



## Intra-articular Autologous Blood Injection Following Arthrocentesis in the Management of Chronic Recurrent Temporomandibular Joint Dislocation - A Prospective Study

Surabhi V<sup>1</sup>, Rithesh KB<sup>2</sup> and Ganesh GK<sup>3\*</sup>

<sup>1</sup>Department of Surgery, Centre for Cleft Services at St Joseph's Hospital Mysore, India

<sup>2</sup>Department of Oral and Maxillofacial Surgery, AJ Dental College and Hospital, Mangalore, India

<sup>3</sup>Department of Dentistry, Karwar Institute of Medical Sciences, Karwar, India

### Abstract

**Introduction:** Purpose of this study is to assess the outcome of autologous blood injection to the temporomandibular joint in treating chronic recurrent dislocation.

**Material and Methods:** 15 patients with chronic recurrent temporomandibular joint dislocation considered in the study underwent single needle arthrocentesis followed by autologous blood injection in upper joint cavity. The pre-operative findings of patient's maximum mouth opening and an evaluation of temporomandibular joint radiograph compared post operatively.

**Results:** All the patients tolerated the arthrocentesis and intra articular autologous blood injection without any serious complications. The mean age group was 32.37 years. The mean difference between the pre and post-operative mouth opening was  $2.46 \pm 1.96$  mm and was assessed by paired t test. Among the 8 patients who had 2 episodes of dislocation pre operatively only 2 patients continue to have repeated dislocation (25%) at the end of 3 months post-operatively. Remaining 7 patients out of 15, who had more than 3 episodes of dislocation pre operatively, experienced no dislocation during the follow up (100%).

**Conclusion:** Intra-articular autologous blood injection following single needle arthrocentesis is simple, minimally invasive and cost effective procedure. The treatment was successful in 86.3% of cases without any serious complications both during the procedure and during follow up period.

**Keywords:** Arthrocentesis; Autologous Blood; Recurrent Dislocation; Temporomandibular Joint

### Introduction

Temporomandibular Joint (TMJ) also known as diarthrodial synovial joint is a complex joint as well as unique both anatomically and functionally. Anatomically TMJ with associated muscles and ligaments dictates and limits the freedom of discontinuous articulation between two bones.

Functionally TMJ is composed of four articulating surfaces with articular disk separating the joint into upper and lower compartments. The lower compartment permits hinge or rotatory motion while upper compartment permits sliding or translator movements. Articular disk being non-vascularized, non-innervated dense fibrous tissue with adequate strength and flexibility tends to resist pressure and adapts to functional demands.

A condition when the condyle tends to move far anteriorly during opening and passes the articular eminence TMJ gets dislocated. Subsequently, the ligaments around the joint are stretched by an intra-articular effusion resulting in severe discomfort, difficulty with speech and chewing and joint pain. Subluxation is the excessive excursion of the condyle secondary to laxity of the joint capsule [1]. Recurrent dislocation is characterized by a condyle that slides over the articular eminence, crosses just beyond the eminence and then returns back to the fossa. Recurrent dislocation of the TMJ may cause injury to the disc, the capsule and the ligaments resulting in progressive TMJ internal derangement [2-4].

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#### \*Correspondence:

Ganesh GK, Department of Dentistry,  
Karwar Institute of Medical Sciences,  
Karwar-581301, Karnataka, India, Tel:  
7829454755;

E-mail: drganeshkrishna@yahoo.com

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Arthrocentesis is a minimally invasive technique of irrigating the upper compartment of TMJ with therapeutic agent like ringers lactate solution to wash out the inflammatory mediators [5] and thereby treat internal derangement of TMJ.

To address chronic recurrent TMJ dislocation many nonsurgical interventions have been tried, including restriction of mandibular movements with simple intermaxillary fixation combined with muscle relaxants followed by soft diet. Other minimally invasive techniques include injection of various therapeutic agents into the TMJ like local anaesthetic agents to manage pain [2], injection of botulinum toxin to various muscles of mastication to reduce the muscle activity [6,7] injection of sclerosing agents like 3% sodium tetradecyl sulphate, alcohol to induce fibrosis and limit the jaw movement [8,9].

Intra-articular injection of autologous blood is one of the conservative methods of treatment in the management of chronic TMJ dislocation. The physiological process following bleeding into any joint in the body like the knee and elbow results in the release of inflammatory mediators by platelets along with the accumulation of dead and injured cells, results in oedema of the joint tissue. This inflammatory reaction diminishes joint mobility. Thereafter, a combination of organized blood clot and loose fibrous tissue forms, which further decreases joint mobility. These tissues further mature, causing a permanent limitation of joint movement, it may lead to the formation of inter compartmental adhesions, which adds on to restricted joint mobility. This exposure of cartilage to blood results in a disturbance of the cartilage matrix turnover and a decrease in chondrocyte metabolism, causing localized contraction [10].

Intra articular injection of autologous blood into the TMJ was first reported by Brachmann in 1964, which involves injecting patients own blood taken from antecubital fossa. There are many studies conducted for treatment of TMJ dislocation using autologous blood injection followed by restricting the mandibular movements by either elastic bandage or intermaxillary fixation for a period of two weeks [11]. The disadvantage of this is it could lead to ankylosis and degeneration of joint capsule. Studies on managing patients without intermaxillary fixation and elastic bandages following autologous blood are limited.

The aim of the study is to assess the outcome of intra-articular autologous blood injection following single puncture arthrocentesis using single puncture dual needle in the management of chronic temporomandibular joint dislocation. Also to evaluate the long term effect and effectiveness of intra-articular injection of autologous blood injection with arthrocentesis in management of chronic TMJ dislocation without intermaxillary fixation.

## Materials and Methods

Patients reporting to unit of Department of Oral and Maxillofacial Surgery A.J. Institute of Dental Sciences, Mangalore with history of recurrent dislocation were included in the study. After approval by the institutional ethical board, the set sample size for the research was 15. Every patient was explained about the detailed surgical procedure, possible complication followed by a written informed consent. Patients between the age of 18 to 75 years with history of recurrent TMJ dislocation with at least two episodes of dislocation in the past 6 months were included in this study. Patients who were previously treated by various intra articular injections or surgical procedures for the management of chronic TMJ dislocation any pathology involving the TMJ were excluded from the study.

## Preoperative evaluation protocol

- Pre-operative facial photographs
- Maximal inters incisal mouth opening on the day of surgical procedure.
- TMJ radiograph was taken to evaluate the position of the head of the condyle in relation to articular eminence both in open and closed mouth position. All theradiographs were evaluated by a single person based on the following types.
  - Type 1: The head of the condyle is directly below the tip of the articulareminence.
  - Type 2: The head of the condyle in front of the tip of the articulareminence.
  - Type 3: The head of the condyle is high up in front of the base of the eminence.

## Procedure

Patients were seated comfortably in a semi reclined position. Pre-operative maximal Interincisal mouth opening was recorded Cotton pellet was placed in the auditory meatus to protect the ear from the irrigation fluid. The skin over the TMJ was prepared with antiseptic solution with 10% povidone iodine solution. Local anaesthesia was administered 2% lidocaine with 1:200000 epinephrine over the preauricular area to anesthetize the auriculotemporal nerve. A line was drawn from the tragus of the ear to the lateral canthus of the eye. The point of articular fossa was found on this line, 10 mm anterior to the tragus of the ear and 2 mm inferior to the line. At this point the dual needle was inserted into the superior joint space with the patient in open mouth position. The correct position of the needle was confirmed by mandibular movements. The joint was then flushed with 50 ml ringers lactate solution. Then 3 ml of blood was withdrawn from the patients antecubital fossa, with one end of the dual needle closed, 3 ml of autologous blood was injected into the superior joint space. After the procedure all patients were advised to restrict the mouth opening to less than one finger breadth followed by soft diet for 1 week.

Post-operative antibiotics and non-steroidal anti-inflammatory drugs were given for a period of 5 days.

## Post-operative assessment

The patients were recalled for follow up after 1 week, 2 weeks, 3 months and 6 months.

- Maximum inter incisal mouth opening was measured, while the operators hand was placed on the preauricular area to ensure the patient did not proceed to dislocation.
- Number of episodes of dislocation.
- 6 months post-operative TMJ radiograph was taken to check for any destructive changes within the bony compartment of TMJ and was evaluated by a single person.

## Results

All 15 patients tolerated the arthrocentesis procedure and intra articular autologous blood injection without any serious complications, both during injection and follow up period. Post-operative pain was tolerable in all patients and lasted only for few days after injection and easily controlled by taking the prescribed non-steroidal anti-inflammatory drugs. The age groups of the study

**Table 1:** Age and gender distribution.

Age		Gender		Total
		Male	Female	
<=19	Count	0	1	1
	% of Total	0%	6.70%	6.70%
20-29	Count	4	3	7
	% of Total	26.70%	20.00%	46.70%
30-39	Count	2	2	4
	% of Total	13.30%	13.30%	26.70%
40-49	Count	1	0	1
	% of Total	6.70%	0%	6.70%
50-59	Count	1	0	1
	% of Total	6.70%	0%	6.70%
>=70	Count	0	1	1
	% of Total	0%	6.70%	6.70%
Total	Count	8	7	15
	% of Total	53.30%	46.70%	100.00%

Majority 7 (46.7%) of the study participants were in the age group of 20 years to 29 years

**Table 2:** Descriptive Statistics.

	Number	Minimum	Maximum	Mean	Std. Deviation
Age	15	18	71	32.27	14.738

The mean age of the study participants is 32.27 years with the standard deviation of 14.7 years. The minimum age was 18 years and the maximum age was 71 years

**Table 3:** Gender Distribution.

Gender	Frequency	Percent
Males	8	53.3
Females	7	46.7
Total	15	100

Majority of the study participants 8 (53.3%) are males

**Table 4:** Paired Samples Statistics.

Pair 1		Mean	N	Std. Deviation	Std. Error Mean
Pre injection mouth opening		39.33	15	1.718	0.444
	Six months	36.87	15	1.552	0.401

patients were in the range of 18 years to 71 years. The mean age group was 32.37 years (Table 1 and 2). Out of 15 patients, 8 were male and 7 were female patients (Table 3).

**Evaluation of mouth opening**

Maximum Inter incisal mouth opening was recorded pre operatively which ranged from 36 mm to 42 mm, with an average of 39.33 mm (Table 4). Patients were recalled after 1 week, 2 weeks, 3 months and 6 months post-operatively and maximum Interincisal mouth opening was recorded at each follow-up which progressively

**Table 5:** Paired Samples Test.

Pair 1	Pre-injection mouth opening Six months	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
		2.467	0.915	0.236	1.96	2.974	10.435	14	0

Using Paired t test it was observed that Statistically there was significant very high difference between pre injection mouth opening and six months post injection (p<0.001)

**Table 6:** Number of episodes of dislocation Pre-injection.

No. of Episodes	No of Individuals	Percent
2	8	53.3
3	4	26.7
4	2	13.3
5	1	6.7
Total	15	100

**Table 7:** Six months: Number of episode of dislocation post injection.

No. of episode	No of individuals	Per cent
0	13	86.7
1	2	13.3
Total	15	100

**Table 8:** Pre-injection number of episodes of dislocation with six months post injection Cross tabulation.

No. of episodes (within six months)	6 months post injection		Total
	0	1	
2	6	2	8
Count %	75.00%	25.00%	100.00%
3	4	0	4
Count %	100.00%	0.00%	100.00%
4	2	0	2
Count %	100.00%	0.00%	100.00%
5	1	0	1
Count %	100.00%	0.00%	100.00%
Total	13	2	15
Count %	86.70%	13.30%	100.00%

Multiple bar diagram to compare pre injection no of episodes of dislocation with six months post injection

decreased. At six months the average post-operative mouth opening was 36.87 mm. The mean difference between the pre and post-operative mouth opening was 2.46 ± 1.96 mm and was assessed by paired t test. The difference was significant statistically with the P value <0.001 (Table 5).

**Evaluation for frequency of dislocation pre injection**

Out of 15 patients treated, different patients had different frequencies of dislocation. 8 patients had 2 episodes of dislocation, 4 patients had 3 episodes of dislocation, 2 patients had 4 episodes of dislocation and 1 patient had 5 episodes of dislocation pre operatively (Table 6 and 7). Among the 8 patients who had 2 episodes of dislocation pre operatively only 2 patients continue to have repeated dislocation (25%) at the end of 3 months post operatively. Remaining 7 patients out of 15, who had more than 3 episodes of dislocation pre operatively, experienced no dislocation during the follow up of 1 week, 2 weeks, 3 months and 6 months (100%) (Table 8).

## Discussion

TMJ dislocation occurs because of multiple factors that prevent the condyle from translating back to the condylar fossa, leading to chronic recurrent condylar dislocation. These include laxity of TMJ ligaments, a large abnormally placed eminence, muscle hyperactivity and spasms. This condition is more common in patients with TMJ internal derangement, joint laxity, occlusal disturbances, and loss of vertical height, neurological disorders or as a result of trauma [12].

Many surgical and non-surgical techniques for the treatment of chronic recurrent TMJ dislocation have been described in literature. Aim of the surgical treatment is to restrict the condylar movement beyond the articular eminence, by creating a mechanical obstruction beyond the condylar pathway. Surgical interventions include capsular plication, reduction or augmentation of the articular eminence, lateral pterygoid myotomy and condylectomy. The eminectomy allows unrestricted sliding of the condyle by removing the anatomical barrier to the spontaneous reduction of the joint. Combination of multiple methods have also been reported [12,13].

This procedure requires hospitalization, general anaesthesia and surgical access to TMJ area. Treating TMJ by surgical intervention requires careful surgical dissection, due to complex anatomy of TMJ. It carries risk of complications such as facial nerve injury, altered sensation, swelling, pain and infection [14,15]. To overcome the complications of surgical intervention many non-surgical minimally invasive techniques have now become popular, with varying degree of success which includes immobilization of the jaw post reduction so as to prevent further episodes of dislocation. Immobilization of the jaw can be achieved by using Barton's bandage, head chin cup or maxilla mandibular fixation using arch bars. Injection of sclerosing agents like alcohol, sodium tetracycl sulphate to induce fibrosis and restrict joint movements and injection of botulinum toxin to various muscles of mastication to reduce muscle activity.

Intra-articular autologous blood injection is also one of the conservative, minimally invasive methods to treat chronic TMJ dislocation. As mentioned by Machon et al. [10] the first person who reported injection of autologous blood into the TMJ as a treatment for recurrent dislocation was Brachmann in 1964 [16]. The physiological process following intra articular autologous blood into TMJ is similar to bleeding into any joint in the body like the knee and elbows which results in the release of inflammatory mediators by platelets along with the accumulation of dead and injured cells, leading to oedema of the joint tissue.

This inflammatory reaction diminishes joint mobility. Thereafter, a combination of organized blood clot and loose fibrous tissue forms, which further decreases joint mobility. These tissues mature, causing a permanent limitation of joint movement, it may lead to the formation of inter compartmental adhesions. Which results in restricted joint movements? This exposure of cartilage to blood results in a disturbance of the cartilage matrix turnover and a decrease in chondrocyte metabolism, causing localized contraction [17-19]. In this present study 15 patients with history of recurrent dislocation with a minimum of 2 episodes in the last six months. They were treated with single puncture arthrocentesis followed by intra articular autologous blood injection into the TMJ. Post-operatively patients were recalled after 1 week, 2 weeks, 3 months and 6 months and at each follow up maximum interincisal mouth opening was recorded and compared with the pre-operative values. The result showed

progressive decrease in mouth opening, which was statistically significant at the end of six months.

In our study intra articular autologous blood injection was carried out following arthrocentesis. Arthrocentesis or lavage of the TMJ upper compartment markedly improves function and eliminates pain in many TMJ disorders. Arthrocentesis also helps to reinstate the joint lubrication. The origin of TMJ dislocation is probably related to decreased lubrication which increases the friction between the eminence and the disc [20]. The use of single needle technique to flush the joint before blood injection is recommended by Guarda Nardini et al. [21] which were followed in the present study rather than the traditional 2 needle technique. The use of single needle achieves higher intra articular pressure during saline inflow, to help break adhesences and less traumatic than two needle entry, moreover only one puncture is required for the procedure and also there are more chances to have both the needles in the same compartment.

Autologous blood injection was carried out following arthrocentesis procedure. Emad et al. conducted a similar study where they divided the patients into 2 groups of 15 patients each. Group A was treated by autologous blood into superior joint space and group B was treated by autologous blood into superior joint space and pericapsular tissue. The result showed that injection of autologous blood both into superior joint space and per capsular tissue gave higher success rate of (80%) than the other group which was (60%). But in our study though autologous blood was injected only into superior joint space and success rate was up to (86.3%). This was probably because of difference in volume of autologous blood that was considered in the study. Additional 1 ml of autologous blood was injected into the superior joint space in our study. Machon et al. [10] advocated that intra-articular injection should be repeated if there is recurrence of dislocation. In our study only 2 out of 15 patients had episodes dislocation within six months of post injection. However the procedure was not repeated in those patients who continue to have dislocation as the patients refused for another injection. Restricting the mandibular movements post injections is the key to the success of the procedure. Pain following the injection further restricts the mandibular movements, permitting the injected blood to settle and create fibrosis. Exaggerated mouth opening may threaten the integrity of fibrosis and releasing the limitation achieved, resulting in recurrent dislocation [22].

Immobilization can be done using many techniques. Pinto et al. [23] advocated the use of elastic bandage. In our study intermaxillary fixation was not done following autologous blood injection, instead the patient was asked to restrict the mouth opening to less than one finger breadth and soft diet for 1 week. So we advocate the use of autologous blood injection without intermaxillary fixation and by just restricting the mouth opening. In the present study six months post operatively TMJ radiograph were taken to check for any destructive changes within the bony compartment and compared with the preoperative TMJ radiograph. Postoperative radiograph showed absence of any destructive changes, which was similar to that reported by Machon et al. [10] in his study.

Some researchers have claimed that even a short, single exposure of cartilage to blood results in long lasting changes in chondrocyte metabolism that might eventually lead to cartilage destruction and marked limitation of mouth opening [24]. But in the present study there were no serious complications encountered during the procedure or post operatively during the follow up period. According



to Traintafyllidou et al. [25] the disadvantage of this technique is it leads to statistically significant reduction in mouth opening in patients with TMJ hypermobility. But in our study good functional mouth opening was achieved with a mean of 36.87 mm after 6 months post operatively.

## Conclusion

This study was carried out to evaluate the effect of intra-articular autologous blood injection following arthrocentesis in the management of chronic TMJ dislocation. The treatment was successful in 86.3% of cases without any serious complications both during the procedure and during follow up period. Single puncture arthrocentesis is less traumatic when compared to traditional two needle technique. By just restricting mouth opening without intermaxillary fixation, intra articular autologous blood injection can be carried out. Intra-articular autologous blood injection following single needle arthrocentesis is simple, minimally invasive and cost effective procedure. This conservative approach can be tried prior to performing more invasive surgical intervention. The procedure does not require hospitalization or general anesthesia. The procedure can be performed under local anaesthesia or under sedation in an outpatient clinic.

## References

- Okeson J.P. Management of temporomandibular joint disorders and occlusion. St. Louis, 6<sup>th</sup> edition. 2008.
- Undt G, Kermer C, Rasse M. Treatment of recurrent mandibular dislocation, Part 2: Eminectomy. *Int J Oral Maxillofac Surg.* 1997;26(2):98-102.
- Nitzan DW. Temporomandibular joint "open lock" versus condylar dislocation: Signs and symptoms, imaging, treatment and pathogenesis. *J Oral Maxillofac Surg.* 2002;60(5):512-3.
- Fernandez-Sanroman J. Surgical treatment of recurrent mandibular dislocation by augmentation of articular eminence with cranial bone. *J Oral Maxillofac Surg.* 1997;55(4):333-8.
- Neeli AS, Umarani M, Kotrashetti SM, Baliga S. Arthrocentesis for the Treatment of internal derangement of TMJ. *J Maxillofac Oral Surg.* 2010;9(4):350-4.
- Ziegler CM, Haag C, Muhling J. Treatment of recurrent temporomandibular joint dislocation with intermuscular botulinum toxin injection. *Clin Oral Investig.* 2003;7(1):52-5.
- Daelen B, Throwirth V, Koch A. Treatment of recurrent dislocation with type A botulinum toxin. *Int J Oral Maxillofac Surg.* 1997;26(6):458-60.
- Mckelvey LE. Sclerosing solution in the treatment of chronic subluxation of temporomandibular joint. *J Oral Surg.* 1950;8(3):225-36.
- Qiu WL, Hu QG. Treatment of habitual dislocation of the temporomandibular joint subsynovial joint of sclerosant through arthroscopy. *Proc Chin Acad Med Sci Peking Union Med Coll.* 1989;4(4):196-9.
- Machon V, Abramowicz S, Franklin M, Dolwick. Autologous blood injection for the treatment of chronic recurrent temporomandibular joint dislocation. *J Oral Maxillofac Surg.* 2009;67(1):114-9.
- Caminiti MF, Weinberg S. Chronic mandibular dislocation. The role of non-surgical and surgical treatment. *J Can Dent Assoc.* 1998;64(7):484-91.
- Akinbami BO. Evaluation of the mechanism and principles of management of temporomandibular joint dislocation. Systemic review of literature and proposed new classification of temporomandibular joint dislocation. *Head Face Med.* 2011;15:7:10.
- Kummoona R. Surgical reconstruction of the temporomandibular joint subluxation and dislocation. *Int J Oral Maxillofac Surg.* 2001;30(4):233-8.
- Macon V, Abramowicz S, Paska J, Dolwick MF. Autologous blood injection for the treatment of chronic temporomandibular joint dislocation. *J Oral Maxillofac Surg.* 2009;67(1):114-9.
- Daif ET. Autologous blood injection as a new treatment modality for chronic temporomandibular joint dislocation. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2010;109(1):31-6.
- Brachmann F. Eigen blutung jektionen bei rezidivierenden, nicht fixierten Kiefergelenkluxationen. *Zahnärztl.* 1964; 15:97.
- Hooiveld M, Roosendaal G, Wenting M, van den Berg M, Bijlsma J, Lafeber F. Short-term exposure of cartilage to blood results in chondrocyte apoptosis. *Am J Pathol.* 2003;162(3):943-51.
- Hooiveld M, Roosendaal G, Wenting M, van den Berg M, Bijlsma J, Lafeber F. Blood-induced joint damage: longterm effect in vitro and in vivo. *J Rheumatol.* 2003;30(2):339-44.
- Hooiveld M, Roosendaal G, Wenting M, van den Berg M, Bijlsma J, Lafeber F. Initiation of degenerative joint damage by experimental bleeding combined with loading of the joint. A possible mechanism of hemophilic arthropathy. *Arthritis Rheum.* 2004;50(6):2024-31.
- Nitzan D. Arthrocentesis- Incentives for using this minimally invasive approach for temporomandibular disorders. *Oral Maxillofac Surg Clin North Am.* 2006;18(3):311-28.
- Guarda-Nardini L, Manfredini D, Ferronato G. Arthrocentesis of the temporomandibular joint: a proposal for a single-needle technique. *Oral Surg Oral Med Oral Pathol Oral Endod.* 2008;106(4):483-6.
- Oshiro N, Yoshida H, Uemura M, Suwa F, Morita S. Analysis of MRI findings in minimum invasive treatment for habitual temporomandibular joint dislocation by autologous blood injection around the temporomandibular joint capsule. *J Craniomaxillofac Surg.* 2014;42(7):1486-90.
- Pinto AS, McVeigh KP, Bainton R. The use of autologous blood and adjunctive 'face lift' bandage in the management of recurrent TMJ dislocation. *Br J Oral Maxillofac Surg.* 2009;47(4):323-4.
- Verma G, Chopra S, Tiwari AK. Autologous blood injection for treatment of recurrent TMJ dislocation: A case report. *Ann Dent Speciality.* 2014;2(1):27-30.
- Triantafyllidou K, Venetis G, Markos A. Short-term results of autologous blood injection for treatment of habitual TMJ luxation. *J Craniofac Surg.* 2012;23(3):689-92.