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Research Article

Temporomandibular Joint Arthrocentesis Using Double Lumen Single Barrel Needle for Acute Lock Cases: A Preliminary Summary of Findings

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Abstract

Purpose: Disc derangement is related to the increased intra-articular friction preventing the smooth gliding of the joint. Arthrocentesis of the temporomandibular joint was introduced in 1991 by Nitzan., *et al*. and has since gained widespread popularity among practitioner who treats temporo-mandibular joint disorders. This study was conducted to evaluate the efficacy of single puncture arthrocentesis in using double lumen single barrel needle for acute lock cases.

Materials and Methods: Five patients who required arthrocentesis of the temporomandibular joint were treated with single puncture arthrocentesis with modified double lumen single barrel needle. The number of attempts to access superior joint space, duration of the operative procedural time and visual analogue scale score (VAS) for pain to assess surgical discomfort were the main outcome variables.

Results: None of the patient developed any complication. The mean ± SD of the number of attempts to access superior joint space was1.4 ± 0.547 and mean ± SD of the operative procedural time was 16 ± 1.581. There was significant difference in maximal mouth opening and VAS score of pain post-operatively.

Conclusion: This study shows that lysis and lavage of the upper joint compartment by single puncture arthrocentesis using double lumen single barrel needle effective and less technique sensitive requiring less procedural time.

Keywords: Temporomandibular Joint; Internal Derangement; Closed Lock Jaw; Single Puncture Arthrocentesis; Disc Displacement.

Introduction

Internal derangement of the temporomandibular joint (TMJ) generally progresses from the first stage, where there is clicking accompanied by normal maximal mouth opening (MMO), to the stage where clicking gradually ceases concomitantly with varying degrees of restriction in opening (closed lock) [1,2].

In a normal temporomandibular joint, the disc is positioned over the condylar head with the posterior band situated in the 12 o'clock (superior to the condyle) position and the intermediate zone situated in the 1 o'clock (superior-anterior to the condyle) position. On mouth opening the disc-condyle complex translates in a forward direction. Although the condyle also rotates forward, the disc relatively rotates in a posterior direction over the condyle.

In patients with internal derangement of TMJ, this normal joint dynamic is altered [3].

If conservative methods fail, arthrocentesis may be indicated to restore mandibular function [4]. Consistent access and lavage of the temporomandibular joint are the key factors for efficient arthrocentesis [5]. It has been proposed that lavage and lysis of the upper joint space would eliminate the vacuum effect, resolve adhesions, and alters the viscosity of the synovial fluid thereby aiding translation of the disc and condyle. Arthrocentesis is the least invasive surgical intervention into the TMJ, can effectively re-establish a normal maximal mouth opening, and reduce pain and dysfunction [6].

The single needle approach for temporomandibular joint lavage based on the rationale that flushing saline or ringer's lactate into the superior joint compartment provides enough pressure to release joint adherences and clear the inflammatory concentrates from the joint cavity. The anatomy of temporomandibular joint is complex and conventional technique for arthrocentesis to reach the superior joint space demands experience and identification of the superior joint space is essential for successful lavage and lysis [7].

Single puncture arthrocentesis performed by using double lumen single barrel needle reduces the number of the entry ports. It makes the procedure simple by ensuring a relatively simpler access to the joint space for inflow and obtaining the out flow [8]. This study focuses on evaluation of the number of attempts to access superior joint space, duration of the operative procedural time, increase in maximal mouth opening post-operatively, deviation of the mandible on mouth opening and VAS score for pain, by using double lumen single barrel needle for single puncture arthrocentesis in cases of acute lock.

Figure 1: Point of insertion of double lumen single barrel needle and Single Puncture Arthrocentesis using Modified Double Lumen Single Barrel Needle.

Materials and Method

The study was conducted on 5 patients diagnosed with internal derangement of temporomandibular joint and had persistent pain and reduction in mouth opening after conservative management for more than a week.

In the operating room, the patient was seated at a 45-degree angle, with head turned to the unaffected side. Affected auricular region must be prepared with 5% povidone-iodine and draped following strict aseptic measures. Auriculotemporal nerve block was given via an insertion through the skin just anterior to the junction of the tragus and the ear lobe with 1.5 ml of local anaesthetic. The external auditory meatus on the affected side was blocked with a cotton plug and marking for the needle was placed using skin marking ink and drawn the line from the tragus to the outer canthus.

Double lumen single barrel needle was inserted into the joint space 2 mm below the 10 mm from the mid-tragal end of Holmlund Hell sing's line. Then from the one end of the customized needle, the joint was irrigated with 100 ml of Ringer's Lactate solution.

Then, 100 mg Hydrocortisone sodium succinate was injected following which the customized needle was withdrawn. Entry port was covered with a sterile dressing for 24 hours.

Results

The study involving 5 patients diagnosed with internal derangement of temporomandibular joint with acute closed lock jaw. The parameters evaluated were number of attempts to access superior joint space, duration of operative procedural time, maximal mouth opening, VAS score for pain and deviation of the mandible opening.

None of the patient developed any complication. The mean ± SD of the number of attempts to access superior joint space was1.4 ± 0.547, (Table 1, Figure 2) and mean ± SD of the operative procedural time was 16 ± 1.581(Table 2, Figure 3). There was significant difference in maximal mouth opening (Table 3, Figure 4) and VAS score of pain (Table 4, Figure 5) post-operatively. 80% of the included patients did not show deviation on mouth opening postoperatively (Table 5).

No. of attempts to access superior joint space	
Patient 1	2
Patient 2	2
Patient 3	1
Patient 4	1
Patient 5	1
Mean ± SD	1.4 ± 0.547

Table 1: Number of attempts to access superior joint space.

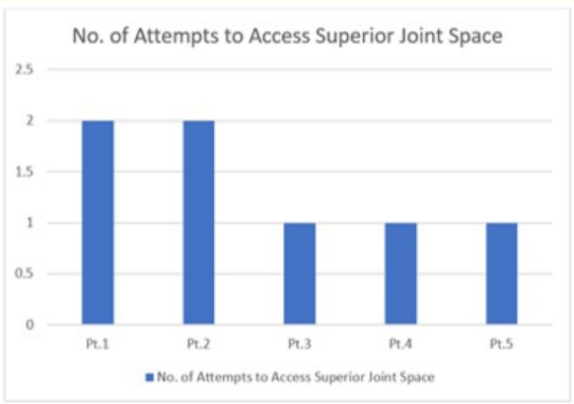

Figure 2: Number of attempts to access superior joint space.

	Duration of operative procedural time (in minutes)
Patient 1	16
Patient 2	18
Patient 3	15
Patient 4	17
Patient 5	14
Mean ± SD	16 ± 1.581

Table 2: Duration of the operative procedural time.

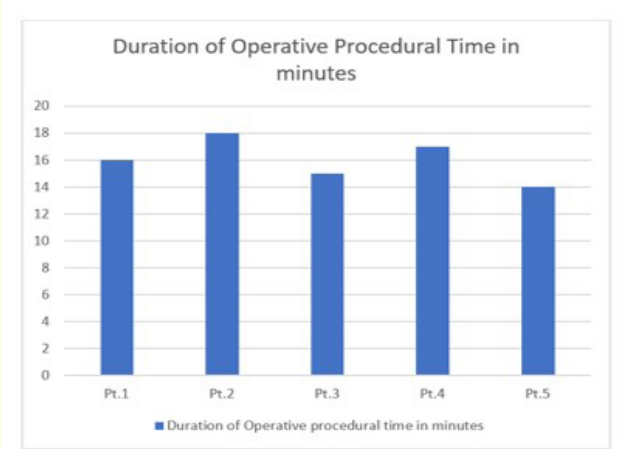

Figure 3: Duration of the operative procedural time.

	Pre-Operative (mm)	Post-Operative after 1 month (mm)
Patient 1	26	33
Patient 2	27	31
Patient 3	25	30
Patient 4	28	31
Patient 5	25	32
Mean ± SD	26.2 ± 1.303	31.4 ± 1.140
p Value	0.0002	

Table 3: Maximal Mouth Opening (Interinscial distance between 11 and 41 in mm).

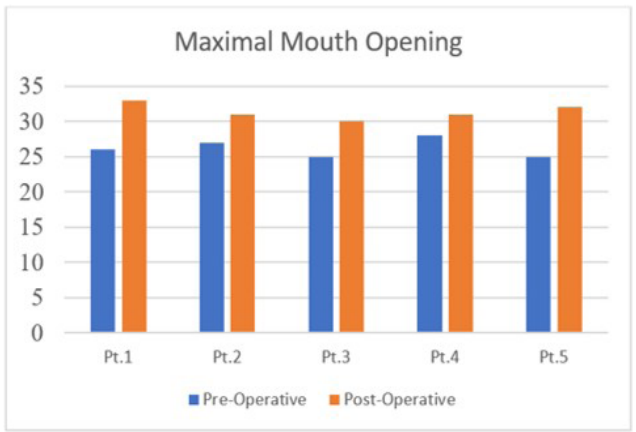

Figure 4: Maximal mouth opening
(Interinscial distance between 11 and 41 in mm).

	Pre-Operative	Post-Operative after 1 month
Patient 1	8	2
Patient 2	9	3
Patient 3	7	2
Patient 4	8	3
Patient 5	7	2
Mean ± SD	7.8 ± 0.836	2.4 ± 0.547
p Value	Less than 0.0001	

Table 4: VAS Score for Pain.

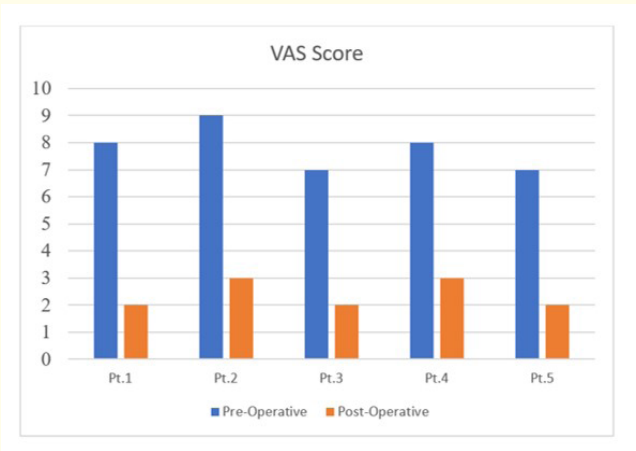

Figure 5: VAS Score for Pain.

	Pre-Operative	Post-Operative after 1 month
Patient 1	Yes	No
Patient 2	Yes	Yes
Patient 3	Yes	No
Patient 4	Yes	No
Patient 5	Yes	No

Table 5: Deviation on mouth opening towards affected side.

Discussion

Based on the observations of successful outcome of arthroscopic lavage and lysis, an alternative theory for the mechanism of closed lock in the TMJ was first proposed by Nitzan and Dolwick [9]. The theory stipulates that sudden severe limited mouth opening is not caused by abnormal disc shape or position, but rather is the result of restricted gliding or forward translation of the condyle caused by the adherence of the disc to the fossa due to a reversible effect such as a vacuum, or possibly a yet to be determined change in synovial fluid consistency. Such events may occur as a result of sustained pressure applied to the joint as may be the case for patients who brux or clench their teeth. Effectively, the joint becomes 'stuck' by a suction cup effect resulting in sudden severe limitation of mouth opening. This theory would serve to explain why acute persistent closed lock would successfully respond to simple treatment such as arthrocentesis, pressure injection and lysis and lavage of the superior joint space [6].

It has been proposed that lavage and lysis of the upper joint compartment would eliminate the vacuum effect, resolve adhesions, and alter the viscosity of the synovial fluid, thereby aiding translation of the disc and condyle [10].

Kaneyama K., *et al*. in 2004 investigated the ideal volume of perfusate for arthrocentesis of the temporomandibular joint (TMJ) disorders (TMDs). The study involved evaluation of 17 joints in 17 patients with TMD in this study. Arthrocentesis of the TMJ was done by perfusion of 400 mL of Ringer's solution. The first 5 mL of perfusate was collected, and then a 5 - mL sample was collected when the total volume of perfused outflow approached 50, 100, 200, 300, and 400 ml. The author concluded that the concentrations of bradykinin, interleukin-6, and protein were measured by immunoassay. The author concluded that concentration of bradykinin, interleukin-6, and protein during arthrocentesis were effectively reduced by more than 200 mL of lavage ($P < 0.05$). With a perfusate volume of 300 to 400 mL, the protein and bradykinin were no longer detectable [11].

Talat W., *et al*. compared single- vs. double-needle arthrocentesis with visco-supplementation for treating disc displacement without reduction of the temporomandibular joint. significant improvement in the baseline levels was achieved ($p < 0.01$). Both techniques were equally effective at reducing pain and increasing the maximal mouth opening. The single-needle technique was easier to perform and required a shorter operative time ($p < 0.01$). He concluded that Single-needle (Shepard cannula) arthrocentesis can be an alternative to the standard technique; however, it might add to the cost of the procedure [12].

In this study, we evaluated the number of attempts to access superior joint space, duration of operative procedural time, maximal mouth opening, VAS score for pain and deviation of the mandible opening. The mean ± SD of the number of attempts to access superior joint space was 1.4 ± 0.547 (Table 1, Figure 2) and mean ±SD of the operative procedural time was 16 ± 1.581 (Table 2, Figure 3). There was significant difference in maximal mouth opening, p value = 0.0002 (Table 3, Figure 4) and VAS score of pain, p value was less than 0.0001 (Table 4, Figure 5) post-operatively. Complications of arthrocentesis are uncommon, though neurovascular injury, penetration of the middle cranial fossa, and damage to the joint have been reported [13] We did not encounter any complications.

Conclusion

Using double lumen single barrel needle for single puncture arthrocentesis requires a smaller number of attempts to access joint space and operative time. This technique is much easier to perform by operator i.e. inserting needle into the upper joint compartment on the first attempt, the absence of intra- operative complications and outflow of the mixture of synovial fluid and saline solution.

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