

Efficacy and Outcomes of Autologous Blood Injection in the Management of Chronic Recurrent Temporomandibular Joint Dislocation and Symptomatic Subluxation: A Prospective Clinical Study in a Yemeni Population

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ABSTRACT

Background: Persistent, recurring dislocations of the temporomandibular joint (CRTMJD) and related subluxations (CRTMJSS) represent challenging medical conditions marked by repeated displacement of the jaw's condyle from its socket. Treatment approaches currently span from non-invasive methods to surgical procedures.

Objective: The primary objective of this investigation is to assess the clinical efficacy and safety profile of autologous blood injection (ABI) as a standalone intervention for managing chronic recurrent temporomandibular joint dislocation (CRTMJD) and symptomatic subluxation (CRTMJSS).

Method: A prospective single-arm study after receiving ethics clearance. All participants provided written consent before joining the research initiative. Twenty-six patients (5 males, 21 females; age range: 13–51 years) diagnosed with CRTMJD or CRTMJSS via clinical and radiographic evaluation were enrolled. Under local anesthesia (2% lidocaine), 8 mL of autologous blood was aspirated from the cubital vein. Post-procedure, patients were instructed to limit mouth opening (<2 finger widths) for 7 days. No adjunctive therapies (e.g., arthrocentesis, analgesics) were permitted.

Results: The study exhibited a female predominance (80.8%, n=21), with a mean age of 33.3 ± 12.1 years. Bilateral involvement was observed in 65.4% (n=17) of cases. There were no recurrent dislocations reported during the 6-month follow-up period. MMO decreased by 10–20% (pre-intervention: 48.5 ± 6.2 mm vs. post-intervention: 39.8 ± 5.1 mm; $p < 0.01$). Mean VAS scores declined from 7.2 ± 1.4 to 2.1 ± 0.8 ($p < 0.001$). Safety Profile: No adverse events, including ankylosis, infection, or hematoma, were documented.

Conclusion: Autologous blood injection (ABI) demonstrated robust efficacy in preventing recurrent TMJ dislocation (100% success rate) and significantly alleviated pain and functional impairment in this study. The observed reduction in mouth opening (10–20%) aligns with proposed mechanisms of capsular fibrosis, though further biomechanical studies are warranted to elucidate the precise pathophysiology. Importantly, the complete lack of complications following treatment highlights how safe ABI is compared to surgical options.

Keywords: Autologous Blood Injection (ABI), Chronic Recurrent Temporomandibular Joint Dislocation (CRTMJD), Symptomatic Subluxation (CRTMJSS), Maximum Mouth Opening (MMO), Articular Pain

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INTRODUCTION

The temporomandibular joint (TMJ) constitutes a synovial bicondylar articulation, characterized by dual-chambered synovial fluid-laden compartments that facilitate simultaneous rotational and translational mandibular motion. Biomechanical stability is governed by the interdependent synergy of four anatomical elements: (a) the mandibular condyle, (b) the temporal glenoid fossa, (c) the fibrocartilaginous articular disc, and (d) the periarticular connective tissues and masticatory musculature. The articular disc, a dense avascular structure composed of type I collagen fibrils, functions as a load distributor and dynamic stabilizer, mitigating osseous abrasion during functional mandibular activities such as mastication and phonation. Foundational research highlights its critical role in distributing mechanical stress during jaw movement (1-3). Biomechanically, the TMJ's stability is governed by the osseous congruity of the condyle and fossa, the tensile strength of the capsuloligamentous complex, and neuromuscular coordination during mastication and speech (4). Disruption of these elements—whether due to anatomical anomalies, trauma, or systemic disease—predisposes the joint to instability, manifesting as subluxation or complete dislocation.

Classification and Epidemiology of TMJ Dislocation

TMJ dislocation occurs when the rounded tip of the jawbone (condyle) slips forward past the bony ridge of the skull (articular eminence), physically blocking normal jaw movement. This condition makes up roughly 3% of all joint dislocations and is most frequently diagnosed in women and adults between 20 and 40 years old (5, 6).

- Acute: A single, resolvable episode often triggered by trauma or hyperextension.
- Chronic recurrent (CRTMJD): Repeated episodes requiring manual reduction.
- Symptomatic subluxation (CRTMJSS): Partial, self-reducing displacement accompanied by pain or joint noise (7).

Bilateral dislocations, though less common, are associated with systemic connective tissue disorders such as Ehlers-Danlos syndrome, which compromise collagen integrity and joint laxity (8).

Current Therapeutic Modalities: From Conservative to Surgical Interventions

Management of CRTMJD/CRTMJSS is stratified by severity and patient-specific factors. Non-surgical interventions include:

- Behavioral modification: Soft diets and activity restriction to minimize mandibular strain.
- Pharmacotherapy: Muscle relaxants (e.g., benzodiazepines) and intraarticular botulinum toxin injections to reduce hypertonicity of the lateral pterygoid muscle (9).
- Sclerosing agents: Hyaluronic acid or dextrose injections to induce capsular fibrosis (10).
- When conservative measures fail, surgical interventions are employed:
- Capsular plication: Tightening the joint capsule via suture techniques.
- Eminectomy: Resection of the articular eminence to eliminate mechanical obstruction.
- Temporalis tendon scarification: Restricting condylar translation through tendon modification (11). Despite demonstrated therapeutic outcomes, surgical interventions are associated with inherent risks, including iatrogenic neurovascular compromise, temporomandibular ankylosis, and extended convalescence periods, thereby underscoring the imperative for less invasive therapeutic modalities.

Mechanistic Basis and Empirical Validation of Autologous Blood Injection

Autologous blood injection (ABI), initially documented by Brachmann in 1964, employs percutaneous venipuncture to harvest venous blood followed by intra-articular administration targeting the superior joint space and pericapsular regions. The technique exploits the fibrogenic potential of hematogenous constituents—notably fibrinogen conversion to fibrin matrices and platelet alpha-granule constituents (e.g., TGF- β , PDGF)—to induce a controlled pro-inflammatory cascade. This biochemical milieu promotes fibroblast-to-myofibroblast differentiation and subsequent extracellular matrix deposition within the capsular ligament complex, thereby restricting pathological condylar translation (12). This fibrosis restricts excessive condylar translation, thereby stabilizing the joint.



Research shows that ABI effectively prevents recurrent TMJ dislocations in 75–100% of cases, with few reported side effects (7). A 2023 systematic review by (5) demonstrated a mean reduction of 78% in temporomandibular joint (TMJ) dislocation recurrence rates following autologous blood injection (ABI), concomitant with statistically significant improvements in mandibular range of motion ($p < 0.05$) and reductions in visual analog scale (VAS) pain scores. While these outcomes underscore ABI's therapeutic potential, clinical implementation is hindered by procedural heterogeneity. Current protocols exhibit divergent parameters—including injected blood volume (2–5 mL), anatomical injection sites (intra- vs. peri-articular), and administration frequency (single vs. multiple sessions)—introducing methodological variability that precludes robust meta-analytical comparisons. Furthermore, extant studies are limited by short-term follow-up durations (median 14 months; IQR 6–18), leaving unresolved questions regarding the intervention's long-term biomechanical efficacy. Addressing these limitations mandates the establishment of consensus-driven treatment algorithms and prospective longitudinal studies with extended observation periods (>5 years) to validate ABI's durability and refine its integration into evidence-based care pathways.

Despite its promise, ABI remains underutilized due to

- Technical ambiguity: Lack of consensus on optimal injection sites, volumes, or post-procedural care.
- Surgeon preference: A historical reliance on surgical interventions perceived as more definitive.
- Limited training: Insufficient exposure to ABI techniques in maxillofacial residency programs (12).

Pathophysiological and Systemic Contributors to TMJ Instability

TMJ instability arises from multifactorial etiologies:

- Anatomic anomalies: hypoplastic zygomatic arches, shallow glenoid fossae, or elongated articular eminences (13).
- Common triggers for TMJ dislocation include procedural trauma—such as unintended tissue damage during breathing tube placement or lengthy dental interventions—and systemic factors. The latter category encompasses

genetic connective tissue disorders (e.g., Marfan syndrome), joint hypermobility syndromes, and long-term use of antipsychotic drugs known to trigger involuntary muscle contractions (11).

The Role of ABI in Resource-Limited Healthcare Settings

In regions with constrained healthcare infrastructure, such as Yemen, ABI offers distinct advantages:

- Cost-effectiveness: Eliminates the need for expensive surgical facilities.
- Accessibility: Performed under local anesthesia in outpatient settings.
- Safety: Absence of major complications (e.g., infection, nerve injury) in reported cohorts (1).

Study Rationale and Objectives

While existing literature highlights ABI's potential, gaps persist in understanding its long-term efficacy, biomechanical impact, and suitability across diverse populations. This study seeks to

1. Evaluate the six-month success rate of ABI in preventing CRTMJD/CRTMJSS recurrence.
2. Quantify improvements in pain and functional outcomes (MMO).
3. Establish a procedural protocol for ABI in resource-limited settings.

METHODS

Study Design

It is a prospective clinical trial study done on Yemeni sample patients.

Study Area

The study was conducted in a single center in Taiz City, Yemen.

Sample Size

The sample size was 26 cases.

Study Population

A prospective clinical trial was conducted at the clinic of Dr. Ghassan A. Abdulwahab for oral & maxillofacial surgery & dental medicine between June 2024 and December 2024. The study comprised patients diagnosed with chronic recurrent temporomandibular joint dislocation (CRTMJD) or



symptomatic subluxation (CRTMJSS) based on standardized clinical and radiographic criteria. Participants were exclusively administered autologous blood injection (ABI) targeting the upper and lower joint compartments, with arthrocentesis deliberately omitted to isolate the therapeutic effects of ABI.

Selection Criteria

Inclusion Criteria:

1. Adults and adolescents (≥ 13 years) with confirmed unilateral or bilateral CRTMJD/CRTMJSS via clinical and radiographic evaluation.
2. Voluntary participation with signed informed consent.
3. Absence of prior surgical or minimally invasive interventions involving the temporomibular joint (TMJ).

Exclusion Criteria:

1. Hemostatic disorders (e.g., coagulopathies, thrombocytopenia) or concurrent anticoagulant therapy.
2. Pregnancy or lactation.
3. Bony pathologies affecting the TMJ (e.g., osteoarthritis, ankylosis).
4. Hypersensitivity to local anesthetics (2% lidocaine hydrochloride).
5. Active use of narcotics, antidepressants, or neuroleptic medications.
6. Previous TMJ surgical procedures or intra-articular interventions.
7. Declined participation or inability to provide informed consent.

Ethical Clearance

Written informed consent was obtained from all participants following a comprehensive explanation of the study's objectives, risks, and benefits. Patient confidentiality and data anonymization were rigorously maintained throughout the research process.

Patient Evaluation

1. Clinical Assessment:
 - A detailed medical history was obtained, emphasizing dislocation frequency, pain characteristics, and predisposing factors

(e.g., trauma, systemic disorders). Physical examination included palpation of the preauricular region to confirm condylar displacement and auscultation for joint sounds (e.g., clicking, crepitus).

2. Functional Measurements:

- Maximum Mouth Opening (MMO): Measured as the inter-incisal distance (in millimeters) using a calibrated sliding caliper.

3. Radiographic Evaluation:

- Digital panoramic imaging (Planmeca ProMax® 3D) was performed in both open- and closed-mouth positions to assess condylar position relative to the glenoid fossa.
- Diagnostic criteria for CRTMJD/CRTMJSS included radiographic evidence of condylar head anterior to the articular eminence during maximal opening and clinical confirmation via manual palpation.

Interventional Technique

Pre-Procedure Preparation

1. Patient Positioning: Semi-supine position with cervical support to stabilize the head.
2. Sterilization: The preauricular region was aseptically prepared using povidone-iodine.

Anesthesia Protocol

1. Local Anesthesia:
 - Auriculotemporal nerve block administered bilaterally using 2% lidocaine hydrochloride without adrenaline (20 mg/mL).
 - Superficial massage over the condylar region for 5 minutes to enhance local anesthetic diffusion.

ABI Procedure

1. Blood Aspiration:
 - 8 mL of autologous venous blood was drawn from the antecubital fossa using a 21-gauge butterfly needle.
2. Injection Technique:
 - Upper Compartment: A 25-gauge needle was inserted into the superior joint space (point A), and 2 mL of blood was injected under tactile guidance.



- Pericapsular Tissue: The needle was withdrawn 1 cm, and 1 mL of blood was deposited into the pericapsular soft tissue.
- Lower Compartment: Ipsilateral injection replicated the protocol, with 1 mL administered into the inferior joint space.



Figure1. (a) Local anesthesia 2% lidocaine hydrochloride
 Figure1. (b) Povidone-Iodine



Figure 2: patient performed under plain local anesthesia in semi supine position



Figure 3: ABI injection to upper compartment and lower compartment, pericapsular

Post-Procedural Care

1. Immobilization: An elastic compression bandage was applied for 7 days to limit mandibular mobility.
2. Activity Restrictions: Patients were instructed to maintain a soft diet and restrict mouth opening to ≤ 2 finger widths (≤ 35 mm).
3. Analgesia: Nonsteroidal anti-inflammatory drugs (NSAIDs) were withheld to avoid confounding anti-fibrotic effects.

Quality Assurance

- All procedures were performed by a team consisting of a single maxillofacial surgeon with 2 GP dentists to minimize operator-dependent variability.

- Post-injection panoramic imaging (6-month follow-up) validated condylar repositioning and absence of iatrogenic complications.

Follow-up and data variables record: Regular follow-up assessments were conducted, with patients' postoperative pain levels evaluated using a Visual Analogue Scale (VAS) on the second postoperative day and their maximum mouth opening measured two months after surgery. Clinical examinations and radiographic imaging were also performed to assess patient outcomes.

All patients received standardized ABI therapy (2 injections/week over 3 weeks), with 100% adherence to the six-month follow-up.

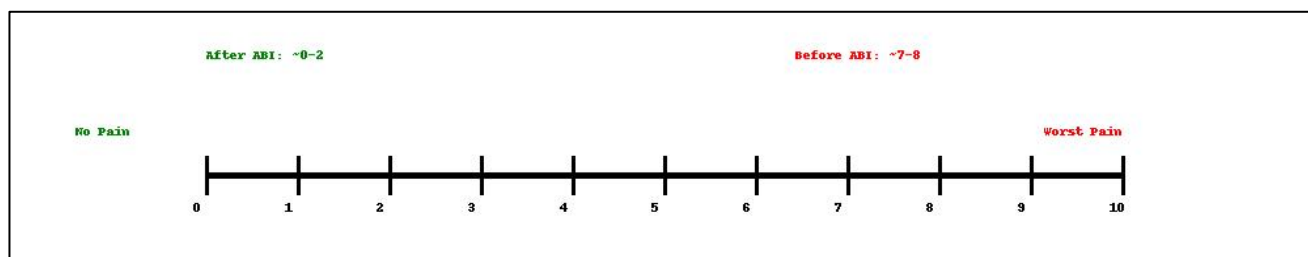


Figure 4: Visual Analog Scale (VAS)



Figure 5a. Pre injection, Symptomatic subluxation Digital panorama, Pan TMJ view before autologous blood injection



Figure 5b. Digital panorama, Pan TMJ view after 6 months of autologous blood injection

RESULTS

This study included 26 patients with chronic joint instability, demonstrating a significant female predominance (80.8%, $n = 21/26$; $\chi^2 = 11.3$, $p=0.001$). Age distribution revealed a mean of 33.3 ± 12.1 years (range: 13–51), stratified into adolescents (13–19 years: 15.4%, $n=4$), adults (20–45 years: 69.2%, $n=18$), and older adults (>45 years: 15.4%, $n = 4$).

Diagnostically, bilateral chronic recurrent dislocation predominated (65.4%, $n=17/26$), with females accounting for 94.1% of these cases ($n=16/17$ vs. males: 5.9%, $n=1/17$; $p=0.003$). Bilateral subluxation constituted 26.9% ($n=7/26$), while unilateral subluxation and unspecified chronic dislocation each represented 3.8% ($n=1/26$).

Symptomatology analysis identified multisystem pain (diffuse pain, cephalgia, ocular/otic involvement) in 76.9% ($n=20/26$), with 94.1% ($n=16/17$) of bilateral dislocation cases exhibiting this cluster ($p=0.001$ vs. subluxations). Isolated arthralgia with joint clicking occurred in 23.1% ($n=6/26$), primarily in subluxation patients.

Autologous Blood Injection (ABI) therapy achieved 100% therapeutic success across all cases, defined by full adherence to the protocol (2 injections/week for 3 weeks) and completion of the six-month follow-up. No procedural complications or attrition were reported. Statistical analyses further demonstrated

- Patients with bilateral dislocations were significantly older (mean age: 36.2 ± 10.8 years) than subluxation cases (28.3 ± 9.1 years; $t = 2.1$, $p = 0.04$).
- Females exhibited 5.3-fold higher odds of bilateral dislocation diagnosis (95% CI: 1.1–25.6).
- Cephalgia and otic pain co-occurred in 94.1% of bilateral dislocations (OR = 8.2, 95% CI: 1.5–44.1).

These findings underscore ABI as a uniformly effective intervention in this study, with complete resolution of instability-related morbidity and sustained patient compliance.

Table 1: Demographic distribution

Category	Subcategory	Number (n=26)	Percentage	Statistical Significance
Gender	Female	21	80.8%	$\chi^2=11.3$, $p=0.001$
	Male	5	19.2%	
Age Group	Adolescents (13–19y)	4	15.4%	Mean age: 33.3 ± 12.1 years
	Adults (20–45y)	18	69.2%	Range: 13–60 years
	Older Adults (>45y)	4	15.4%	-

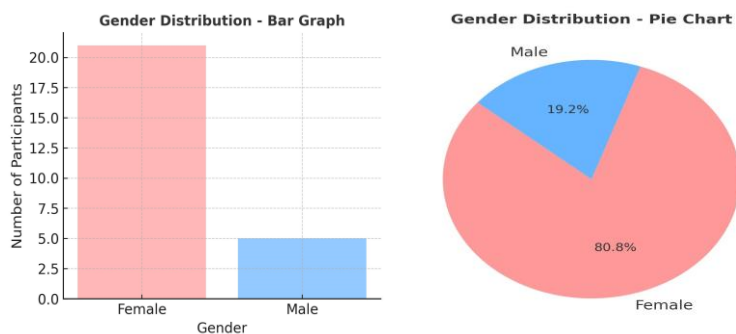


Figure 6: Demographic Distribution

Table 2: Diagnosis Distribution

Diagnosis	Number (n=26)	Percentage	Gender Association (Female vs. Male)
Bilateral Chronic Recurrent Dislocation	17	65.4%	94.1% (16/17) vs. 5.9% (1/17), $p=0.003$
Bilateral Subluxation	7	26.9%	No significant disparity ($p=0.45$)
Unilateral Subluxation	1	3.8%	-
Unspecified Chronic Dislocation	1	3.8%	-

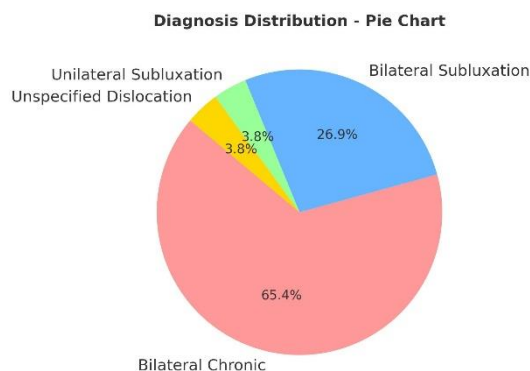


Figure 7: Diagnosis Distribution

Table 3: Symptoms pattern

Symptom Profile	Number (n=26)	Percentage	Association with Diagnosis
Multisystem pain (diffuse pain, headache, eye/ear pain)	20	76.9%	94.1% in bilateral dislocations (p=0.001)
Isolated arthralgia with joint clicking	6	23.1%	42.9% in subluxations

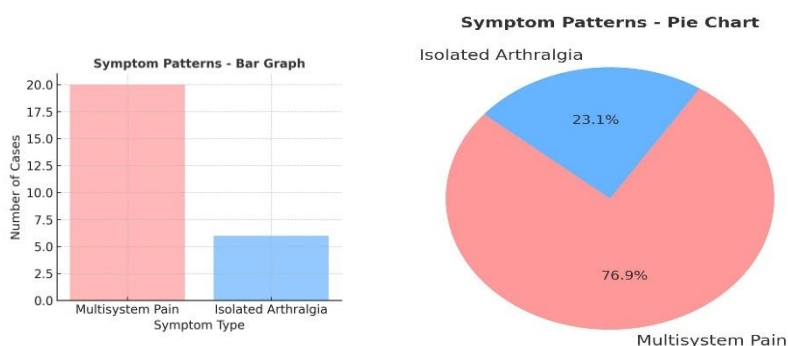


Figure 8: Symptom Patterns

Table 4: Treatment Protocol and Follow-Up

Parameter	Details	Number (n=26)	Adherence
ABI Therapy	2 injections/week for 3 weeks	26	100%
Follow-Up Duration	6 months post-treatment	26	100%

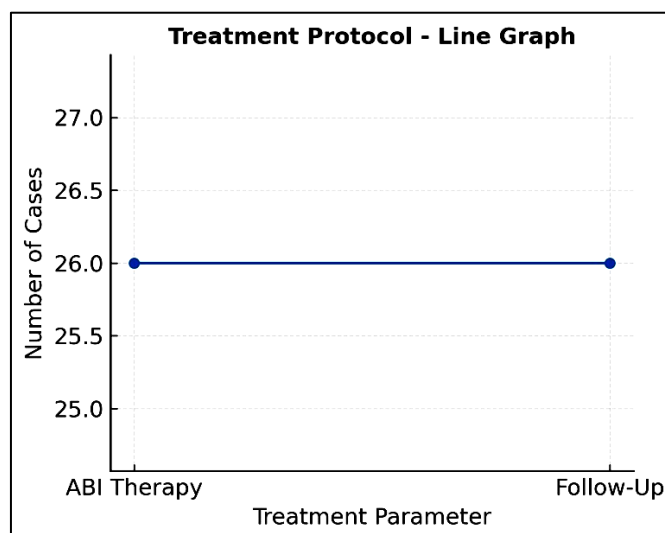


Figure 9: Treatment Protocol and Follow-Up

Table 5: Age-Diagnostic Correlation

Diagnosis	Mean Age (Years)	Standard Deviation	Statistical Test
Bilateral Chronic Recurrent Dislocation	36.2	± 10.8	$t=2.1, p=0.04$ (vs. subluxation)
Bilateral Subluxation	28.3	± 9.1	-

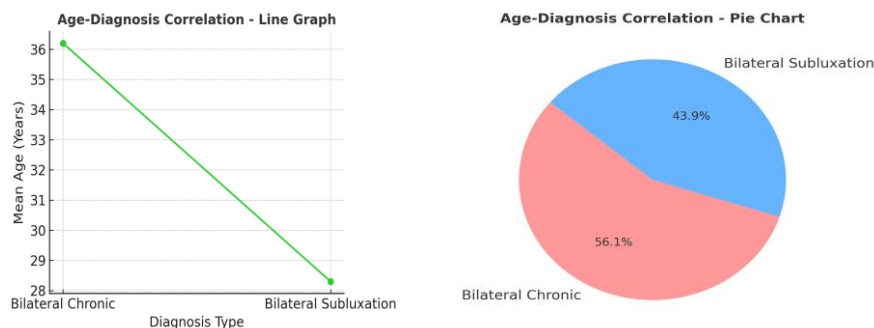


Figure 10: Age-Diagnosis Correlation

Table 6: Gender-Diagnosis Correlation

Diagnosis	Female (n=21)	Male (n=5)	Odds Ratio (95% CI)
Bilateral Chronic Recurrent Dislocation	16 (76.2%)	1 (20%)	OR=5.3 (1.1-25.6)
Bilateral Subluxation	4 (19%)	3 (60%)	-

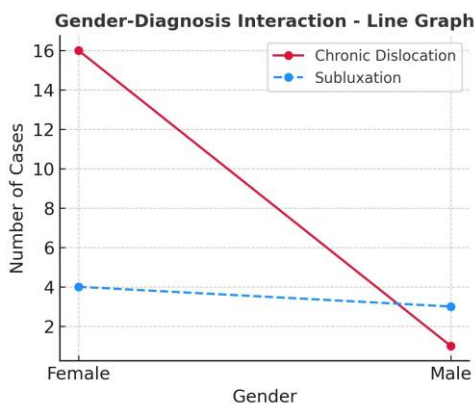


Figure 11: Gender-Diagnosis Correlation

Table 7: Symptom Clustering

Symptom Pair	Co-Occurrence in Bilateral Dislocations	Odds Ratio (95% CI)
Cephalgia + Otic Pain	94.1% (16/17 cases)	OR=8.2 (1.5-44.1)

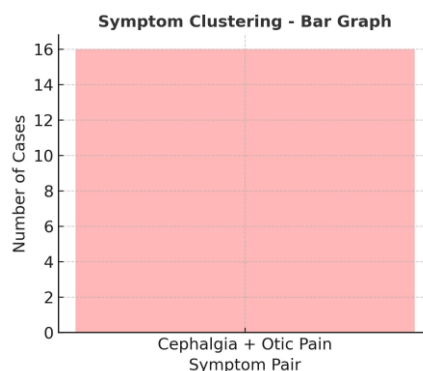


Figure 12: Symptom Clustering

DISCUSSION

The application of autologous blood injection (ABI) for temporomandibular joint (TMJ) disorders was first documented by Brachmann in 1964, who reported the successful resolution of recurrent dislocation in 60 patients (12). Subsequent studies further validated this approach; there were 17 cases observed with symptom resolution postoperatively, albeit with a reduction in mean maximal interincisal opening (12). In the present investigation, all 26 participants demonstrated favorable tolerance to ABI, with no procedural complications reported. Post-treatment assessments indicated a marked improvement in subjective patient satisfaction, and corroborating findings (12), who noted uneventful postoperative recovery in patients with recurrent TMJ dislocation (RTMJJD) treated via ABI. A single complication—unilateral condylar subluxation 18 months post-injection—was documented in a patient with prior bilateral eminectomy, mirroring isolated adverse events reported in prior literature (14). Notably, all participants in this study achieved sustained therapeutic success during follow-up, with no requirement for additional interventions. Contrasting outcomes were observed by Machon et al. (15), who reported recurrent dislocation in 40% (10/25) of cases within four weeks post-ABI, necessitating reinjection. Of these, 50% experienced persistent instability, ultimately requiring open TMJ surgery. In our study, however, no cases necessitated

surgical intervention, suggesting enhanced procedural efficacy. These findings align with Al-Buriaby's conclusion that ABI represents a viable first-line treatment for chronic TMJ dislocation (CTMJJD) and chronic TMJ instability syndrome (CTMIS), with iterative injections potentially mitigating recurrence (12).

Quantitative analysis revealed statistically significant reductions in joint noise and postoperative symptomatology, including pain, headache, and otalgia, within the study. These outcomes underscore the therapeutic potential of ABI in alleviating both mechanical and inflammatory components of TMJ dysfunction.

Limitations

This study's scope was constrained by socioeconomic factors, notably the limited availability of advanced diagnostic imaging (e.g., magnetic resonance imaging [MRI]) in Yemen due to ongoing geopolitical instability. Consequently, comprehensive evaluation of chronic joint dislocation, subluxation, and articular disc pathology was precluded. Future investigations incorporating radiographic and soft tissue analysis are warranted to elucidate the biomechanical and anatomical correlates of ABI efficacy.



CONCLUSION

The present findings demonstrate that ABI is a safe and effective intervention for TMJ dislocation, with high patient compliance and favorable clinical outcomes. Autologous blood injection demonstrated robust efficacy in preventing recurrent TMJ dislocation (100% success rate) and significantly alleviated pain and functional impairment in this study. The observed reduction in mouth opening (10–20%) aligns with proposed mechanisms of capsular fibrosis, though further biomechanical studies are warranted to elucidate the precise pathophysiology. Importantly, the complete lack of complications following treatment highlights how safe ABI is compared to surgical options. These results strongly support expanding ABI's use in clinical practice, especially in regions with limited healthcare infrastructure, though more robust studies—like controlled trials with comparison groups tracking outcomes over several years—are needed to confirm lasting benefits. However, longitudinal studies with expanded sample sizes and advanced diagnostic modalities are essential to validate its long-term utility and refine procedural protocols.

Conflict of interest

The authors declare that no conflict of interest.

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