

Short-term effects of arthrocentesis plus viscosupplementation in the management of signs and symptoms of painful TMJ disc displacement with reduction. A pilot study

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Abstract

Aim To provide data on the short-term effect of a cycle of five weekly arthrocenteses plus hyaluronic acid injections in the management of signs and symptoms of painful disc displacements.

Methods Thirty-one consecutive patients (25 females, six males; mean age 42.4) with a combined diagnosis of disc displacement with reduction and arthralgia according to the Research Diagnostic Criteria for Temporomandibular Disorders underwent a cycle of five arthrocenteses with injections (one per week) of 1 ml hyaluronic acid. A number of subjective and objective clinical parameters were assessed at the time of the diagnosis (baseline), at each appointment during the treatment, at the end of the treatment, and three follow-up appointments (1 week, 1 month, and 3 months).

Results At the end of the treatment period, marked improvements with respect to baseline values were recorded in all the outcomes variables, and they were maintained over the 3-month follow-up span. Significant changes were shown in subjective outcome variables, viz., masticatory efficiency, maximum pain levels,

functional limitation, perceived efficacy, and objective clinical parameters, viz., jaw range of motion on different movements. Tolerability of treatment was acceptable since the first intervention and was moderately improved over time.

Conclusions A cycle of five weekly hyaluronic acid injections performed immediately following arthrocentesis is effective to improve signs and symptoms in patients with painful temporomandibular joint disc displacement with reduction and to maintain them over a 3-month follow-up.

Keywords Temporomandibular joint · Temporomandibular disorders · Arthrocentesis · Hyaluronic acid · Disc displacement with reduction

Introduction

The term temporomandibular joint (TMJ) arthrocentesis defines the lavage of the upper joint compartment by the use of saline solution, using needles for the inflow and the outflow [1]. This technique was first introduced at the beginning of the 1990s and derives directly from TMJ arthroscopy, on the basis of the hypothesis that the most effective successful component of TMJ arthroscopy was the simple fact that the patient was submitted to an intervention and not all the complicated manoeuvres intended to recapture the disc, fix the disc, and remove the adhesions within the joint using tiny and sophisticated instruments [2]. The under pressure flow of a liquid through the joint should allow by itself the removal of the catabolytes, the distension of the joint with breakages of some adhesions, and the mobilisation of the disc [3].

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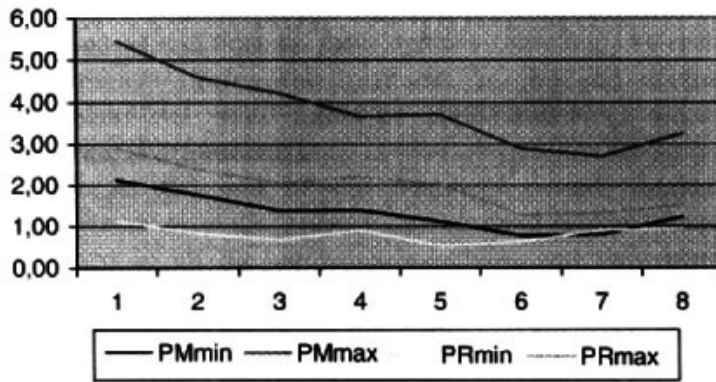


Fig. 1 Pain levels (VAS scores) at the eight points of observation in time during treatment and follow-up periods

Over the years, arthrocentesis has become increasingly popular in the TMD field, and favourable results have been reported in cases of suddenly onset closed lock and mouth opening restriction [4] and TMJ osteoarthritis [5]. Moreover, it has been shown that the injection of hyaluronic acid immediately following the joint lavage may be of additional value [6], likely due to the effect of viscosupplementation, which helps reducing the intra-articular friction coefficient [7]. In particular, protocols providing a combination of arthrocentesis plus hyaluronic acid (HA) have been proven effective in the short-to-medium term to provide pain relief and improve jaw function to patients with TMJ osteoarthritis [8, 9].

Notwithstanding, very few data are available on the use of such combined approach to patients with painful internal derangements. Considering these premises, the present investigation aims to provide pilot data on the short-term effect of a cycle of five weekly arthrocenteses plus hyaluronic acid injections in the management of signs and symptoms of painful disc displacements with reduction.

Materials and methods

Study design

Criteria for inclusion in the study were the presence of a combined diagnosis of disc displacement with reduction and arthralgia according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) [10] in the absence of both RDC/TMD muscle disorders (group I diagnoses) and rheumatic diseases. Patients had to refer a history of pain lasting from more than 4 months.

A RDC/TMD axis I group IIa diagnosis of disc displacement with reduction was made when the following signs and symptoms were present: presence of a reciprocal click sound eliminated on protrusive opening. A RDC/TMD axis I group IIIa diagnosis of arthralgia was based on the presence of TMJ pain with lateral and/or posterior

palpation plus anamnestic reporting of TMJ pain during maximum voluntary mouth opening and/or maximum assisted mouth opening and/or lateral excursions (see reference [10] for more details).

Thirty-one consecutive patients (25 females, six males; mean age 42.4; range 24–61) satisfying inclusion criteria gave informed consent to the treatment received and participated to the study. The mean pretreatment pain duration was about 13 months (range 4–36 months). The study design provided a cycle of five arthrocentesis with injections (one per week) of 1 ml hyaluronic acid (Hyalgan[®], Fidia, Abano Terme, Italy) performed by one of two trained investigators (L.G.N., D.M.) according to the protocol described by Guarda-Nardini et al. [11].

A number of clinical parameters were assessed at the time of the diagnosis (baseline), at each appointment during the treatment, at the end of the treatment, and three follow-up appointments (1 week, 1 month, and 3 months):

- pain at rest and mastication, assessed by means of a visual analogue scale (VAS) from 0 to 10, with the extremes being “no pain” and “pain as bad as the patient ever experienced”, respectively;
- mastication efficiency, assessed by a VAS from 0 to 10, the extremes of which were “eating only semi-liquid” and “eating solid hard food”;
- maximum nonassisted and assisted mouth opening, protrusion, and left and right laterotrusion (in millimetre);
- functional limitation during usual jaw movements (0, absent; 1, slight; 2, moderate; 3, intense; 4, severe);
- subjective efficacy of the treatment (0, poor; 1, slight; 2, moderate; 3, good; 4, excellent);
- tolerability of the treatment (0, poor; 1, slight; 2, moderate; 3, good; 4, excellent).

Injection technique

The injection technique for TMJ arthrocentesis is currently performed utilising the same landmarks used

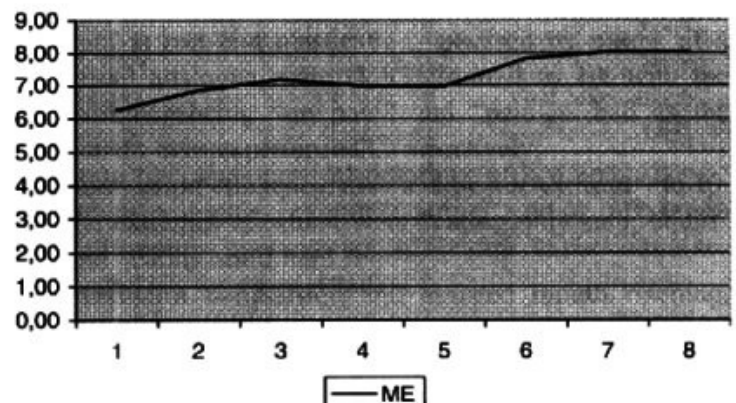


Fig. 2 Masticatory efficiency

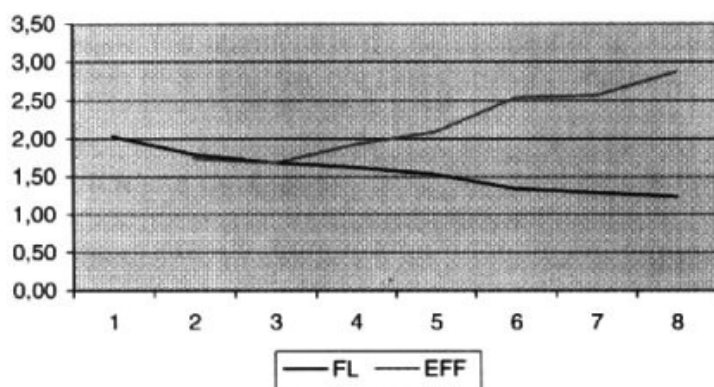


Fig. 3 Functional limitation and subjective perceived efficacy

for arthroscopy. A line connecting the midtragus to the lateral cantus, viz., Holmlund line, has to be traced, then the patient is required to open wide the mouth in order to better define the empty glenoid fossa and the articular tubercle (Fig. 1). Local anaesthesia is then achieved with mepivacaine 2% (Carbocaine, Sanofi Winthrop, NY, USA). The anaesthetic is first injected into the joint cavity, relaxing this virtual space. Subsequently, the needle is withdrawn gently to the skin surface, thus anaesthetizing also the soft tissues over the joint (Fig. 2). A second injection of 2 ml lidocaine is then performed, first around the capsule and then inside the joint itself. Once a satisfactory anaesthesia is achieved, the patient is asked to open the mouth wide in order to keep the fossa empty and to gain space for needle insertion. A first 19 G needle is placed 10 to 12 mm in front the tragus and 2 to 3 mm below the Holmlund line, and a second one is inserted few millimetres in front of the first one [12]. Once the two needles are inside the upper compartment of the joint, arthrocentesis is performed using a single

syringe several times for a total amount of up to 300 ml, which is the ideal saline volume to remove catabolytes and inflammatory mediators [13] (Fig. 3). Once arthrocentesis is completed, one needle is removed, and 1 cm³ of hyaluronic acid is injected into the joint in 3 s through the other one.

The hyaluronic acid used in the present investigation, Hyalgan[®], is a defined (500–730 kDa) molecular weight fraction of a highly purified avian sodium hyaluronate, buffered (pH 6.8–7.5) in physiologic saline.

Statistical analysis

Baseline and posttreatment data were compared by means of Wilcoxon's rank sum test for ordinal variables (pain at rest and mastication, masticatory efficiency, functional limitation, subjective efficacy of treatment, tolerability of treatment) and *t* test for continuous variables (maximum assisted and unassisted mouth opening, protrusive and laterotrusion movements). *P* value for statistical significance was set at 0.05. All statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS 15.0, SPSS Inc., Chicago, IL, USA).

Results

At the end of the 3-month follow-up, marked improvements with respect to baseline values were recorded in all the outcomes variables (Table 1). Significant changes were shown in almost all the subjective parameters, with the only exception of minimum pain at rest and mastication.

Table 1 Mean scores and statistical significance of differences between baseline and 3-month follow-up values

Outcome variable	Expected sign	Baseline	3-month follow-up	Significance
Masticatory efficiency (0–10)	+	6.27±2.17	8.02±1.98	0.000
Minimum pain at mastication (0–10)	–	2.13±2.47	1.23±2.09	0.055
Maximum pain at mastication (0–10)	–	5.45±2.90	3.25±2.87	0.001
Minimum pain at rest (0–10)	–	1.13±1.83	0.95±2.23	0.672
Maximum pain at rest (0–10)	–	2.90±3.12	1.53±2.27	0.012
Functional limitation (0–4)	–	2.03±0.76	1.24±0.93	0.000
Subjective efficacy (0–4)	+	1.74±1.14	2.87±0.95	0.000
Tolerability (0–4)	+	2.24±1.12	2.46±1.14 ^a	0.471
Unassisted mouth opening (mm)	+	39.57±10.40	44.97±8.10	0.001
Assisted mouth opening (mm)	+	43.13±9.77	47.86±8.52	0.000
Right laterotrusion (mm)	+	7.23±1.99	9.14±3.12	0.007
Left laterotrusion (mm)	+	7.97±3.03	9.45±3.10	0.040
Protrusion (mm)	+	7.18±2.34	7.59±2.43	0.161

^a Tolerability data refers to baseline and posttreatment values

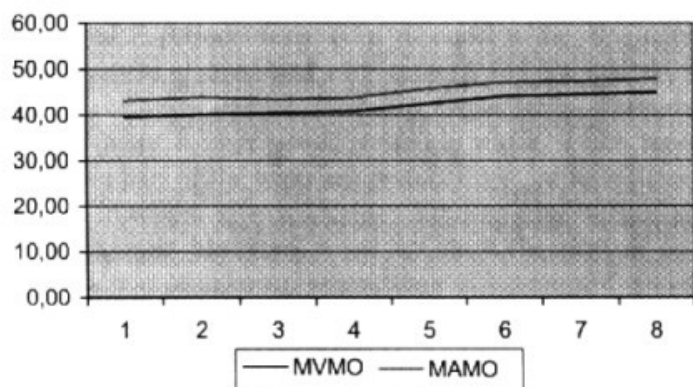


Fig. 4 Maximum voluntary (MVMO) and assisted mouth opening (MAMO; in millimetre)

Masticatory efficiency, maximum pain levels, and functional limitation scores as well as subjective perceived efficacy significantly improved during treatment, and positive effects were still maintained at the end of the follow-up span (Figs. 1, 2, and 3). Also objective parameters, viz., jaw range of motion on different movements, improved significantly during treatment and kept on being stable over time, with the exception of protrusion (Figs. 4 and 5). Tolerability of treatment was acceptable since the first intervention and was moderately improved over time (Fig. 6).

Discussion

Arthrocentesis of the TMJ has been the subject of several investigations over the past two decades but, despite the encouraging findings reported in the literature, it seems that available data are inconclusive as for its actual mechanism of action [14]. The hydraulic distension provoked by the under pressure lavage of the upper joint compartment with a large volume of saline has been considered the reason for the positive clinical outcomes in patients with sudden onset closed lock [4]. Notwithstanding, a single-session arthro-

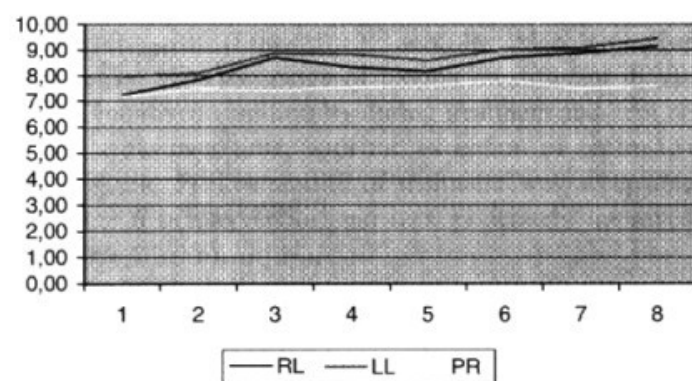


Fig. 5 Right (RL) and left laterotrusion (LL) and protrusion (PR) movements (in millimetre)

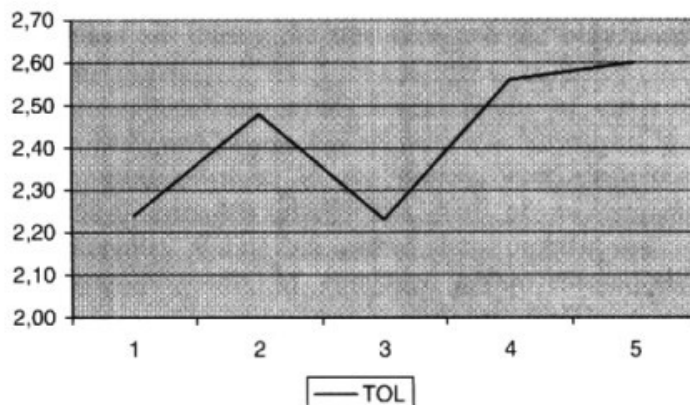


Fig. 6 Tolerability of the five injections

centesis was then proven effective also to improve pain and dysfunction in subjects affected by TMJ osteoarthritis, likely due to a thorough removal of catabolytes from the joint space [5].

The same indications were described also for hyaluronic acid injections, but the literature is inconclusive as for the best protocol to be adopted for any specific indication. A single pumping injection of hyaluronic acid gave positive outcomes in patients with TMJ closed lock [15], and comparative trials suggested that HA injection immediately following arthrocentesis may provide an additional positive effect with respect to arthrocentesis alone in patients with TMJ internal derangements, viz., disc displacement with and without reduction [6, 16].

The rationale for the use of HA lies in the concept that viscosupplementation may help reducing the frictional coefficient of the TMJ, thus allowing smooth and increased motion [7]. Notwithstanding, low molecular weight HA, such as those used in TMJ investigations, are commonly administered in accordance to five weekly injections and have given excellent results in the management of inflammatory-degenerative disorders in larger joints, viz., the knee, the hip, and the ankle [17]. Besides, it was introduced in the field of TMJ disorders, also giving good outcomes in patients with osteoarthritis [8, 9, 11, 18]. To the best of the authors' knowledge, such a protocol was never adopted before in patients with other painful conditions.

The present investigation showed that a cycle of five weekly injections of HA following arthrocentesis is effective in improving jaw function and decreasing pain levels in a group of subjects with painful TMJ disc displacement with reduction. Besides, improvements were maintained over the 3-month follow-up span.

Such findings are in line with those reported by our research group in patients with TMJ osteoarthritis, in which improvements were maintained even over longer follow-up periods [8, 9]. Thus, studies on larger samples with longer

observation periods are needed to confirm the long-term effectiveness of combined arthrocentesis and HA injections in patients with painful TMJ disc displacement. Interestingly, future studies would establish which is the most effective part of the treatment protocol, viz., arthrocentesis or HA injection.

Such issue has been raised up since the time of the introduction of viscosupplementation as a treatment option for TMJ disorders. Despite early studies suggested that hyaluronic acid did not provide superior outcomes with respect to those of arthrocentesis or corticosteroids [19], successive reports did not confirm such findings and suggested that HA injections may increase positive outcomes achieved with joint lavage [6, 16]. The main problem related with the need to get deeper into this issue is the difficulty to design methodologically correct studies. The different protocols that are usually adopted for arthrocentesis (single session) and HA injections (five weekly injections) make not possible to perform e.g. a double-blind, randomised, and controlled clinical trial to test for the superiority of one treatment or the combination of the two over the other.

Notwithstanding, it seems logical to suppose that viscosupplementation in inflamed joints might be more useful if performed after a thorough joint lavage that allows washing out the inflammatory mediators. Such assumption was at the basis of the choice of this study's protocol, which already gave encouraging results in patients with osteoarthritis that have been now extended to subjects with painful disc displacement with reduction.

The patients of this study sample referred pain from more than 4 months, and all of them had undergone some forms of pharmacotherapy, mostly by means of systemic anti-inflammatory nonsteroid drugs prescribed by their general dentists or physicians, without having any relevant improvement in their symptoms. Despite they might have actually viewed as chronic pain patients needing for a comprehensive multidisciplinary approach, their scores in the RDC/TMD axis II graded chronic pain scale showed that only one patient out of 25 subjects who complete the RDC/TMD axis II as a screening assessment (data were missing for the remaining six patients and thus, were not presented here as part of the present study) had high disability, moderately limiting levels of pain-related impairment. Such observation suggested to try adopting the present protocol without going deeper into the assessment of chronic pain. It is also likely that this protocol was more aggressive than actually needed to reduce pain in a population of patients as that included in the present study, but the risk for side effects associated with arthrocentesis plus viscosupplementation treatment was judged to be low, as confirmed by the absence of any

complications during the treatment and the observation period.

Some ethical and even clinical points of concerns might have thus arisen, but all participants (patients and researchers) involved in the project were conscious/informed that this study was part of an ongoing investigation aiming to gather data on the use of different protocols of combined arthrocentesis plus hyaluronic acid injections in different TMD, in the attempt to get deeper into the study of this promising technique. In the near future, information on the best protocol to adopt in the different clinical conditions will be hopefully available, in order to be able to provide targeted therapies at the individual level. As stated above, the combination of five joint lavages and HA injections is likely to be a quite invasive protocol to provide pain relief in subjects with pain associated with reducing disc displacement, as confirmed by the moderate subjective efficacy perceived by this study's patients. Anyway, it should be viewed as the standard of reference, in line with findings from other joints, until the efficacy of less invasive protocols should be assessed.

The issue of treatment benefit-to-cost ratio should also be addressed in future studies, because HA injections need to stand comparison with conservative approaches, such as occlusal splints, physiotherapy, and pain medication, before being definitively introduced within the daily armamentarium of the TMD specialist.

Conclusions

Within the limitations of this study, it was shown that a cycle of five weekly hyaluronic acid injections performed immediately following arthrocentesis is effective to improve signs and symptoms in patients with painful TMJ disc displacement with reduction and to maintain them over a 3-month follow-up. Studies with longer follow-up on larger samples are requested to confirm these positive outcomes.

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