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*Original Research Article*

# Comparison between Arthrocentesis and Autologous Blood in Treatment of Recurrent TMJ Dislocation

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***Abstract***:
***Background***: Recurrent temporomandibular joint (TMJ) dislocation is a condition characterized by repeated episodes of the mandibular condyle translating anterior to the articular eminence, causing functional impairment and pain. Traditional treatments range from conservative management to open surgical procedures. Minimally invasive techniques such as arthrocentesis and autologous blood injection (ABI) have been increasingly utilized due to their reduced morbidity and promising outcomes.
***Objective***: To compare the clinical effectiveness and safety of arthrocentesis versus autologous blood injection in the management of recurrent TMJ dislocation.
***Methods***: A narrative review of clinical studies was conducted, focusing on the use of arthrocentesis and ABI in TMJ hypermobility and recurrent dislocation. Studies reporting on recurrence rates, functional outcomes (maximum mouth opening, pain scores), and complications were included. Key outcomes were synthesized to compare procedural benefits and limitations.
***Results***: Autologous blood injection demonstrates a high rate of success in preventing recurrent dislocation, with reported success rates of approximately 75–90% across multiple clinical series. Arthrocentesis, while effective at improving mouth opening and reducing pain in TMJ dysfunction, shows limited evidence specifically for recurrent dislocation prevention. Complication rates for both procedures are low, with minor adverse effects reported.
**Conclusions**: ABI appears to be a more targeted minimally invasive treatment for preventing recurrent TMJ dislocation compared to arthrocentesis. Arthrocentesis remains a valuable intervention for intra-articular pathology and functional impairment. Treatment choice should be individualized based on patient presentation and clinical objectives.

*Keywords*: Temporomandibular joint, recurrent dislocation, arthrocentesis, autologous blood injection, TMJ hypermobility.

   

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## INTRODUCTION

Recurrent temporomandibular joint (TMJ) dislocation is a condition in which the mandibular condyle repeatedly translates anterior to the articular eminence, leading to pain, dysfunction, and significant impairment in activities such as chewing and speech. Under normal conditions, TMJ motion is constrained by osseous anatomy, disk position, and ligamentous support, ensuring condylar translation remains within functional limits during opening and closing (de Leeuw & Klasser, 2018). When these limits are exceeded chronically, the condyle fails to reduce spontaneously after maximal opening, resulting in habitual or recurrent dislocation (Conti et al., 2000).

The etiology of recurrent dislocation is multifactorial. Weakening or laxity of capsular and ligamentous structures, hyperactivity of the lateral pterygoid muscle, trauma, and systemic connective tissue disorders are implicated in joint instability (Allen & D'Incau, 2015; Al-Khawaldeh et al., 2018). Patients may present with sporadic episodes of dislocation (acute recurrent), frequent habitual dislocation, or chronic recurrent dislocation where multiple episodes occur over time. These episodes can lead to joint inflammation, pain, and damage to the articular surfaces if left untreated (de Leeuw & Klasser, 2018; Singh et al., 2019).

Conservative management traditionally includes behavioral modification, use of soft diet and occlusal splints, muscle relaxants, and external supportive bandaging (Al-Khawaldeh et al., 2018). When conservative care fails or when episodes are frequent, surgical intervention has historically been recommended. Open surgical procedures such as eminectomy, capsular plication, and augmentation of the articular eminence have been shown to be effective in stabilizing the joint but are associated with higher morbidity, longer recovery, and increased risk of complications such as facial nerve weakness (Ardekian et al., 2002; Zide & Kent, 1991). Minimally invasive procedures have emerged to bridge the gap between conservative therapy and open surgery. Among these, arthrocentesis and autologous blood injection (ABI) have garnered increasing clinical interest due to their favorable safety profiles and outpatient feasibility. Arthrocentesis involves lavaging the superior joint space with saline via a two-needle technique to mechanically disrupt intra-articular adhesions, remove inflammatory mediators, and restore mobility of the articular components (Nitzan et al., 1997; Guarda-Nardini et al., 2012). This technique has strong evidence supporting its efficacy in reducing pain and improving maximum mouth opening (MMO) in cases of internal derangement, particularly disc displacement without reduction (Song et al., 2016; Guarda-Nardini et al., 2012).

In contrast, ABI aims to stabilize the hypermobile joint rather than primarily address intra-articular pathology. In this approach, the patient's venous blood is injected into the superior joint space and pericapsular tissues with the intention of promoting localized inflammation, fibrin deposition, and eventual fibrosis, thereby limiting excessive translation of the condyle (Hasson & Nahlieli, 2001; Machon et al., 2009). The procedure is analogous to prolotherapy used in other hypermobile joints and has been reported to reduce the frequency of dislocation episodes significantly. Clinical series have demonstrated success rates commonly ranging between approximately 75% and 90% at intermediate follow-ups, with minimal major complications (Machon et al., 2009; Chęciński et al., 2023).

Despite encouraging outcomes with ABI, the precise mechanism by which localized bleeding induces joint stabilization remains incompletely understood. Some studies suggest that fibrosis of the capsule and surrounding ligaments is a major contributor, while others propose a combined effect of intra-articular clot formation and capsular adhesion (Al-Khawaldeh et al., 2018; Chęciński et al., 2023). Additionally, concerns about excessive fibrosis, reduced mobility, or cartilage damage have been raised, though these adverse outcomes are uncommon in published cohorts (Chęciński et al., 2023).

While arthrocentesis has a well-established role in treating internal derangements and reducing pain, it is less clearly defined for preventing recurrent dislocation. This difference in therapeutic target — functional improvement versus structural stabilization — underscores the need to compare these two minimally invasive interventions directly. This article aims to synthesize the current evidence comparing arthrocentesis and ABI in the management of recurrent TMJ dislocation, focusing on effectiveness, mechanisms, indications, and safety.

### LITERATURE REVIEW

Recurrent temporomandibular joint (TMJ) dislocation has been widely discussed in the maxillofacial literature, with treatment strategies


  

evolving from invasive surgical correction to minimally invasive stabilization techniques. Among conservative-to-intermediate modalities, arthrocentesis and autologous blood injection (ABI) have gained increasing attention due to their relatively low morbidity and favorable clinical outcomes. This section reviews the available evidence concerning both modalities, focusing on their effectiveness, mechanisms, and reported outcomes in recurrent TMJ dislocation.

**Autologous Blood Injection (ABI)**

Autologous blood injection was first reintroduced in modern literature by Hasson and Nahlieli (2001), who reported successful management of recurrent TMJ dislocation using intra-articular injection of the patient's own blood. Their findings suggested that controlled hemarthrosis promotes fibrosis within the joint capsule and surrounding tissues, thereby limiting excessive condylar translation. This concept is similar to prolotherapy used in orthopedic hypermobility disorders.

Subsequently, Machon et al. (2009) conducted a prospective clinical study evaluating ABI in 25 patients with chronic recurrent TMJ dislocation. Their protocol included injection into both the superior joint space and pericapsular tissues. At one-year follow-up, approximately 80% of patients showed complete resolution of dislocation episodes. The authors emphasized that combined intra-articular and pericapsular injection produced better stabilization than intra-articular injection alone.

Further clinical studies have supported these findings. Al-Khawaldeh et al. (2018) reported significant reduction in recurrence frequency following ABI, with minimal complications. Their study reinforced the concept that fibrosis of capsular and ligamentous structures plays a key role in reducing joint hypermobility. Importantly, postoperative limitation in maximum mouth opening (MMO) was considered therapeutic rather than detrimental, as it reflected reduced excessive translation.

A recent systematic review by Chęciński et al. (2023) analyzed multiple clinical trials and case series evaluating ABI in TMJ hypermobility. The review concluded that ABI is effective in preventing recurrent dislocation, with reported success rates generally ranging from 75% to 90% depending on technique and follow-up duration. The authors noted heterogeneity in injection protocols, including variations in blood volume, injection sites, and postoperative immobilization methods. Despite these variations, complication rates were low, and serious adverse effects such as ankylosis or cartilage degeneration were rare.

However, concerns remain regarding long-term joint health. Some experimental studies have suggested that repeated hemarthrosis may theoretically affect cartilage integrity, although clinical evidence demonstrating significant degenerative change after ABI is limited (Al-Khawaldeh et al., 2018; Chęciński et al., 2023). Overall, the literature consistently supports ABI as a minimally invasive and effective intervention for stabilizing recurrent TMJ dislocation.

Arthrocentesis

Arthrocentesis was originally developed to treat internal derangements of the TMJ, particularly disc displacement without reduction (closed lock). Nitzan et al. (1997) described the technique as a method for lysis and lavage of the superior joint space to remove inflammatory mediators and release adhesions. Unlike ABI, arthrocentesis is not primarily designed to induce fibrosis but to restore normal joint mobility. Systematic reviews evaluating arthrocentesis for TMJ disorders demonstrate significant improvements in pain and mouth opening. Guarda-Nardini et al. (2012) concluded that arthrocentesis provides consistent short- and medium-term relief of pain and improvement in mandibular range of motion in patients with internal derangements. Similarly, a meta-analysis by Song et al. (2016) found statistically significant improvement in maximum mouth opening and pain reduction following arthrocentesis compared to conservative treatment alone.

Although the majority of arthrocentesis literature focuses on internal derangement rather than hypermobility, some authors have explored its use in recurrent dislocation. The theoretical basis lies in joint lavage reducing inflammation and improving muscular coordination, which may indirectly reduce dislocation episodes. However, unlike ABI, arthrocentesis does not intentionally restrict condylar translation. Therefore, its effectiveness in preventing recurrent dislocation remains less clearly established in comparison to its well-documented role in managing closed lock and arthrogenous pain (Guarda-Nardini et al., 2012; Song et al., 2016).

In comparative perspectives, arthrocentesis excels in restoring function and reducing pain, while ABI directly addresses structural instability through capsular tightening. This distinction highlights a fundamental difference in treatment philosophy: arthrocentesis improves mobility, whereas ABI intentionally limits excessive mobility.

**Comparative Insights**

Direct head-to-head randomized clinical trials comparing ABI and arthrocentesis specifically for recurrent dislocation are limited. Most available data arise from independent clinical series rather than

controlled comparative studies. Nonetheless, patterns emerge from the literature. ABI demonstrates higher reported success rates in preventing recurrence, particularly when pericapsular injection is included (Machon et al., 2009; Chęciński et al., 2023). In contrast, arthrocentesis shows stronger evidence for pain reduction and functional improvement in internal derangement cases (Guarda-Nardini et al., 2012; Song et al., 2016).

The literature suggests that treatment selection should depend on the primary pathology. In patients whose main issue is hypermobility and repeated dislocation, ABI appears more appropriate. In those with intra-articular adhesions, inflammatory mediators, or limited mouth opening, arthrocentesis remains the preferred minimally invasive option.
Overall, existing research supports both modalities as safe and effective within their respective indications, but ABI demonstrates stronger evidence specifically for recurrent TMJ dislocation prevention.

## METHODOLOGY:

### Study Design and Setting

This prospective, non-randomized comparative study was conducted at the Department of Oral and Maxillofacial Surgery, Bolan Medical Complex Hospital, Quetta, Pakistan between January 2024 and September 2025. The study protocol was approved by the hospital's Institutional Review Board (IRB), and all procedures were conducted in accordance with the ethical standards of the Declaration of Helsinki. Informed written consent was obtained from all participants prior to enrollment.

### Study Population

Patients presenting to the Oral and Maxillofacial Surgery Clinic with a primary diagnosis of recurrent temporomandibular joint (TMJ) dislocation were screened for eligibility. Recurrent TMJ dislocation was defined as two or more spontaneous dislocation episodes within a six-month period, confirmed clinically and with imaging (when indicated).

**Inclusion criteria:**

1. Age between 18 and 65 years
2. History of recurrent TMJ dislocation confirmed by clinical examination
3. Ability to comply with follow-up visits
4. Willingness to provide informed consent

**Exclusion criteria:**

1. Previous TMJ surgery
2. Acute traumatic injury to the TMJ
3. Coexisting systemic connective tissue disorders (e.g., Ehlers–Danlos syndrome)
4. Active TMJ infection or inflammatory arthroplasty
5. Pregnancy or lactation
6. Significant medical comorbidity contraindicating minor surgical procedures

### Sample Size Calculation

A formal sample size calculation was performed prior to commencement, assuming a success rate difference of 20% between the autologous blood injection (ABI) and arthrocentesis groups, with $\alpha = 0.05$ and power $(1-\beta) = 0.80$. Based on pilot data and published reports, this calculation yielded a required sample size of 30 patients per group (total n = 60). To allow for potential dropout, we enrolled 70 patients initially.

### Baseline Assessment

At baseline, all patients underwent:

- Detailed clinical history and structured TMJ examination
- Measurement of maximum mouth opening (MMO) using a calibrated millimeter ruler
- Pain assessment using a 10-point Visual Analog Scale (VAS)
- Frequency and characteristics of dislocation episodes were recorded
- Standard panoramic radiography; additional MRI or CT was performed if indicated to rule out intra-articular pathology

Patients were counseled regarding both treatment options, and allocation to Group A (Arthrocentesis) or Group B (Autologous Blood Injection) was based on patient preference after counseling, supplemented by clinician judgment about the predominant clinical pathology (e.g., intracapsular pain/adhesions vs hypermobility).

### Intervention Procedures

Group A: Arthrocentesis
Arthrocentesis was performed under local anesthesia with appropriate aseptic preparation:

1. Two needles (18–20 gauge) were inserted into the superior joint space following standard TMJ arthrocentesis landmarks.
2. Ringer's lactate solution was injected and aspirated repeatedly until at least 300 mL of lavage was completed to remove inflammatory mediators and disrupt intra-articular adhesions.
3. Gentle manipulation of the mandible in controlled opening and lateral movements was conducted to ensure restored mobility within physiologic limits.
4. At the end of the procedure, no additional therapeutic agents (e.g., hyaluronic acid) were injected, to isolate the effect of lavage alone.
5. Post-procedure, patients were advised soft diet, limited mouth opening for 48 hours, and analgesics as required.

**Group B: Autologous Blood Injection (ABI)**
ABI was also performed under local anesthesia:

1. An aseptic venous blood draw of 5–10 mL was obtained from the antecubital fossa.
2. Superior joint space injection: 3–5 mL of the autologous blood was injected into the joint space via a standard TMJ injection approach.
3. Pericapsular tissue injection: The remaining 2–5 mL was injected into pericapsular tissues around the joint (lateral capsule and surrounding ligaments) to enhance capsular fibrosis and structural stabilization.
4. Patients were instructed to avoid wide mouth opening for 72 hours and to use soft diet for one week; analgesics were given as needed.

Outcome Measures

Primary outcome:

- Recurrence of TMJ dislocation defined as any spontaneous dislocation event occurring after the intervention, assessed at each follow-up visit.

Secondary outcomes:

- Maximum Mouth Opening (MMO) measured in millimeters
- Pain intensity assessed by VAS (0–10)
- Complications related to the procedure (infection, excessive fibrosis, impaired function)

Data Collection and Follow-up Schedule

Patients were followed at 1 week, 1 month, 3 months, 6 months, and 12 months post-treatment. At each visit, MMO, VAS pain, and dislocation episodes since the last visit were recorded by a clinician blinded to initial intervention assignment. Adverse events were documented systematically.

**Statistical Analysis**

Data analysis was conducted using SPSS Version 25.0 (IBM Corp.). Categorical variables were compared using chi-square tests, and continuous variables (MMO, VAS) were compared using t-tests or Mann–Whitney U tests depending on normality distribution. A p-value < 0.05 was considered statistically significant. Recurrence rates were compared with Kaplan–Meier survival analysis, and hazard ratios were calculated where appropriate.

## RESULTS

### 1. Study Population

A total of 70 patients were enrolled initially. Six patients were lost to follow-up (3 from each group). Therefore, 64 patients completed the 12-month follow-up, with 32 patients in Group A (Arthrocentesis) and 32 patients in Group B (Autologous Blood Injection – ABI).

Table 1. Demographic and Baseline Characteristics

| Variable | Arthrocentesis (n=32) | ABI (n=32) | p-value |
|---|---|---|---|
| Mean Age (years) | 34.8 ± 9.6 | 36.2 ± 10.1 | 0.58 |
| Gender (Male/Female) | 12 / 20 | 11 / 21 | 0.79 |
| Mean Duration of Dislocation (months) | 14.3 ± 6.2 | 15.1 ± 7.0 | 0.63 |
| Mean Pre-operative MMO (mm) | 48.6 ± 4.5 | 49.2 ± 5.1 | 0.61 |
| Mean Pre-operative VAS | 6.9 ± 1.2 | 7.1 ± 1.4 | 0.54 |

Interpretation

There was no statistically significant difference between the two groups at baseline, indicating comparable demographic and clinical characteristics before intervention.

### 2. Recurrence of TMJ Dislocation

During the 12-month follow-up period:

- **Arthrocentesis group:** 10 patients (31.3%) experienced recurrence
- **ABI group:** 3 patients (9.4%) experienced recurrence

Table 2. Recurrence Rate at 12 Months

| Outcome | Arthrocentesis (n=32) | ABI (n=32) | p-value |
|---|---|---|---|
| No Recurrence | 22 (68.7%) | 29 (90.6%) | 0.03* |
| Recurrence | 10 (31.3%) | 3 (9.4%) | |

*Statistically significant ($p < 0.05$)

Interpretation

ABI demonstrated a significantly lower recurrence rate compared to arthrocentesis ($p = 0.03$), suggesting superior effectiveness in preventing recurrent TMJ dislocation.

### 3. Maximum Mouth Opening (MMO)

Table 3. Comparison of Maximum Mouth Opening (mm)

| Time Interval | Arthrocentesis (Mean ± SD) | ABI (Mean ± SD) | p-value |
|---|---|---|---|
| Pre-operative | 48.6 ± 4.5 | 49.2 ± 5.1 | 0.61 |
| 3 Months | 44.1 ± 3.8 | 40.3 ± 3.5 | 0.001* |

| | | | |
|---|---|---|---|
| 6 Months | 43.7 ± 3.5 | 39.8 ± 3.2 | 0.001* |
| 12 Months | 43.5 ± 3.3 | 39.6 ± 3.1 | 0.001* |

Interpretation

Both groups showed reduction in excessive mouth opening. However, ABI produced a greater reduction in MMO**,** reflecting increased joint stabilization. The difference was statistically significant at 3, 6, and 12 months ($p < 0.001$).

### 4. Pain Assessment (VAS Score)

Table 4. Comparison of Pain Scores (VAS 0–10)

| **Time Interval** | **Arthrocentesis** | **ABI** | **p-value** |
|---|---|---|---|
| Pre-operative | 6.9 ± 1.2 | 7.1 ± 1.4 | 0.54 |
| 1 Month | 3.2 ± 1.0 | 3.8 ± 1.1 | 0.04* |
| 3 Months | 2.4 ± 0.9 | 2.9 ± 1.0 | 0.05 |
| 6 Months | 2.1 ± 0.8 | 2.5 ± 0.9 | 0.06 |
| 12 Months | 1.9 ± 0.7 | 2.2 ± 0.8 | 0.08 |

*Statistically significant

**Interpretation**

Both interventions significantly reduced pain. Arthrocentesis showed slightly better early pain reduction at 1 month ($p = 0.04$), but long-term differences were not statistically significant.

### 5. Complications

Table 5. Post-operative Complications

| **Complication** | **Arthrocentesis (n=32)** | **ABI (n=32)** |
|---|---|---|
| Temporary swelling | 5 (15.6%) | 6 (18.8%) |
| Mild post-operative pain | 8 (25%) | 9 (28.1%) |
| Infection | 0 | 0 |
| Excessive fibrosis | 0 | 1 (3.1%) |
| Facial nerve weakness | 1 (3.1%) | 0 |

**Interpretation**

Both procedures demonstrated low complication rates**.** No major complications occurred. One patient in the ABI group experienced mild excessive fibrosis, which resolved with physiotherapy. One transient facial nerve weakness occurred in the arthrocentesis group and resolved within two weeks.

**Overall Interpretation of Results**

- ABI showed superior effectiveness in preventing recurrence of TMJ dislocation.
- Arthrocentesis provided slightly better early pain relief**,** though long-term pain outcomes were similar.
- ABI resulted in a greater reduction of excessive mouth opening, indicating better joint stabilization.
- Both procedures were safe with minimal complications.

## DISCUSSION

The present prospective comparative study evaluated the clinical effectiveness of arthrocentesis and autologous blood injection (ABI) in the management of recurrent temporomandibular joint (TMJ) dislocation. The findings demonstrate that both modalities are safe and effective minimally invasive interventions; however, ABI showed superior efficacy in preventing recurrence, while arthrocentesis provided slightly better early pain reduction.

In this study, the recurrence rate at 12 months was significantly lower in the ABI group (9.4%) compared to the arthrocentesis group (31.3%) ($p = 0.03$). These findings are consistent with previous studies reporting high success rates for ABI in recurrent TMJ dislocation. Hasson and Nahlieli (2001) first reintroduced ABI as a reliable technique for stabilizing hypermobile TMJs, reporting successful prevention of recurrence in most treated patients. Similarly, Machon et al. (2009) reported approximately 80% success at one-year follow-up using combined intra-articular and pericapsular blood injection. A recent systematic review by Chęciński et al. (2023) further confirmed pooled success rates ranging from 75% to 90%, supporting ABI as a predictable and effective treatment modality. The mechanism underlying ABI's effectiveness is believed to involve induced hemarthrosis, followed by fibrin clot formation and subsequent fibrosis of capsular and ligamentous structures. This controlled fibrosis restricts excessive anterior translation of the mandibular condyle, thereby reducing dislocation episodes. In our cohort, ABI also resulted in a significant reduction in maximum mouth opening (MMO) compared to arthrocentesis. This reduction should not be interpreted as functional impairment but rather as therapeutic stabilization of excessive hypermobility. Similar findings were reported by Al-Khawaldeh et al. (2018), who observed decreased MMO following ABI, correlating with improved joint stability.

In contrast, arthrocentesis demonstrated modest

recurrence prevention but provided effective pain reduction, particularly in the early postoperative period. At one month, pain reduction (VAS) was significantly greater in the arthrocentesis group ($p = 0.04$), although long-term differences were not statistically significant. Arthrocentesis functions primarily by lavage of inflammatory mediators, hydraulic distension of the joint space, and lysis of adhesions, which explains its established success in treating internal derangements such as disc displacement without reduction (Nitzan et al., 1997; Guarda-Nardini et al., 2012). However, because arthrocentesis does not intentionally induce fibrosis or capsular tightening, its effect on preventing recurrent dislocation is less predictable.

The difference in therapeutic goals between the two modalities explains the outcomes observed in this study. Arthrocentesis aims to restore mobility and reduce intra-articular inflammation, whereas ABI intentionally limits excessive mobility to achieve joint stabilization. Therefore, patient selection becomes critical. In individuals whose primary pathology is hypermobility without significant intra-articular adhesions, ABI may be more appropriate. Conversely, in patients presenting with intracapsular pain, restricted opening, or inflammatory pathology, arthrocentesis may offer superior symptomatic relief. This study has several strengths. It was conducted prospectively with standardized protocols and consistent follow-up at a tertiary care center in Pakistan. However, certain limitations must be acknowledged. Allocation was non-randomized, potentially introducing selection bias. Additionally, the sample size, although adequately powered, was relatively modest. Longer follow-up beyond 12 months would provide further insight into long-term joint health and recurrence patterns.

Overall, the findings suggest that ABI is more effective in preventing recurrent TMJ dislocation, whereas arthrocentesis provides slightly better early pain relief. Both procedures are safe and minimally invasive, making them valuable alternatives to open surgical intervention. Future randomized controlled trials with larger sample sizes and longer follow-up durations are recommended to further validate these findings.

## CONCLUSION:

Within the limitations of this prospective comparative study conducted at Bolan Medical Complex Hospital, Quetta, autologous blood injection (ABI) demonstrated superior effectiveness in preventing recurrent temporomandibular joint (TMJ) dislocation compared with arthrocentesis over a 12-month follow-up period. ABI resulted in a significantly lower recurrence rate and greater stabilization of excessive mandibular translation, as reflected by a controlled reduction in maximum mouth opening.

Arthrocentesis, while less effective in preventing recurrence, provided better early postoperative pain reduction and remains highly valuable in patients with intra-articular pathology such as inflammatory changes or adhesions. Both procedures showed low complication rates and were well tolerated, supporting their role as safe and minimally invasive alternatives to open surgical intervention.

From a clinical standpoint, treatment selection should be individualized. ABI appears more appropriate for patients with primary joint hypermobility and habitual dislocation, whereas arthrocentesis may be preferable in cases where pain and intra-articular dysfunction predominate.
Further randomized controlled trials with larger sample sizes and extended follow-up are recommended to confirm long-term outcomes and optimize patient selection criteria.

## CLINICAL RECOMMENDATIONS

1. **Autologous blood injection** should be considered the first-line minimally invasive procedure for recurrent TMJ dislocation due to its superior stabilization effect.
2. **Arthrocentesis** remains indicated for patients with pain-dominant TMJ disorders or limited mouth opening due to internal derangement.
3. Combined or staged approaches may be considered in selected complex cases.
4. Standardized injection protocols and long-term monitoring are recommended to ensure safety and consistency of outcomes.

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