Influence of Arthrocentesis Irrigation Volume at Temporomandibular Disorder Treatment

Abstract

Introduction: Temporomandibular disorder (TMD) treatment varies from conservative therapy to invasive procedures such as arthrocentesis. The procedure is simple and has speed, low cost, low morbidity and good patient acceptance. Literature variations, however, have been found about the type and volume of the solution used for the irrigation of temporomandibular joint (TMJ).

Subjects and Methods: The aim of this study was to compare the results provided by two different volumes of 0.9% saline solution (100 ml and 250 ml) used in arthrocentesis technique for TMD treatment. It included patients unresponsive to conservative treatment. Preoperative (T0) and postoperative evaluations were performed at T1 (30th day), T2 (60th day), and T3 (90th day), in which maximal mouth opening (MMO), pain, and the presence or absence of joint sounds were recorded. Patients were randomized into two groups: 1 – submitted to arthrocentesis using 100 ml of 0.9% saline solution in TMJ and 2 – arthrocentesis performed using 250 ml of 0.9% saline solution in each TMJ. Data were submitted to descriptive and comparative analyses for each parameter per group and between groups. The effect size was calculated according to Cohen test. Minimum detectable change (MDC) was obtained and the sensibility was calculated. A statistical significance of 5% was established. Group 1 obtained increase in MMO and decrease in pain (statistically significant); in Group 2, pain decreased significantly. In Group 1, clicking decreased significantly. No statistical differences were found between groups (P = 0.333). MMO and pain results exceeded MDC, and sensibility was good. Conclusion: In conclusion, arthrocentesis is effective in TMD symptoms’ relief, without statistical difference between the volumes used.

Keywords: Arthroscopy, pain, temporomandibular joint

Introduction

Temporomandibular disorder (TMD) is a pathologic alteration in the stomatognathic system involving temporomandibular joint (TMJ)-associated masticatory muscles. This represents a great deal of maxillofacial clinic care, affecting mostly women.[1-5] Pain, clicking, crepitus, and limitation of mandibular movements are some of the signs and symptoms observed in patients with this disorder. TMD can be classified into three categories: myofascial disorder (MD), internal derangement (ID), and degenerative joint disease (DJD). MD is considered the most common cause of pain where there is muscle damage associated or not with psychological disorders. ID is defined as an abnormal relationship between articular disc, mandibular condyle, glenoid cavity, and articular eminence. DJD is characterized by the TMJ articular surfaces’ degeneration, as occurs in some rheumatoid arthritis cases.[6]

TMD treatment varies from conservative therapy – such as guidance about liquid diet, physiotherapy, application of moist heat, nonsteroidal anti-inflammatory drugs, and bite plates – to invasive procedures such as arthroscopy, disectomy, condylectomy, and arthrocentesis.[7]

Arthrocentesis is the irrigation under hydraulic pressure of the upper joint compartment. It promotes the removal of necrotic tissue, blood, and inflammatory mediators, as well as the breaking of possible adhesions on articular disc and mandibular fossa, resulting in pain decrease and mouth opening improvement.[8-10] Some advantages of the technique are simplicity, speed, low cost, low morbidity, and good patient acceptance.[2,3,11-15]

According to literature, it is indicated when nonsurgical therapies fail, being a boundary between nonsurgical and surgical therapies.[15] It should be considered in

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patients who do not respond to nonsurgical treatment due to its effectiveness in reducing pain and discomfort and increasing mouth opening.\textsuperscript{[16]}

Literature variations have been found about the type and volume of the solution used for the irrigation of TMJ.\textsuperscript{[3,12,16‑20]} Thus, this study aimed to compare the results provided by two different volumes of 0.9% saline solution used in arthrocentesis technique for TMD treatment.

**Patients and Methods**

**Study design**

This prospective study included patients with TMD from the Department of Oral and Maxillofacial Surgery of Santo Antonio Hospital and Edgard Santos University Hospital (affiliated with the Federal University of Bahia). Patients included had been diagnosed by the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMDs) and undergone arthrocentesis from February 2008 to January 2009 due to the failure of conservative treatment. Patients with localized pain (acute or chronic), limitation of mandibular movements, and joint sounds (clicking and crepitation) were included. The exclusion criteria were the presence of one of the following conditions: osteoporosis, rheumatoid arthritis, sclerosing spondylitis, recurrent dislocation or ankylosis of TMJ, traumatic arthritis, cysts, and tumors.

Maximal mouth opening (MMO), pain, and joint sounds were the parameters used to evaluate the efficacy of arthrocentesis, and the results were collected by clinical evaluation four times: T0 (preoperative evaluation), T1 (30th postoperative day), T2 (60th postoperative day), and T3 (90th postoperative day).

Preoperative evaluation (T0) also included radiographic evaluation to confirm the absence of oral pathologies and joint cysts or tumors.

MMO measurement was made using a digital caliper (Mitutoyo\textsuperscript{®}, Mycal Absolute model, 500 series, code 500-144 B), collecting in millimeters the distance between the incisal edge of the maxillary and mandibular incisors.

The pain quantification was obtained by the visual analog scale (VAS) at the moment of clinical evaluation, which is one of the most effective ways to evaluate it.\textsuperscript{[19]}

Auscultation was performed using a stethoscope (Littmann Master Classic II Black Edition) on both TMJ regions (following RDC/TMD protocol) to identify the presence or absence of joint sounds.

**Patients**

The patients were randomly categorized into two groups:

- Group 1: Patients who underwent arthrocentesis using a volume of 100 mL of 0.9% saline solution in each TMJ
- Group 2: Patients who underwent arthrocentesis using a volume of 250 mL of 0.9% saline solution in each TMJ.

The sample consisted of 13 individuals, 12 (92.3%) females and 1 (7.7%) male. The median age was 30 years (range: 18.5–35.5 years). Group 1 had seven individuals and Group 2 had six.

**Procedures**

Arthrocentesis was performed by the same surgeon based on the surgical protocol developed by Nitzan et al. 1991\textsuperscript{[11]} under intravenous sedation.

First, surgical sequence included antisepsis, the positioning of the surgical field, protection of the external auditory meatus with gauze, and tracing of the canthal–tragus line [Figure 1]. Second, two points were marked [Figure 1 - A]: 10 mm in front of the tragus and 0.5 mm below the canthal–tragus line [Figure 1 - B]: 20 mm in front of the tragus and 1 mm below the canthal–tragus line.

Third, auriculotemporal nerve anesthesia was performed (by 1.5 mL of 2% lidocaine with adrenaline 1:200,000), followed by the insertion of a needle (40 mm × 12 mm) in each point previously marked (to penetrate into the upper joint compartment).

Finally, the surgeons promoted two different volumes of irrigation with 0.9% saline solution under continuous pressure and a hypodermic syringe connected to the needle (according to randomly categorized groups). Mandibular manipulation was also performed to increase mouth opening and break possible intra-articular fibrous adhesions. Patients were discharged with compressive dressing for 3 days.

Postoperative medication was a nonsteroidal anti-inflammatory drug for 3 days, and patients were advised to have a liquid and soft diet for a fortnight.

As mentioned in the “Study Design” section, patients failed on conservative treatment. The same physiotherapist

**Figure 1: Canthal–tragus line tracing (1). Point A – 10 mm in front of the tragus and 0.5 mm below the canthal–tragus line; Point B – 20 mm in front of the tragus and 1 mm below the canthal–tragus line**
had treated all of them for a year without improvement of signs and symptoms. Physiotherapy was stopped at the acceptance of participating in this study and it was rebooted at the 3rd postoperative day.

It included jaw exercises to strengthen muscles and improve flexibility and range of motion: MMO sustained for 1 min repeated five times plus laterally left and right movements sustained for 1 min each for three times (exercises were performed four times a day, for 30 days). Weekly, patients returned for physiotherapy evaluation (as done on conservative treatment) to present a timetable of the exercises performed.

**Ethics**

The study was approved by the Research Ethics Committee of the Faculty of Dentistry of the Federal University of Bahia. All participants who agreed to be part of the study signed an informed consent prepared for this purpose.

**Statistical analysis**

The database was created in Excel 2003. Descriptive analyses were performed with the purpose of identifying the general and specific characteristics of the sample. To verify the existence of significant differences in the parameters evaluated, T0 was compared to T3 (for each group of patients and between groups) using nonparametric Mann–Whitney test \( (P < 0.05) \) was considered statistically significant) was applied for comparisons between groups. According to the population studied, for a statistical power of 80%, a minimum sample size of six patients per group was needed. The effect size was calculated according to Cohen test \( (d) \). Minimum detectable change (MDC) for MMO and pain results were obtained and the sensibility of the test was calculated.

**Results**

The sample was statistically homogeneous according to age and patients’ TMD signs and symptoms (evaluated by the RDC/TMD protocol). Each patient acted as her/his control, as conservative treatment was performed for about one year (without success) before the decision about arthrocentesis. No statistically significant difference was found between the groups \( (P = 0.333) \).

### Maximum mouth opening and pain

In Group 1, the MMO median at T0 was 46.0 mm, and it was 50 mm at T1, T2, and T3. The MMO showed a statistically significant difference between T0 and T3 [Table 1]. The VAS median value was 9 at T0, 2 at T1, and the same at T2 and T3. The median VAS showed a statistically significant difference between T0 and the three postoperative times [Table 1].

In Group 2, the median value of MMO at T0 was 44.0 mm, 43.0 mm at T1, 50.0 mm at T2, and 51.0 mm at T3. The MMO showed the absence of statistically significant difference between T0 and the three postoperative times [Table 1]. The VAS median value was 9 at T0, 4.5 at T1 and T2, and 2.5 at T3. The VAS median value was statistically significantly different between T0 and the three postoperative times [Table 1].

### Joint sounds

In Group 1, at T0, six patients (85.7%) had TMJ crepitus. At T1, this number decreased to four (57.1%), and at T2 and T3 to three (42.9%). The decrease in crepitus was not statistically significant \( (P = 0.125) \), although an improvement (no crepitus) occurred over time [Table 2]. In addition, in Group 1, at T0, all patients (100.0%) had clicking. At T1, this number decreased to four (57.1%), and it decreased to three (42.9%) at T2 and T3. The decreasing number of individuals with clicking was statistically significant over time \( (P = 0.031) \) [Table 2].

In Group 2, at T0, five individuals (83.3%) had TMJ crepitus. At T1, this number decreased to three (50.0%), and it increased to four (66.7%) at T2 and T3. In addition, in Group 2, at T0, all patients (100.0%) had clicking. At T1, this number decreased to three (50.0%), and it increased to four (66.7%) at T2 and T3. Neither the number of individuals with crepitus nor the number of individuals with clicking showed a statistically significant difference \( (P = 0.750 \text{ and } P = 0.188, \text{ respectively}) \), although there was an improvement in both groups. At T2, in both evaluations, one individual presented with joint sounds again [Table 2].

### Effect size

Cohen test revealed a medium effect size of arthrocentesis treatment \( (d = 0.6) \), which confirms the clinical relevance of this technique for TMD’s signs and symptoms’ relief.

| Variables | T0 (preoperative) | T1 (30th day) | T2 (60th day) | T3 (90th day) | P (T0/T3) |
|-----------|------------------|-------------|-------------|-------------|----------|
| MMO (mm)  | 46.0             | 44.0        | 50.0        | 50.0        | 0.039*   | 0.548    |
| VAS (1-10)| 9.0              | 9.0         | 2.0         | 4.5         | 2.0      | 2.5      | 0.001*   | 0.016*   |

*\( P < 0.05 \). MMO=Maximal mouth opening, VAS=Visual analog scale
Minimum detectable change and sensibility

MMO and pain results exceeded the MDC. MDC for MMO was 3.0 (δ = 3.0) with a sensibility of 6.23%, and for pain results, MDC was 3.75 (δ = 3.75) with a sensibility of 6.67%. Although sensibility exceeded the 5% of significance level, the sensibility was considered good.

Discussion

The current study involved groups with a prevalence of females (100% in Group 1 and 83.3% in Group 2, with a median age of 30 and 24.5 years, respectively). All patients in this study had a reduction of pain and increased mouth opening after 90 days of postoperative follow-up. This result was also confirmed by other authors. 

According to the results of this study, both groups (use of 100 mL of 0.9% saline solution – Group 1; use of 250 mL of this same solution – Group 2) showed improvement of mouth opening and the decrease of pain and joint sounds. Comparing MMO between the two groups, both obtained improvement in the course of time. The only exception was in Group 2, at T1, where the median value of MMO decreased to 43.0 mm. Evaluating the VAS, we also noticed an improvement in pain relief between T0 and postoperative times (T1, T2, T3), and this improvement was more evident in Group 1 (100 mL).

The evaluation of crepitus and clicking in both groups showed a regression of these signs between T0 and after surgery (T1, T2, T3), being more evident in Group 1 (100 mL). Nevertheless, no statistically significant difference between groups was observed (P = 0.333), as was reported by Lee et al., who evaluated 43 patients submitted to four different treatments and did not observe statistically significant differences in the presence of joint sounds between groups. The measured values for TMD parameters were also obtained by Li et al., who evaluated 523 patients undergoing arthroscopy and divided them into groups according to the presence of disruption of the articular disc. Li et al. also reported no statistically significant differences between groups on mouth opening and postarthroscopy symptoms.

TMD has a strong predilection for females. Ethunandan and Wilson reported that TMD affects approximately 10% of the population, mainly young women. Emshoff and Rudisch conducted a study about IDs of the TMJ in which 31 sample patients were female and only 6 were male. Carvajal and Laskin, also studying the IDs of the TMJ, reported that all 26 patients included in their sample were female, aged between 16 and 55 years. Nitzan and Price demonstrated higher prevalence in women (80%) (aged between 16 and 54 years) of osteoarthritis of the TMJ. Nishimura et al. argued that the levels of these parameters are already evident after 1 week, which was confirmed in the current study. Our study also elucidated the predilection for females, but each patient acted as her control.

Some published studies have compared the volume of irrigation solution required for effective arthrocentesis. According to Dieter et al., the ideal volume varies from 50 to 500 mL. Nitzan et al., used 50–100 mL. Zardeneta et al., reported that infusions of 100 mL are sufficient for an effective therapeutic washing. The present study corroborates with Nitzan et al. and Zardeneta et al., but our results cannot confirm this hypothesis only based on the absence of a significant difference in Group 2 (P > 0.05).

Another factor to be considered among the results of different studies is the presence of some subjectivity in the measurement of these parameters (mouth opening, pain, and joint sounds). Gurung et al., evaluated lateral and prohibitive jaw movements complementary to MMO and VAS results in patients submitted to arthrocentesis. On the other hand, corroborating with the present study, Jamot et al., evaluated 45 patients submitted to arthrocentesis due to unresponsive to conservative treatment. The parameters were MMO and VAS measured for a period of 2 months after the procedure. Subjectivity can be found considering the technique, as demonstrated by Şentürk et al., in a literature review, which discussed the advantages and disadvantages of TMJ arthrocentesis technique and identified 12 distinct techniques (five classified as double puncture and seven as single puncture). Bouchard et al., reported a systematic review with meta-analysis and elucidated statistical and clinical heterogeneity among studies included, recommending arthrocentesis with caution due to the lack of strong evidence.

Schiffman et al. stated that, according to the International Association of Oral and Maxillofacial Surgeons, there are criteria in determining the success of TMD treatment. These criteria are no pain (or decrease of frequency and intensity), minimal interincisal mouth opening of 35 mm, and absence

| Table 2: Crepitus and clicking in Groups 1 and 2 |
|-----------------|-----------------|-----------------|-----------------|-----------------|
|                  | T0 (preoperative) | T1 (30th day)   | T2 (60th day)   | T3 (90th day)   |
|                  | 1                | 2                | 1               | 2               | 1               | 2               |
| Crepitus         | 85.7             | 83.3             | 57.1            | 50.0            | 42.9            | 66.7            | 42.9            | 66.7            | 0.125           | 0.750           |
| Clicking         | 100.0            | 100.0            | 57.1            | 50.0            | 42.9            | 66.7            | 42.9            | 66.7            | 0.031*          | 0.188           |

*P<0.05
or reduction of joint sounds. In the present study, all patients improved their interincisal mouth opening (50 mm in Group 1 and 51 mm in Group 2 at T3), decreased pain, and decreased joint sounds, evolving without complications. Moreover, the effect size observed by Cohen test detected a medium effect ($d = 0.6$), resulting in clinical relevance of this technique for TMD’s symptoms’ relief, also confirmed by patients’ VAS results. However, studies are necessary that maintain a longer postoperative follow-up, with the maintenance of these parameters for longer periods of time, which is also one of the success criteria.

Longer follow-up is a limitation of this study, as well as the small sample.

At the end, this study demonstrated the effectiveness of both volumes of saline solution irrigation at arthrocentesis treatment (100 mL and 250 mL), which resulted in mouth opening improvement and pain/joint sound decrease. No discerning statistical differences were observed between treatments.

**Ethics statement/confirmation of patients’ permission**

The study was approved by the Research Ethics Committee of the Faculty of Dentistry of the Federal University of Bahia and it was in accordance with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all participants.

**Conclusion**

In conclusion, arthrocentesis is effective in TMD symptoms’ relief, without statistical difference between the volumes used.

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Nil.

**Conflicts of interest**

There are no conflicts of interest.

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