabado Exercises. Quoted from (Wang & Zhang, 2023).

Component	Description	Benefits
Rest Position of the Tongue	Promotes diaphragmatic breathing, reducing reliance on neck and shoulder muscles.	Improves posture and minimizes strain on accessory muscles **(Wang & Zhang, 2023)**.
Scapular Protraction Correction	Encourages shoulder girdle retraction to correct abnormal scapular positioning.	Enhances overall posture and function **(Johnson., et al 2022)**.
Muscle Engagement Mechanism	Controlled opening promotes functional engagement without directly stretching the lateral pterygoid.	Relaxes hypertonic masseter and temporalis muscles, alleviating discomfort in TMJ disorders **(Xu L, et al., 2020)**.
Control of TMJ Rotation	Focuses on rotational movements to reduce strain on masticatory muscles and preserve joint integrity.	Improves muscle coordination, reduces pain symptoms, and protects joint structures **(Johnson., et al 2022)**.
Rhythmic Stabilization	Enhance proprioception through reciprocal inhibition, relaxing antagonistic muscles during contraction.	Promotes proper jaw rest position, improving motor control and muscle relaxation **(Xu L, et al., 2020)**.
Axial Extension	Stretches supra- and infrahyoid muscles to improve cervical alignment and reduce tension.	Decreases unnecessary muscle activity, normalizes sternocleidomastoid positioning, and aids relaxation **(Wang & Zhang, 2023).**
Shoulder Posture	Activates scapular retraction muscles to correct forward shoulder posture.	Reduces neck strain and mitigates TMJ dysfunction caused by poor posture. **(Wang & Zhang, 2023).**
Stabilized Head	Distraction of the upper cervical spine alleviates mechanical compression and elongates posterior cervical muscles.	Improves cervical alignment and reduces strain contributing to TMJ symptoms. **(Johnson., et al. 2022)**.

The mechanics of TMJ gliding and its implications for treatment and function are summarized in Table 2, highlighting key factors such as load distribution, neuromuscular control, synovial fluid circulation, joint stability during movement, muscle coordination, disc positioning, healing promotion, muscle relaxation, and pain reduction all contributing to improved joint function. The timing and application of the gliding technique within the intervention program are detailed in Table 3, specifying when and how the gliding manipulations are integrated alongside cervical positioning and mandibular exercises to optimize therapeutic outcomes.

Table 2: Mechanism of Rocabado Technique (gliding). Quoted from (Rocabado et al., 2019).

Glide Type	Patient Position	Description
Anterior Glide	Supine	The therapist places their thumb above the posterior part of the lower teeth intraorally, while the index finger wraps around the angle of the mandible for control. A downward distraction force is applied, followed by an anterior glide.

Medial Glide	Supine	The therapist stabilizes the cranium using one hand. The contralateral thumb is placed on the medial side of the lower molars. Mobilization involves gently moving the cranium laterally over the mandibular condyle to achieve a medial glide.
Lateral Glide	Supine	The therapist stabilizes the cranium with one hand. The therapist's thumb contacts the medial side of the lower molars (rearmost molar), while the index finger palpates the mandibular condyle. A lateral force is applied with wrist extension to promote lateral TMJ glide and condylar translation.

Table 3: Timing for the Rocabado Technique of gliding Session. Quoted from (Johnson., et al 2022).

Aspect	Description
Frequency	Exercises are performed six times a day, with each exercise completed six times per session to reinforce muscle memory and improve joint function **(Johnson., et al 2022).**
Session Duration	Each session should last approximately 10–15 minutes to ensure correct performance and focus on technique.
Timing Throughout the Day	Sessions should be spaced throughout the day: morning, mid-morning, afternoon, early evening, and before bed to maintain muscle engagement and reduce stiffness **(Pundkar et al., 2021).**
Post-acute Phase	Exercises should be introduced after the acute phase of **TMJ** dysfunction has subsided to restore mobility and strengthen surrounding musculature **(Jebamalar et al., 2016).**
Integration with Other Treatments	Combining Rocabado exercises with other modalities, such as heat or cold therapy, can enhance effectiveness by managing pain and improving flexibility.
Regular Monitoring	Patients should be regularly monitored to assess progress and tailor the exercise regimen to individual needs **(Journal of Pharmaceutical Research International, 2021).**

Control group who underwent arthrocentesis: The procedure was performed under local anesthesia. A 20-gauge needle was inserted into the upper joint space approximately 10 mm anterior to the tragus. The joint was lavaged with lactated Ringer's solution to reduce inflammation. This treatment was accompanied by appropriate medical and nursing care

3. RESULTS

As shown in Table 4, the study included 34 females (64.7%) and 12 males (35.3%) in the study group, and 17 females (50.0%) and 17 males (50.0%) in the control group, with no significant difference in gender distribution ($\chi^2 = 1.503$, $p = 0.220$). The affected side distribution was similar between groups, with 16 left (47.1%) and 18 right (52.9%) in the study group, and 19 left (55.8%) and 15 right (44.1%) in the control group ($\chi^2 = 0.000$, $p = 1.000$). Mean age was comparable, with 48.24 ± 5.6 years in the study group and 47.24 ± 5.27 years in the control group ($p = 1.000$).

Both groups showed significant improvements in mandibular lateral excursion and pain levels after the 8-week intervention ($p = 0.001$). The control group demonstrated greater baseline and post-intervention values in lateral excursion, with right lateral excursion increasing from 1.53 ± 0.79 mm to 2.24 ± 0.65 mm (46.4% improvement) and left lateral excursion improving from 1.47 ± 0.99 mm to 2.06 ± 0.85 mm (40.1% improvement). In comparison, the study group's right lateral excursion increased from 0.85 ± 0.61 mm to 1.29 ± 0.52 mm (51.8% improvement) and left lateral excursion from 1.12 ± 0.91 mm to 1.71 ± 0.68 mm (52.7% improvement).

Importantly, the control group achieved a more substantial reduction in pain intensity, with Visual Analog Scale (VAS) scores decreasing from 5.93 ± 1.04 to 1.00 ± 0.88, representing an 83.1% reduction, compared to a 74.8% reduction in the study group (from 4.93 ± 1.04 to 1.24 ± 0.88). These findings indicate that while both interventions effectively improved mandibular mobility and reduced pain, the control group, which received arthrocentesis with standard medical and nursing care, demonstrated superior overall clinical outcomes, particularly in pain relief and functional capacity.

Table 4: Baseline characteristics and measurements of all groups of the study

Measurements	Study Group (N=34)	Control Group (N=34)	Chi square test (X^2) Paired t-test	p-values
- Female	22 (64.7%)	17 (50.0%)	$X^2 = 1.503$	p = 0.220
- Male	12 (35.3%)	17 (50.0%)		
Affected Side - Left (LT)	16 (47.1%)	19 (55.8%)	$X^2 = 0.000$	p = 1.000
Affected Side - Right (RT)	18 (52.9%)	15 (44.1%)		
Age (Mean ± SD)	48.24 ± 5.6 SD	47.24 ± 5.27 SD	$X^2 = 0.000$	p = 1.000
Right Lateral Excursion	Pre: 0.85 ± 0.61 SD	Pre: 1.53 ± 0.79 SD	t = -3.897 (Study), -4.243 (Control)	p = 0.001
	Post: 1.29 ± 0.52 SD	Post: 2.24 ± 0.65 SD		p = 0.001
Left Lateral Excursion	Pre: 1.12 ± 0.91 SD	Pre: 1.47 ± 0.99 SD	t = -5.633 (Study), -6.159 (Control)	p = 0.001
	Post: 1.71 ± 0.68 SD	Post: 2.06 ± 0.85 SD		p = 0.001
VAS	Pre: 4.93 ± 1.04 SD	Pre: 5.93 ± 1.04 SD	t = 18.647 (Both)	p = 0.001
	Post: 1.24 ± 0.88 SD	Post: 1.0 ± 0.88 SD		p = 0.001

Mean ± SD= mean ± standard deviation, $p > 0.05$ = non-significant, $p < 0.05$ = Significant, P-value: probability value

4. DISCUSSION

This study was designed as an open label randomized controlled trial involving 68 patients aged 40 to 55 years diagnosed with temporomandibular joint disc displacement without reduction. Patients were randomly assigned into two equal groups in number: One group received the Rocabado exercise protocol, while the other underwent arthrocentesis. The primary outcome measures included lateral excursion assessed via the Therabite range of motion scale and pain levels measured by the visual analogue scale (VAS). Assessments were conducted before the intervention and at eight weeks post-intervention. The results demonstrated significant improvements in TMJ symptoms for both the Rocabado approach and arthrocentesis groups, with notable differences in specific outcomes.

In both groups, there was an improvement in the lateral excursion in favor of the study group, as the right lateral excursion had 51.76% improvement and left lateral excursion had 52.68% improvement, compared to that improvement of the control group with 46.41% improvement and 40.14% respectively. As regarding pain measurement (VAS), the improvement in both groups was as follows: the control group had 83.1% improvement, compared to 74.85% improvement in the study group ($p = 0.001$).

Numerous studies and reviews support the efficacy of both arthrocentesis and the Rocabado approach in treating TMJ disorders. Fruto et al. (2006) highlighted that specific manipulative techniques could significantly reduce pain levels while improving overall function, particularly with Rocabado's non-thrust long axis distraction techniques playing a significant role in improving TMD. Marega et al. (2006) conducted a systematic review evaluating various interventions for managing TMJ dysfunction, including exercise, manual therapy, electrotherapy, relaxation training, and biofeedback. The review concluded that active exercise and manual mobilization are effective treatment options; it also recommended postural training

alongside other interventions due to unclear independent effects.

Nicolakis et al. (2000) investigated exercise therapy for craniomandibular disorders focusing on active and passive jaw movement exercises for patients with anterior disc displacement. Their findings highlighted a close relationship between the cervical spine and the craniomandibular complex, noting that exercises could influence jaw closure patterns and alleviate myofascial pain.

Laskin et al. (2021) suggest physiotherapy as a therapeutic approach for TMJ disorders to facilitate joint movement, prevent adhesions, regulate muscle function, blood circulation, and restore bite force. Various physical therapy treatments have been proposed for TMD patients including computer-aided devices, low-level laser therapy, superficial heat application, active and passive stretching exercises, therapeutic ultrasound, and nerve stimulation. Laskin et al. (2021) state that exercises should be designed for groups of muscles rather than single isolated muscles; contraction of one group automatically causes stretching in antagonists.... These exercises are designed for groups of muscles rather than single isolated muscles; contraction of one muscle group automatically stretches the antagonist group leading to pain reduction through reciprocal inhibition. This interconnected approach improves muscle function while managing TMJ disorders ultimately reducing pain and enhancing jaw function (Rowicki & Zakrzewska, 2006).

According to McNeely et al. (2006), exercise plays a crucial role in suppressing joint adhesion production and contracture processes; it helps maintain proper orientation during collagen distribution. Motion and stress inhibit contracture formation by accelerating glycosaminoglycan (GAG) production; GAG synthesis is vital for lubrication and maintaining fiber distance within the joint capsule.

Houglum (2005) explains that small gliding movements during joint manipulation facilitate synovial fluid movement enhancing nutrient exchange and improving joint mobility by loosening adhesions while maintaining tensile strength of articular tissues. The author notes significant pain reduction achieved through manual mobilization which induces soft-tissue relaxation; pain modulation occurs through mechanisms such as the pain gate theory and descending pathway inhibition both locally and systemically. Da Rocha Moraes et al. (2013) assert that TMJ isometric exercises increase intra-muscular pressure related to muscle tension facilitating relaxation; these exercises promote actin-myosin synthesis resulting in elevated cellular ATP levels which enhance muscle metabolism while aiding removal of metabolites.

Khare et al. (2012) elucidate that the Rocabado technique restores joint function by addressing muscle imbalances; it strengthens neck extensors and shoulder retractors thereby improving TMJ movement patterns. Zhang et al. (2016) echo this perspective emphasizing the importance of incorporating rehabilitative techniques such as the Rocabado approach into treatment plans to ensure lasting benefits. Eric et al. (2006) provide insights into TMJ manipulation techniques aimed at normalizing range motion while relieving soft tissue tension throughout the jaw region; therapeutic exercises prevent formation of abnormal fibrous tissue thereby improving mandibular motion range. Haketa et al. (2016) confirmed that therapeutic exercise involving stretching muscles around joints can relieve pain and decrease functional impairment during chronic phases of TMD. Lisa et al. (2012) studied the 6x6 Rocabado exercise protocol intervention for temporo-mandibular joint open lock; they found these interventions improved neuromuscular control during activities involving extreme mouth opening while preventing recurrence of open-lock episodes.

Mulet et al. (2007) determined whether Rocabado's 6 × 6 exercise program benefits self-care by reducing myofascial pain while improving forward head posture revealing significant decreases in jaw pain intensity without substantial changes in head posture. Klein et al. (2020) discuss Professor Marino Rocabado's expertise in managing craniomandibular craniovertebral dysfunctions through structured exercise programs targeting postural relationships among head-to-neck, neck-to-shoulders, and lower jaw-to-upper jaw dynamics—recommending patients performing each task six times per day to improve overall function while alleviating symptoms associated with TMD. Furthermore, Abboud et al. (2015) emphasized the importance of tailoring rehabilitation programs to address specific needs of each patient while advocating a multidisciplinary approach integrating physical therapy with other treatment modalities to optimize patient outcomes. This comprehensive strategy aims to reduce risks associated with chronicity of TMD symptoms while promoting early intervention through active patient participation in their recovery process.

Finally, Abboud et al. (2015) present a strong argument for including physical therapy interventions in managing TMD by underscoring their effectiveness in improving muscle strength and mobility enhancing overall patient quality of life; research indicates that manual therapy techniques can significantly improve outcomes for patients with TMJ disorders for instance Garrigós-Pedrón et al. (2018) found manual therapy effective in reducing pain while increasing maximal mouth opening (MMO), crucial for restoring normal function in individuals suffering from TMD-related conditions. In the ongoing debate regarding the treatment of temporomandibular joint (TMJ) disorders, particularly disc displacement without reduction, various authors have expressed opinions on the effectiveness of arthrocentesis and the Rocabado approach. In the ongoing debate regarding the treatment of temporomandibular joint (TMJ) disorders, particularly disc displacement without reduction, various authors have expressed opinions on the effectiveness of arthrocentesis and the Rocabado approach.

Similarly, Kumar et al. (2021) emphasized the immediate relief provided by arthrocentesis, highlighting its role in improving

functional outcomes in patients with acute symptoms. Their findings suggested that the procedure can lead to substantial improvements in both pain levels and jaw mobility.

This corresponds to (Haketa et al. (2016) reported that the effect of lysing the adhesions and stretching or releasing the anterior synovium is evidenced immediately intraoperatively as an increase in joint mobility.

Trieger et al. (1999) highlighted that numerous studies have demonstrated the efficacy of arthrocentesis for the treatment of temporomandibular joint (TMJ) disorders, showing significant improvements in pain levels and mandibular mobility following arthrocentesis compared with baseline measurements.

Vos et al. (2013) have shown through randomized controlled trials that combining arthrocentesis with sodium hyaluronate injections yields better outcomes than either treatment alone.

De Riu et al. (2013) conducted a prospective study that revealed patients undergoing arthrocentesis experienced considerable pain reduction and improvements in maximum incisal mouth opening following the treatment. Furthermore, Alpaslan et al. (2000) discovered that arthrocentesis effectively lowered inflammatory markers in the synovial fluid, which played a role in alleviating pain and enhancing joint function.

Klein et al. (2020) reported that comparative studies indicate that while both treatments can relieve symptoms, TMJ arthrocentesis may produce faster results in acute cases of disc displacement without reduction because it directly addresses joint pathology. Critics of arthrocentesis have also highlighted its limitations in promoting long-term stability.

Both arthrocentesis and Rocabado exercises are effective for treating TMJ disorders. Arthrocentesis provides quick relief by addressing intra-articular issues, particularly beneficial for acute pain. The Rocabado approach focuses on long-term rehabilitation through exercises improving muscular coordination and range of motion. The choice between these treatments should be individualized based on patient needs and clinical circumstances.

5. CONCLUSION

This study confirmed that both arthrocentesis and Rocabado exercises significantly improved functional outcomes and reduced pain levels in patients with TMJ disorders. However, arthrocentesis demonstrated greater efficacy than the Rocabado exercises across all measured parameters within a short-term framework. This outcome highlights the principle that "one swift blow is better than many weak ones," as arthrocentesis provides a more immediate and impactful relief than the gradual benefits of Rocabado exercises approach. Nonetheless, Rocabado approach also offer substantial benefits, embodying the idea of "slowly but surely," as they provide sustained improvement over time through consistent practice and patient adherence. These insights contribute valuable knowledge regarding effective treatment strategies for TMJ disorders and underscore the importance of individualized patient care based on specific clinical presentations.

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2. Conflict of interest

The authors state there are no conflicts of interest in this work.

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REFERENCES

[1] Abboud W, Yahalom R, and Givol N. (2015): Treatment of intermittent locking of the jaw in Wilkes stage II derangement by arthroscopic lavage. J Oral Maxillofacial Surg; 73:1466–72.

[2] Brooks-Wells, A., & Jackson, K. (2024): Lateral Pterygoid Muscle: Anatomy and Clinical Relevance. Physiopedia. Retrieved from https://www.physio-pedia.com/Lateral_Pterygoid.

[3] Brown, A., & Green, B. (2023): Adjunctive therapies in TMJ disorders: A systematic review. Clinical Oral Investigations, 26(3), 789-798.

[4] Da Rocha Moraes, A., Lalue Sanches, M., Ribeiro, E. C., & Guimarães, A. S. (2013): Therapeutic exercises for the control of TMD. Dental Press Journal of Orthodontics, 18(5), 134-139.

[5] De Riu, G., Stimolo, M., Meloni, S.M., Soma, D., Pisano, M., Sembronio, S., & Tullio, A. (2013): Arthrocentesis and TMJ disorders: Clinical and radiological results of a prospective study. International Journal of Dentistry, Article ID 790648.

[6] Eric S. FRuto, Joshua A Cleland, Julie M. Whiteman, Kenneth A. Olson. (2006): Manual physical therapy intervention and exercise for patients with temporomandibular disorders. Journal of Craniomandibular Practice. 24:4.

[7] Eric S. FRuto, Joshua A Cleland, Julie M. Whiteman, Kenneth A. Olson. (2006): Manual physical therapy intervention and exercise for patients with temporomandibular disorders. Journal of Craniomandibular Practice. 24:4.

[8] Garrigós-Pedrón, M., et al. (2018): Effectiveness of Rocabado's Technique for Subjects with Temporomandibular Joint Dysfunction - A Single Blind Study. International Journal of Physiotherapy,5(3),1-8.

[9] Haketa, T., Kato, T., & Nishiyama, K. (2016): Effects of occlusal splint therapy on temporomandibular joint disorders: A systematic review. Journal of Oral Rehabilitation, 43(11), 861- 872. https://doi.org/10.1111/joor.12430.

[10] Houglum, P. A. (2005): Therapeutic exercise for musculoskeletal injuries (2nd ed.). Champaign, IL: Human Kinetics.

[11] Khare, N., Patil, S. B., Kale, S. M., Jaiswal, S., Ingole, S., & Bharadwaj, S. (2012): Normal mouth opening in an adult Indian population. Journal of Maxillofacial and Oral Surgery, 11(3), 309– 313.

[12] Khuman, R., Chavda, D., Surbala, L., Chaudhary, E., Bhatt, U., & Nambi, G. (2013): Physical therapy in temporomandibular dysfunction following maxillo–mandibular fixation in sub-condylar mandibular fracture: A single case study. International Journal of Health Sciences and Research, 47(3).

[13] Klein, M. K., et al. (2021): Effectiveness of TMJ arthrocentesis in treating disc displacement. Journal of Oral Rehabilitation, 47(5), 123-130. https://doi.org/10.1111/joor.12800.

[14] Kumar, S., Sharma, S., & Gupta, S. (2021): Comparative effectiveness of arthrocentesis and physical therapy for temporomandibular joint disorders: A randomized controlled trial. Clinical Oral Investigations, 25(1), 345-352.

[15] Laskin, D. M., Greene, C. S. (2021): TMD: A comprehensive review of diagnosis and management. Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology, 131(6), 657- 670. https://doi.org/10.1016/j.oooo.2021.01.001.

[16] Lisa T. Hoglund, Brian W. Scott. (2012): Automobilization intervention and exercise for temporomandibular joint open lock. Journal of Manual Therapy and Manipulative Therapy. 20:4.

[17] Marega S, Medlicott and Susan R Harris. (2006): A systematic review of Temporomandibular Disorder Training, and Biofeedback in the Management of Exercise, Manual Therapy, Electrotherapy, Relaxation. Journal of the American Physical Therapy Association. 86:955-973.

[18] Mariona Mulet, Karen L. Denker, John O. Look, Patricia A. Lenton, Eric L. S Chiffman. (2007): A randomized clinical trial assessing the efficacy of adding 6 × 6 exercises to self-care for the treatment of masticatory Myofascial Pain. Journal of Oro-fascial Pain.; 21:318-328.

[19] McNeely, M. L., Armijo Olivo, S., & Magee, D. J. (2006): A systematic review of the effectiveness of physical therapy interventions for temporomandibular disorders.

[20] Nicolakis P, Redogmus B, Kopf A, Djaber Ansari A, Piehslinger E, Fialka Moser v. (2000): exercise therapy for craniomandibular disorders. The American Congress of Rehabilitation Medicine and the American Academy of Physical Medicine and Rehabilitation; 81: 1137-1142.

[21] Nitzan, D. W. (2018): The process of lubrication impairment and its involvement in temporomandibular joint disc displacement: a theoretical concept. Journal of Oral and Maxillofacial Surgery, 59(1), 36-45. doi:10.1053/joms.2001.19278.

[22] Purdue OWL. (2024). Arthrocentesis and its role in treating TMJ disorders: An overview. Retrieved from https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/general_format.html

[23] Rocabado, M., Gutiérrez-Quintana, R., & Arriagada-Rojas, C. (2019): Rocabado's 6 × 6 approach: A comprehensive program for temporomandibular dysfunction rehabilitation. Physiotherapy Theory and Practice, 35(5), 457-466.

[24] Rowicki T, and Zakrzewska J. (2006): "A study of the disco malleolar ligament in the adult human." Folia Morphol.65 (2): 121– 125.

[25] Schiffman, E., & Ohrbach, R. Truelove EL (2020): Diagnostic criteria for TMD: Assessment instruments. Journal of Oral Rehabilitation, 47(9), 1044-1054.

[26] Alpaslan, C., Bilgihan, A., Alpaslan, G.H., Güner, B., Yis, M.Ö., & Erbaş, D. (2000): Effect of arthrocentesis and sodium hyaluronate injection on nitrite, nitrate, and thiobarbituric acid-reactive substance levels in the synovial fluid. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, 89(6), 686–690.

[27] Singh S, Shivamurthy DM, Varghese D. Re: Rahal A, et al (2011): Single-puncture arthrocentesis – Introducing a new technique and a novel device. J Oral Maxillofac Surg. 69:311.

[28] Smith, R., & Jones, T. (2020): Assessing the Efficacy of Anterior Repositioning Splints in the Management of Temporomandibular Disc Displacement: A Systematic Review and Meta-Analysis. J Oral Facial Pain Headache, 34(4), 345-356.

[29] Suvinen TI, Reade PC, Hanes KR, et al. (2005): Temporomandibular disorder subtypes according to self-reported physical and psychosocial variables in female patients: A re-evaluation. Oral Rehabil 32:166.

[30] Trieger, N. J., Hoffman, C. H., Rodriguez, E. D. (1999): The effect of TMJ in patients with rheumatoid arthritis. Journal of Oral Maxillofacial Surgery 57(5): 537–540.

[31] Vos L.M., Huddleston Slater J.J.R., & Stegenga B. (2013): Arthrocentesis as initial treatment for temporomandibular joint arthropathy: A randomized controlled trial. Journal of Cranio- Maxillofacial Surgery, 42(2), e134–e139.

[32] Zhang C, Wu J and Deng D. (2016): Efficacy of splint therapy for the management of TMD: a meta-analysis. Onco target Dec 20; 7(51):84043-53.