



Evaluating the additional effects of arthrocentesis on the condylar pathways of temporomandibular joint in patients with internal derangement treated with stabilizing splint



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ABSTRACT

Objectives: The purpose of this investigation is to find out the differences in the condylar pathways of the temporomandibular joint (TMJ) in patients treated with stabilizing splint and arthrocentesis accompanied by stabilizing splint in 6 months period.

Study design: Forty patients who were assigned a clinical diagnosis of internal derangement of the TMJ were included in this study. Full arch stabilizing splints were made for all patients. Patients were divided into two groups; group A (patients who underwent arthrocentesis), group B (patients who did not undergo arthrocentesis). Computerized axiography was performed for each group before therapy (T_0), on the 3rd month (T_1), after arthrocentesis (T_A) (for group A) and on 6th month (T_2). Curve parameters were recorded in three-dimension; X axis (posteroanterior), Y axis (mediolateral), Z axis (superoinferior). Also the distance from the starting point of the movement on sagittal plane (S) was calculated.

Results: There was a significant increase in the value of Z ($p = 0.014$) and S ($p = 0.038$) in mediotrusion movement in group A. Also, there was a significant increase in the value of Z ($p = 0.007$) in protrusion/retrusion movement, value of Z ($p = 0.019$) and S value ($p = 0.002$) in mediotrusion movement and value of Y in open/close movement in group B.

Conclusions: No positive effects on condylar pathways of an additional arthrocentesis to splint therapy alone in patients with internal derangement were found in this study.

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1. Introduction

Abnormal relationship among the mandibular condyle, articular eminence and articular disc are expressed as internal derangement of the temporomandibular joint (TMJ) (Nishimura et al., 2002). This abnormal relationship is usually accompanied by muscle tenderness, TMJ pain, limitation of mouth opening and abnormal sounds (Dergin et al., 2012; McNeill, 1993). The etiologic factors underlying temporomandibular disorders remain a controversial subject. Some of the factors involved are postural problems, dental occlusion, parafunctional habits, unusual chewing patterns and muscular imbalance (Dworkin and LeResche, 1992).

Conservative treatment modalities such as pharmacologic approaches, physical medicine, oral appliances, biobehavioral therapy

and management of the occlusion are applied before considering surgical treatment (Okeson, 2008; Tuncel, 2012).

Arthroscopic studies showed that the causes of TMJ related pains are the inflammatory processes of the capsule, retrodiscal tissue or synovium (González-García et al., 2008). Studies conducted on patients with painful dysfunctional TMJs reveal that remarkable levels of inflammatory mediators of pain are present in the synovial fluid (Yih, 1989).

Being a minimally invasive technique, arthrocentesis is considered the first line of surgical intervention in treating the internal derangement of the temporomandibular joint. Arthrocentesis is also the first choice of therapy for patients who do not respond to conservative treatment modalities. It is an easy and efficient clinical procedure where the lavage of the TMJ is done without viewing the joint (Barkin and Weinberg, 2000).

The aim in recording mandibular movements is to find out the functional status of the mandibular movement which is guided by

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the condyle (Okeson, 2008). To make mandibular movement research more accurate and detailed condylar paths are measured (Han et al., 2010). The computer aided diagnosis axiograph is known to be reliable instrument for measuring the condylar pathways (Piancino et al., 2008).

The purpose of this study was to investigate the effects of arthrocentesis on the condylar pathways of the temporomandibular joint aided with the help of computerized axiography. The null hypotheses were as follows:

1. Arthrocentesis accompanied by stabilizing splint therapy improves the mobility of the TMJ in every movement.
2. Arthrocentesis therapy would have an additional positive effect in decreasing jaw limitation of patients treated by splint therapy.

2. Material & methods

2.1. Study population

Forty patients (35 females and 5 males, mean age 31.4 years) who have internal derangement type III of the TMJ were included in this study. All of the patients had increasing frequency and intensity of joint pain and restriction of motion. This study was performed in compliance with international and Turkish Laws on clinical experimentation. The principles and the research protocol were approved by the Ethical Committee of the University of Marmara Study and was carried out in the Department of Prosthodontics and Oral & Maxillofacial Surgery, The University of Marmara. Patients with rheumatoid arthritis, condylar hyperplasia and congenital craniofacial syndrome were excluded from this study.

2.2. Occlusal splint

The occlusal splints which were made for the patient's were characterized by the following features:

- The appliance is made of hard acrylic resin
- It is typically made in the upper jaw
- It is a full coverage appliance
- Upon mandibular closing, there are even and simultaneous contacts between cusps of the lower teeth and the appliance surface
- A flat area of up to 1 mm in diameter allows smooth sliding in the horizontal plane without a vertical component
- Cuspid rise during appliance-guided laterotrusion and protrusion starts after up to 1 mm of freedom in centric, causing separation of all remaining teeth, thus preventing balancing and protrusive interferences.

2.3. Measuring of condylar pathways

The three dimensional condylar pathways of the patients were recorded with the help of a computerized axiograph (Cadiax Diagnostic, Gamma Dental, Klosterneuburg, Austria). Computerized axiography was performed for each group before splint therapy (T_0), in the 3rd month (T_1), two weeks after arthrocentesis (for group A) (T_A) and in the 6th month (T_2). Curve parameters were recorded in three-dimension; X axis (posteroanterior), Y axis (mediolateral), Z axis (superoinferior). Also the distance from the starting point of the movement on the sagittal plane (S) was calculated. These parameters were recorded in open-close (OC), protrusion-retrusion (PR) and mediotrusion (M) movements. Immediate side-shift (ISS) was only recorded in mediotrusion (M) movement.

The axiography system consisted of upper face-bow, mandibular face-bow and a para-occlusal clutch which was fixed to the occlusal surface of the mandibular dentition.

Each patient was comfortably seated in a dental chair. Patients were told to remove all metal objects around the orofacial area to avoid any static electricity. Lower jaw movements were explained to the patient.

The recording process was carried out as follows:

- Placing the para-occlusal clutch
- Mounting the upper face-bow
- Mounting the flags on to the upper face-bow
- Mounting the lower face-bow
- Attaching the styli on to the lower face-bow
- Setting up the wiring of the electronic system
- Localizing and setting the hinge-axis
- Entering the geometric data taken from the upper face-bow
- Choosing the desired standard curve movement from the menu of the software
- Instructing the patient according to the chosen curve
- Recording the curves

2.4. Arthrocentesis

Arthrocentesis was only performed on group A after 3 months of stabilizing the splint therapy. The procedure was carried out under local anesthesia to the superior joint compartment of the TMJ using the technique described by Nitzan et al. (1991). After disinfecting the operation area with antiseptic solution, an auriculotemporal nerve block using 0.3–0.5 ml of anesthetic solution (Ultracain DS Forte, Sanofi, Paris, France) was performed. The two entry points of the needles were marked using the tragus-lateral cantus line as reference. The skin was then penetrated at the first entry point with a 19-gauge needle (Sterijen; Hayat Tibbi Malzemeler, Istanbul, Turkey) at the articular fossa. After placing the needle 3 ml 5 % Ringer Lactate solution (Eczacıbası, Istanbul, Turkey) was injected and aspirated back to ensure the right location of the needle. The second 19-gauge needle was inserted into the distended compartment of the articular eminence and, the superior joint space was irrigated with 150–200 ml of 5% Ringer Lactate solution allowing a free flow through the first needle. After completing the procedure both of the needles were withdrawn. The patients were advised to perform exercises on a daily basis.

2.5. Statistical analysis

The data obtained from the recordings of the condylar pathways were evaluated statistically. The mean value and standard deviation were assessed. The Friedman test was used to evaluate the condylar pathway values both for group A (T_0 , T_1 , T_A , T_2) and group B (T_0 , T_1 , T_2). To evaluate the differences between the groups the Mann Whitney *U* test was used. The level of significance was $p < 0.05$.

3. Results

Figs. 1–3 indicate the mean and standard deviation of condylar pathway values during PR, OC and M movements for group A. There were no significant differences in X, Y, Z and S values between time periods during PR and OC movements ($p > 0.05$). There was a significant increase in the value of Z ($p = 0.014$) and S ($p = 0.038$) in M movement. The increase was seen between measurements at T_0 and T_A periods.

For group B the mean and standard deviation of condylar pathway values in PR, OC and M movements at each time period are shown in Figs. 4–6. There was only a significant increase in the

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