EFFICACY OF ARTHROCENTESIS IN THE MANAGEMENT OF PATIENTS WITH TEMPOROMANDIBULAR JOINT INTERNAL DERANGEMENTS

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Abstract

Objectives: One of the most fascinating and intricate synovial joints in the body is the temporomandibular joint. The temporomandibular joint's movements are controlled by a complex neurological mechanism, which is necessary for the system to operate correctly and effectively. Inconsistent muscle action or structural injury to any of the parts may result from a lack of such harmony. Arthrocentesis is an effective, simple, and minimally invasive treatment in patients with temporomandibular joint (TMJ) closed lock (CL). This study aims to evaluate the effectiveness of TMJ arthrocentesis procedure in patients with Internal derangement of temporomandibular joint.

Materials and methods: 53 consecutive patients with TMJ issues underwent arthrocentesis using various type of solutions in this prospective clinical case series, assigned from December 2021 to march 2022 were reviewed. Preoperative pain scores, post-operative pain scores, pre-operative mouth opening, post-operative mouth opening, and type of solutions were used as outcome measures. This was followed by excel tabulation and imported in SPSS. Data analysis was assessed in SPSS software using paired t-tests were performed to compare clinical data between pre- and post-treatment and maximum effective solution used were determined using one-way ANOVA test by correlating with post-operative pain and mouth opening scores.

Results: Preoperative pain score ranged from 1 to 9 and the mean of the Preoperative mouth opening score = 22.2-25.54. Post-Operative pain score ranged from 0.60 to 1.63 and the mean of the post-operative mouth opening score = 31.47-35.79. There was statistically significant association seen between Preoperative and Post-operative pain and mouth opening score ($P<0.05$). And maximum effective solution used were found to be dexamethasone.

Conclusion: Within the limitations of this study, it can conclude that arthrocentesis is a simple, minimally invasive procedure with a relatively low risk of complications and significant clinical benefits in patients with TMJ disorders. And maximum effective solution used was found to be dexamethasone.

Keywords: TMJ derangements, TMJ Arthrocentesis, dextrose, ringer's lactate, hyaluronidase, PRP.

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1. INTRODUCTION

Arthrocentesis is commonly defined as the lavage of the TMJ without viewing the joint space using sterile needles and sterile irrigants [1] so as to reduce the pain by removing [2] inflammatory mediators from the joint or to increase the mandibular mobility by removing intra-articular adhesions by means of hydraulic pressure from irrigation of the upper chamber of the TMJ [3]. Arthrocentesis is generally suggested in patients unresponsive to conservative therapies [4].

In the treatment of ID of TMJ, arthrocentesis involves introducing a needle to allow aspiration of joint fluids in the upper joint space and a second needle to allow lavage [5]. Lavage of the upper joint space forces apart the disc from the fossa and washes away inflammatory mediators [6]. The procedure is particularly useful in cases of limited mouth opening due to an anteriorly displaced disc that cannot be reduced or due to disc adhesion [7]. Significant improvement in joint movement and reduction of pain after treatment with arthrocentesis has been reported [8].

Temporomandibular disorders (TMDs) represent a wide range of functional changes and pathological conditions affecting the temporomandibular joint (TMJ), masticatory muscles, and other components of the oral maxillofacial region [9,10]. In recent years, TMD has become a frequent cause for seeking medical assistance [11]. The number of patients with TMDs is increasing, probably due to psychological tension in modern society [12]. According to well-accepted psychophysiological concepts, occlusal problems and emotional stress are the most serious aetiological factors. However, the causes of TMD are far more complex [13]. A comprehensive understanding requires consideration of the whole masticatory apparatus and the intra-articular situation [14].

Internal derangement can be defined as the disturbance of smooth movement of the joint [15].Even though the term includes all of the types of intracapsular disturbance that impede smooth functional joint movements, with respect to temporomandibular joint (TMJ) this term is usually used in reference to with disc displacement [16]. The disc derangement can be defined as an improper or malpositioning of the articular disc with respect to eminence and the condyle [17] . In theory, a disc can be displaced to degrees in many variations and also in any direction such as medial lateral, posterior, anterior [18].Disc displacement in only one direction is very rare with an exception of anterior disc displacement [19]. Posterior displacements of the disc are also noted but are not frequent [20] Displacement of the discs in the sideways are rare and only occur in extreme cases of derangement [21].

TMJ disorders may be treated conservatively or surgically [22]. Conservative treatments include the use of bite wafers, rehabilitation exercises, isometric exercises, masticatory muscle massage, analgesic treatment, thermotherapy, and laser therapy [23]. Surgical treatments can be invasive (open approaches) or minimally invasive, including arthrocentesis and arthroscopy. In this study we will be dealing with arthrocentesis, which is minimally invasive and has different techniques to perform the procedure[24].Our team has extensive knowledge and research experience that has translate into high quality publications[25–34]. This study aims to evaluate the effectiveness of TMJ arthrocentesis procedure in patients with Internal derangement of temporomandibular joint.

2. MATERIALS AND METHODS

Study Design and Study Setting:

This retrospective study evaluated the records of patients who visited the saveetha dental college and hospitals, Chennai from December 2021 to March 2022. The study population included patients aged 11-60years who visited the Oral and Maxillofacial surgery department for internal derangement of temporomandibular joint. Patients under medication or with any other systemic condition were excluded from the study.

Data collection:

After reviewing the patient records who visited as an outpatient from December 2021 to March 2022. Among 53 Patients with internal derangement of temporomandibular joint were filtered out by strict inclusion and exclusion criteria to prevent bias and the required data such as age, gender, Preoperative pain scores, post-operative pain scores, preoperative mouth opening, post-operative mouth opening, and type of solutions used in the arthrocentesis procedure were obtained. Repeated and Incomplete Data were verified from the department and then excluded to prevent bias.

Statistical Analysis:

Data was obtained and filtered using Microsoft Excel and was then exported to IBM SPSS Statistics for Windows, Version 20.0 for further statistical analysis. With the obtained data frequency and descriptive tests were done. The paired t-test was used to compare the preoperative and postoperative differences preoperative and post-operative pain scores and mouth opening. One-way ANOVA test was used to determine the effective solution used for TMJ Arthrocentesis treatment.

3. RESULTS

The study population included Male n=21, Female n=32. Age of the study population ranged from 13-

60 years. The outcomes of this study are demonstrated in Tables 1-3 and Figures 1,2. Preoperative pain score ranged from 1 to 9 and the mean of the Preoperative mouth opening score = 22.2-25.54. Post-Operative pain score ranged from 0.60 to 1.63 and the mean of the post-operative mouth opening score = 31.47-35.79. Statistical analysis for correlation between Preoperative and Post-operative pain and mouth opening score was done using paired T-test method and it was found that, positive correlation was seen between Preoperative and Post-operative pain and mouth opening score ($P<0.05$). And maximum effective solution used were determined using one-way ANOVA test by correlating with postoperative pain and mouth opening scores.

Table 1 demonstrates the paired T- test to compare the preoperative and postoperative pain scores and mouth opening scores.

Paired Samples Test

		Paired Differences			
		95% Confidence Interval of the Difference			
		Upper	t	df	Sig. (2-tailed)
Pair 1	PRE OPERATIVE PAIN SCORE - POST OPERATIVE PAIN	4.943	11.838	52	.000
Pair 2	PREOP MOUTH OPENING - POST OP MOUTH OPENING	-1.940	-4.175	52	.000

Results were statistically significant with p values <0.05.

Table 2 demonstrates the minimum and maximum number of effective solutions compared with post-operative pain and mouth opening scores used for TMJ Arthrocentesis treatment.

		Minimum	Maximum
Post operative pain	Ringers lactate	0	6
	Sodium hyaluronate	0	0
	PRP	0	2
	Dextrose	0	4
	Hyaluronidase	0	4
	Dexamethasone	0	0
	Total	0	6
Postoperative mouth opening	Ringers lactate	0	47
	Sodium hyaluronate	29	32
	PRP	30	34
	Dextrose	30	36
	Hyaluronidase	24	45
	Dexamethasone	35	40
	Total	0	47

Table 3 demonstrates the ANOVA test for effective solutions compared with post-operative pain and mouth opening scores used for TMJ Arthrocentesis treatment.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
POST OPERATIVE PAIN	Between Groups	8.445	5	1.689	.465	.801
	Within Groups	170.876	47	3.636		
	Total	179.321	52			
POST OP MOUTH OPENING	Between Groups	190.009	5	38.002	.594	.705
	Within Groups	3009.067	47	64.023		
	Total	3199.075	52			

In the present study, paired T-test shows that there is significant difference between various solutions used in this study for TMJ arthrocentesis by correlating with post-operative pain and mouth opening. By comparing the effect of solutions used for the treatment, the more effective solution was dexamethasone compared to other solutions.

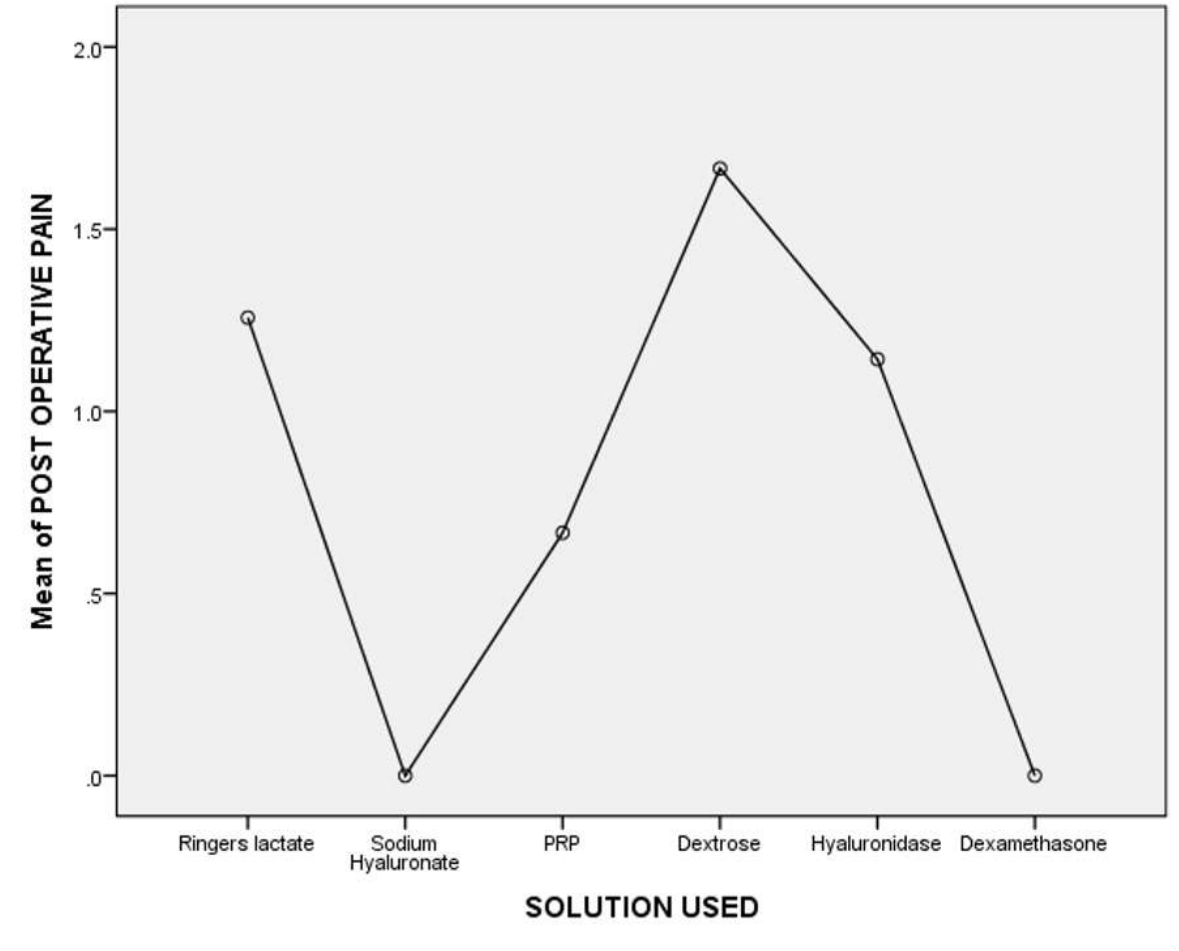

Figure 1 demonstrates the maximum effective solution used for TMJ arthrocentesis correlating with post-operative pain score (mean).

1. Ringers Lactate score - 6
2. Sodium Hyaluronate score - 0
3. PRP score - 2
4. Dextrose score - 4
5. Hyaluronidase score - 4
6. Dexamethasone score - 0 (most effective)

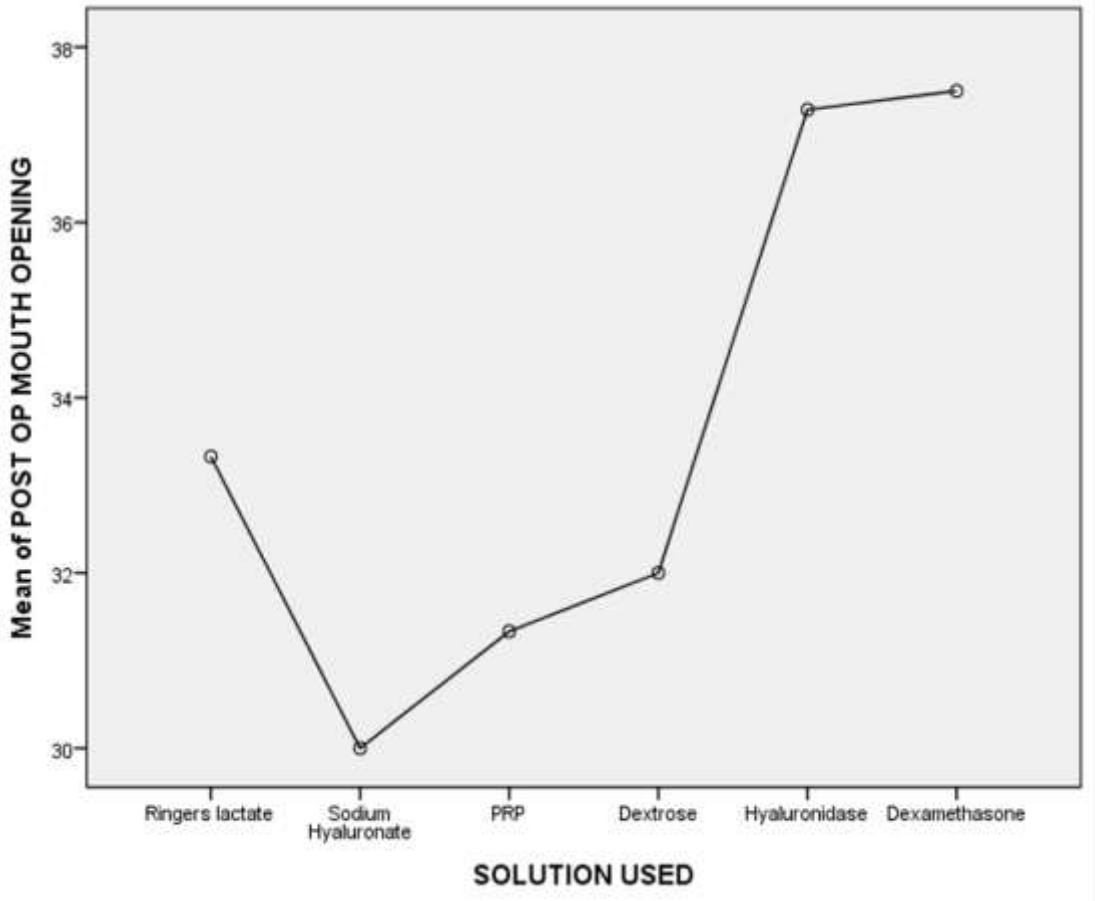

Figure 2 demonstrating the maximum effective solution used for TMJ arthrocentesis correlating with post-operative mouth opening score (Mean).

1. Ringers Lactate score - 33 (more effective)
2. Sodium Hyaluronate score - 30
3. PRP score - 34
4. Dextrose score - 31
5. Hyaluronidase score - 37
6. Dexamethasone score – 38 (most effective)

4. DISCUSSION

Arthrocentesis is the procedure where there is removal of synovial fluid from the TMJ joining this helps in the lubrication of the temporomandibular joint [35]. Arthrocentesis with joint lavage is a procedure which is one of the simplest form of surgical intervention and can be used as a preliminary or an initial procedure in the surgical workflow [36]. It is considered as a minimally invasive procedure resulting in reduction of pain, sounds of the joining and aids in improving the mobility of the temporomandibular joint thus enhancing the mouth opening [37]. It functions on the principle that it aids in the loosening of adherent discs, removing inflammatory factors and pain-mediators thus allowing perfusion of nutrients and thereby aiding in the smooth sliding movement of the disc [38].

Inflammatory and noninflammatory TMJ diseases are typically associated with structural alterations in joint tissues, such as cartilage degradation and subchondral bone alterations, which reflect the responses of cells, extracellular matrix macromolecules, collagen, and proteoglycans to articular load changes [39]. In inflammatory TMJ diseases, various mediators—particularly cytokines—may be responsible for rearrangement of the extracellular matrix in joint tissues, altering normal cell reactions and allowing enzymatic degradation of the matrix [40]. Collagenases and matrix metalloproteinases (MMPs), zinc-containing proteins with enzymatic activity, likely play roles in this process. Macromolecular degradation of the matrix determines physical and biological deterioration of the tissues and promotes the disease, because the degradation fragments, proteoglycans, and collagen released into the synovial fluid generate inflammatory pain, with further release of MMPs [41].

A study assessed dexamethasone for AC with this rationale that it modifies vascular regeneration by eliminating both destructive enzymes and the actions of inflammatory cells (10). However, their

results did not show either positive or negative effects of dexamethasone. Degenerative joint disease is characterized by decreased concentration, molecular weight, and degree of polymerisation of endogenous hyaluronic acid, which involves reduced viscosity of the liquid, resulting in increased susceptibility to damage of the articular heads due to cartilage erosion mediated by exogenous phospholipases. Arthrocentesis has developed as a natural consequence of the success of arthroscopic lavage and lysis for the treatment of internal derangements. Nitzan et al. (15) described arthrocentesis as the simplest form of surgery in the TMJ, seeking to release the articular disc and to remove adhesions between the disc surface and the mandibular fossa by means of hydraulic pressure from irrigation of the upper chamber of the TMJ. Studies to determine whether the effects of arthrocentesis on internal derangements are merely palliative or provide long-term relief of the associated symptoms have shown that arthrocentesis can produce long-term relief of pain and dysfunction in patients with internal derangements of the TMJ (17,21).

A study demonstrated that mechanical stresses to the joint lead to the accumulation of damaging free radicals which, under normal conditions, are neutralized by scavenging mechanisms in the form of enzymes, antioxidants and some hormones (e.g., melatonin) (23). A disease state can occur in susceptible individuals who are unable to respond to the accumulation of free radicals within the TMJ because of the intrinsic deficiency of their free radical scavenging or repair mechanisms. It is referred as 'oxidative stress' which triggers further molecular events that amplify the destruction of articular tissues and result in degenerative disease in the TMJ (23).

Major disadvantages of arthrocentesis are the failure to directly show intra-articular pathology, the scarce possibility of pathological tissue biopsy, and the difficulty of treating more mature adhesions. Sweeping and other nonoperative arthroscopic manoeuvres, which can be performed with arthroscopic lysis and lavage, are not possible with arthrocentesis alone (33-40). Transient facial paresis due to the local anaesthetic or swelling of the neighbouring tissues caused by perfusion of solution may occur during arthrocentesis (41,42). Within the limitations of the study such as incomplete treatment records, unequal male and female ratio, incomplete record of solution used were not taken into account, insufficient recall and review records of patients and complications of the procedure.

5. CONCLUSION

It can be concluded that arthrocentesis is an effective procedure in treating internal derangement of temporomandibular joint, the study shows that Dexamethasone is more effective when compared to other solutions to use in TMJ arthrocentesis by correlating with post-operative mouth opening and pain scores which shows p value. Further studies with increased population and better control groups can be done for obtaining significant results for assessing the best derangement of TMJ.

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