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Temporomandibular joint arthrocentesis for the treatment of osteoarthritis

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SUMMARY

The aim of the study was to estimate the effect of arthrocentesis in the treatment of osteoarthritis of the temporomandibular joint (TMJ), evaluate and compare cytological and biochemical findings in the synovial fluid (SF) as well in venous blood samples and to determine the effectiveness of arthrocentesis with regard to TMJ pain intensity and mandibular movement.

Patients and Methods. Twenty three consecutive patients with a diagnosis of TMJ osteoarthritis (Wilkes´ stages III, IV) after noneffective conservative treatment were treated with arthrocentesis using push and pull technique (Alstergren et al. 1995). Preoperative radiographs and the scores pre- and posttreatment (after 6 months), maximal interincisal opening (MIO) and visual analogue scale (VAS) for pain estimation were performed. Blocking the auriculotemporal nerve with a 2mL of 2% lidocaine solution, the needle was inserted into the upper joint compartment and connected with the three-way stopcock for infusion therapy (Discofix® Braun) and 2-3 mL of saline solution was pushed slowly to the upper compartment and then aspirated back. The first SF aspirate was allocated for the following analysis: SF viscosity, presence of crystals, SF rheumatoid factor (RF) compared to blood plasma RF. The washing was repeated 3-4 times until the aspirate was clear.

Results. After 6 months MIO improved significantly ($p<0.05$) and pain according to VAS had substantially decreased ($p<0.01$). Viscosity of the aspirate was 0.78 (medium), crystals were found in 5 patients (21.7%). There was not statistical significant difference between SF RF and plasma RF values ($p>0.05$).The effectiveness of arthrocentesis may be explained by the joint space expansion achieved with the introduction fluid, washing out inflammatory mediators, the particles of adhesions, fibrillations, crystals etc.

Conclusions. Arthrocentesis with this technique for the treatment of TMJ osteoarthritis offer favourable results with regard to increasing MIO, reducing pain and dysfunction. The presence of crystals or chondromatosis granules in the synovial fluid and increased viscosity of the synovial fluid indicates a pathological condition of an inflammatory nature.

Key words: temporomandibular joint, osteoarthritis, arthrocentesis, synovial fluid.

INTRODUCTION

Arthrocentesis with joint lavage is the simplest form of surgical intervention into the temporomandibular joint (TMJ). It is widely used in the treatment of variuos internal derangements as well as diagnostic purposes (1-4). Successful longterm follow-up studies have also been reported as by filling upper compartment under pressure, any minor adhesions are broken down and lyzed (5, 6). The process during arthrocentesis is refferred to as „lysis and lavage“ and can give good therapeutic outcomes as reported in patients with restricted mouth opening, TMJ disorders (7, 8). The synovial fluid of TMJ osteoarthritis contains higher levels of inflammatory mediators and cytokines, matrix degrading enzymes (9, 10). Arthrocentesis and lavage of the joint removes directly not only most of the degradation products, but inflammatory mediators as well (11, 12).

Several studies suggest that arthrocentesis is an efficient method with relatively high success rates

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(1, 3, 13). Several inflammatory mediators and cytokines play an important role in the pathogenesis of TMJ osteoarthritis (14, 15). Many cell types are involved in inflammation as macrophages, T-lymphocytes, mast cells, dentritic cells, and neutrophilic leucocytes (10). Systemic findings and peripheral *i.e.* synovial aspirate findings might be expected to influence the treatment effects. Our hypothesis is that a difference in the peripheral expression of biochemical and laboratory findings may influence the treatment response.

The aim of the study was to estimate the effect of arthrocentesis in the treatment of osteoarthritis of the TMJ and to evaluate and compare cytological and biochemical findings in the synovial fluid (SF) as well in venous blood samples as well as to determine the effectiveness of arthrocentesis with regard to TMJ pain intensity and mandibular movement.

PATIENTS AND METHODS

Patients

Twenty three consecutive patients with a diagnoses of TMJ osteoarthritis (Wilkes´stages III, IV; 16) after noneffective conservative treatment were treated with arthrocentesis using push and pull technique (2). Outpatient subjects for this study consisted of 4 men and 19 women aged 21-60 years.The study was conducted in the Department of Maxillofacial Surgery at the Tartu University Hospital. The study was approved by the Ethics Committee at the University of Tartu (protocol 94/3, 2000). Four patients had bilateral joint involvement, 19 unilateral.

Inclusion criteria for arthrocentesis were noneffectiveness of NSAID-s, mainly Clotam® (Tolphenamic acid), Arcoxia® (Etoricoxib) as well as other nonsurgical treatment modalities. The pain intensity was assessed with a 100 mm visual analogue scale (VAS) with endpoints denoted by „no pain“ (0 mm) and „worst pain ever experienced (100 mm). If pain was present the patients were asked to select a field from 1 mm to 100 mm on the VAS scale to estimate their level of pain in the TMJ. The absence of pain is scored as 0. Preoperative data as clinical history, a physical exam and radiographs using ortopantomograpy (OPTG) and computer tomography (CT) were documented for diagnostic purposes. This included progression time of TMJ dysfunction, the presence of facial asymmetry, the amplitude of mandibular movement, the presence of joint sounds, deviation on maximal mouth opening, and pain on mandibular movements. Clinical data were collected for pain and measurements of maximal interincisal opening (MIO) before and after treatment (Fig. 1).

All patients were asked to come for reexamination. The scores for preoperative and postoperative MIO and VAS for pain were compared. At the 6 months follow-up, improvement with respect to mean baseline values was recorded.

TMJ arthrocentesis

TMJ anaesthesia was achieved by blocking the auriculotemporal nerve with 2 mL 2% Lidocain (Xylocain, Astra-Zeneca, Sweden). The TMJ was punctured with a 19-G needle inserted into the posterior part of the upper joint compartment in a mouth-open position in order to expand the joint cavity. The needle was connected with the threeway stopcock for infusion therapy (Discofix® B.Braun Melsungen AG, Switzerland) with two syringes in order to perform arthrocentesis using a push and pull technique. Stopcock gives a possibility to open and close the route. The saline solution (NaCl 9 mg/mL) was slowly injected into the posterior part of the upper joint cavity approximately 2-3 mL and then aspirated and allocated for laboratory investigations. The washing was repeated 3-4 times until the aspirate was clear. The procedure was performed in a single session (Fig. 2). No additional substances or drugs were used. The first SF aspirate ~2mL was allocated for the following analysis: the level of SF glucose, C-reactive protein (CRP), SF – rheumatoid factor (RF), presence of crystals – calcium pyrophosphate deposition disease (CCPD) crystals (Fig. 2). The degree of viscosity of SF aspirate was determined, estimating visually in accordance to the viscosimeter scale: 0, 1, 2, 3. SF which flows with difficulty, possesses relatively high viscosity up to grade 3. The washing was repeated 3-4 times until the aspirate was clear. Beforehand venous blood analyses were also performed for erythrocyte sedimentation rate (ESR), plasma RF, plasma-glycose, thrombocyte count (TPC) and C-reactive protein (CRP).

Statistics

Descriptive statistics was performed to assess the significance with regard to each variable (VAS, MIO).The significances of the differences the variables before and after treatment were calculated by Spearman´s ranked (r_s) correlation test to calculate the significance of the correlations between the variables. A probability level below 0.05 was considered as significant.

RESULTS

The scores for pretreatment and posttreatment MIO and VAS for pain were compared. Assessment

Fig. 1. TMJ osteoarthritis. Maximal interincisal opening (MIO) is 13 mm before treatment

Fig. 2. The needle is inserted into posterior part of the upper joint compartment and connected with the three-way stopcock for arthrocentesis

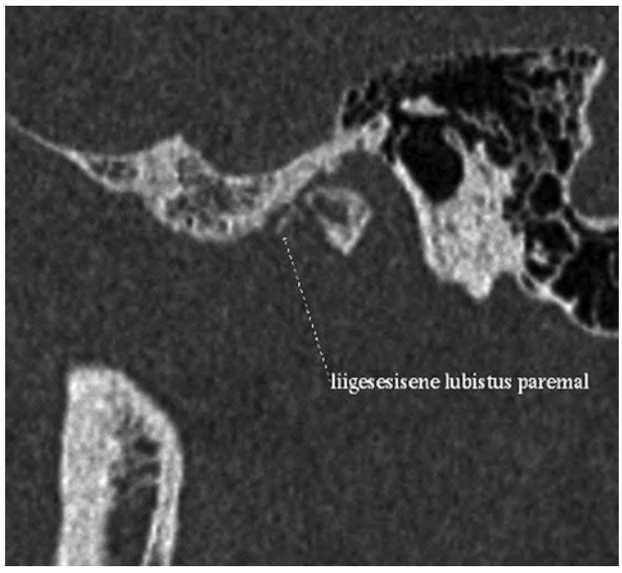

Fig. 3. Sagittal view of the CT. Left TMJ in an open mouth position. The calcifications in the joint space which were removed during arthrocentesis.

Table. VAS and MIO data before and 6 months after treatment

Variables	Minimum	Maximum	Median	SD
VAS before	46	86	75	9.45
VAS after	2	29	18	6.50
MIO before	25	40	31	3.70
MIO after	38	49	44	3.19

of symptoms reported by the patients as well as objective signs noted on clinical examination, confirmed resolution of pain on movement (painless MIO) and increased vertical opening.

There was a significant increase ($p<0.05$) in the MIO postoperatively after 6 months and decrease in the VAS after treatment ($p<0.05$). The preoperative VAS score for pain ranged from 46 mm to 86 mm with a mean of 75 mm. The follow-up VAS scores for pain range was between 2-29 mm with a mean of 18. The preoperative MIO ranged from 25-40 mm with a means of 31mm while postoperative MIO ranged from 38-49 mm with a mean of 44 mm at the follow-up.The clinical variables and comparison objective pre- and postoperative findings are given in Table.

Viscosity of the aspirate was 0,78 (mean), crystals in the SF were found in 5 patients (21.7%). There was no statistical significant difference between SF RF and plasma RF values ($p>0.05$).

Age correlated positively with MIO before treatment ($r_s=0.450$, n=23; $p=0.031$) *i.e.* the younger the patient the more restrictions in the mouth opening. A positive correlation between the VAS data before and after treatment was found ($r_s=0.654$, n=23; $p<0.016$) *i.e.* after treatment the pain disappeared or diminished in the TMJ. Age correlated positively with synovial glucose level ($r_s=0.418$; n=23, $p=0.041$) *i.e.* the older the patient the higher the values of synovial glucose level. Systemic CRP correlated positively with synovial viscosity ($r_s=0.420$; n=23; $p=0.04$) indicating to an increased systemic inflammatory activity.

DISCUSSION

The synovial fluid sampling technique used in this study showes that the upper compartment of TMJ will take up for 4 mL of fluid and, by filling under pressure push and pull technique gives a possibility to lubricate the joint space, brake down adhesions, allowing through washes lavage remove foreign bodies (crystals, calcificates, granulations) and release the adhesions and fibrillations. Arthrocentesis helps allowing through washes lavage remove foreign bodies (crystals, calcificates, granulations) and release the adhesions and fibrillations (Fig. 3). Arthrocentesis is a treatment modality between non-surgical treatment and arthroscopic surgery. Together with intraarticular biopsies, synovial fluid analysis provides a possibility to obtain information about the local joint pathophysiology on a molecular level. Arthrocenthesis causes less trauma than biopsy. It is not an alternative procedure to surgical intervention being highly efficient procedure with

low morbidity (6, 17, 18). Arthrocentesis could be the best indicated treatment for patients with anterior disc placement (19). Our study showed that push and pull technique restored and preserved joint physiology, giving good results in treating patients with TMJ osteoarthritis by obtaining successful results for pain and dysfunction relief. The relatively rapid improvement after arthrocentesis compared to conservative treatment may be explained by the immediate removal of intra-articular adhesions, pro-inflammatory mediators, cytokines and degeneration products available in the synovial fluid (20-22).

It is found (7, 8) no significant differences in the treatment effectiveness for TMJ disorders of a cycle of five weekly injections of arthrocentesis performed according to the classical two-needle technique or the single-needle technique. The two approaches were both effective and may be equally used. The improvement in the quality of joint enviroment achieved with artrhrocentesis seems to be the basis for an explanation of the efficacy of arthrocentesis in the treatment of osteoartrhritis with restricted mouth opening. It is claimed that a displaced disk, by itself, is of only limited significance in TMJ closed lock. Total sliding could be easily obtained by irrigation of the upper joint compartment (1). The arthrocentesis breaks joint adherences that are responsible for the reduced translatory movement of the condyle and are mainly called into cause to explain the phenomena of the disc anchorage to the fossa or eminence, thus allowing immediate mouth opening (23). Fibrous adhesions in the upper joint compartment are one of the factors causing limitation of MIO. It is concluded that lavage under sufficient pressure can remove adhesions and widen the joint space (24, 25). As adhesions and fibrillations in the joint space are the most usual pathologic signs (25) arthrocentesis by a „push and pull“ method has sufficient pressure to release these bands.The push and pull technique is recommended in case of osteoarthritis were radiological findings are minimal (Wilkes´ stages III-IV), allowing full retention of the saline within the joint space and thus lubricating the joint surfaces. In general viscosity is the resistance to flow by any liquid as a result of molecular adhesion. Flow occurs inside the synovial fluid *i.e*. forces arise such a direction as to oppose the flow. This study indicated that higher level of viscosity may influence on TMJ movement pain and that presence of crystals in synovial fluid are result of chronic inflammation. This is supported by the tendency to an association between the increase of systemic CRP level and synovial viscosity. Arthrocentesis of the upper compartment of the TMJ may be a highly effective method to restore normal MIO and functioning. In several studies (21, 26, 27) improvement in MIO and decrease in pain level and joint dysfunction on a VAS were the criteria used for defining a successful outcome. Insertion of a single needle should reduce the risks for nervous injuries as well.

CONCLUSIONS

The advantages of the push and pull technique are as follows: stable access to the joint compartment with limited trauma.

Arthrocentesis with the push and pull technique for the treatment of TMJ osteoarthritis offer favourable results with regard to increasing maximal interincisal opening, reducing pain, increasing jaw motion and improving function. The presence of crystals or chondromatosis granules in the SF and increased viscosity of the SF indicates a pathological condition of an inflammatory nature.

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