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Clinical Paper
TMJ Disorders

Intraoperative comparison of single- and double-puncture techniques in temporomandibular joint arthrocentesis

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Abstract. The objective of this study was to compare techniques for temporomandibular joint (TMJ) arthrocentesis intraoperatively and to determine the ease of performance of these techniques for the physician. A total of 33 TMJ treatments were done using single-puncture arthrocentesis (SPA) type 1, SPA type 2, and double-puncture arthrocentesis (DPA) ($n = 11$ in each treatment group) between December 2013 and December 2017. A retrospective analysis of the duration of the procedure (minutes), occurrence of complications, number of cannula relocations, and ease of the procedure was performed. Ease of the procedure was measured using a Likert-type visual analogue scale (VAS; 0–10). All measurement variables were recorded intraoperatively, and related data were analyzed statistically. Significant differences were found between SPA type 2 and the other techniques in terms of procedure duration and ease of the procedure ($P < 0.05$). No significant differences were found in the occurrence of complications or number of cannula relocations between the techniques ($P > 0.05$). Compared to the other TMJ arthrocentesis techniques, SPA type 2 is easier, and physicians can perform it in a shorter time.

Key words: arthrocentesis; double-puncture; single-puncture; temporomandibular joint (TMJ).

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Arthrocentesis of the temporomandibular joint (TMJ) is a minimally invasive surgery for the treatment of TMJ disorders that can generally be used in patients who do not respond to conservative treatment[1–3]. The main objectives of TMJ arthrocentesis include removal of the synovial fluid and other elements in the upper joint space, provision of adequate synovial fluid viscosity, and removal of adhesions by means of hydraulic pressure. The procedure is suggested to decrease friction between the intra-articular surfaces, to lyse adhesions, and to flush out the chemical mediators of pain by irrigation[4–6]. Several techniques and modifications have been described to improve the performance of the procedure[7]. In 2015, Şentürk and Cambazoğlu catego-

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rized TMJ arthrocentesis techniques into two types based on the number of entry points into the upper joint space[8]: single-puncture arthrocentesis (SPA) and double-puncture arthrocentesis (DPA).

The SPA technique, first described in 2007, involves the establishment of fluid inflow and outflow through separate lumens of a single cannula to irrigate the upper joint space[9]. This method was classified as SPA type 2 by Şentürk and Cambazoğlu[8]. In 2008, Guarda-Nardini et al. reported a technique using fluid input and output through the single lumen of one port[10]; this technique was classified as SPA type 1[8]. The SPA technique is favourable in terms of the reproducibility of the procedure, with a single puncture into the upper joint space being sufficient[11]. However, the procedure involves blind insertion of the cannula, which is sometimes considered a disadvantage despite the use of a single puncture point[7].

The DPA technique is the conventional TMJ arthrocentesis technique. This was first described in 1991 and involves the irrigation of the upper joint space using two separate ports and cannulae[1]. The DPA technique, which is accomplished by entry into the upper joint space through two separate points corresponding to the articular fossa and eminence, is particularly difficult because of the blind insertion of the second cannula into the upper joint space[11].

Few studies comparing these techniques have been reported in the literature, and these clinical and experimental studies have not found any statistically significant differences between the techniques[12–16]. Furthermore, no study appears to have evaluated the ease of performance of these techniques for the physician or the associated comfort of the procedure for the patient.

The aim of this study was to compare the SPA type 1, SPA type 2, and DPA techniques and to evaluate the ease of performance of these techniques for the physician and thereby the comfort of the procedure for the patient. The study specifically evaluated the arthrocentesis techniques in terms of the duration of the procedure (minutes), occurrence of complications, number of cannula relocations, and ease of the procedure. The ease of the procedure was measured using a Likert-type visual analogue scale (VAS; 0–10).

Materials and methods

This retrospective study enrolled 34 patients with available clinical records, who were treated with arthrocentesis between December 2013 and December 2017 in the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Süleyman Demirel University. Patients were treated for TMJ disorders by SPA or DPA under local anaesthesia. The local ethics committee of the Süleyman Demirel University Faculty of Medicine approved the study protocol. All patients were informed of the nature of the surgical and experimental procedures, and their informed consent was obtained before surgery.

Inclusion criteria were as follows: minimum age of 18 years, Wilkes stage III TMJ disorder[17], persistent pain in the TMJ area, limited mouth opening, failure of conservative treatment of at least 6-month duration (medical or splint therapy, etc.), and availability of the patient's clinical data.

The following exclusion criteria were applied: the presence of any systemic disease that could affect the TMJ region, the presence of a malignant disease in the head and neck region, an uncooperative patient, a history of previous TMJ surgery, and any study data missing from the clinical records.

Panoramic radiographs of the TMJ were obtained for all patients. When necessary, magnetic resonance imaging (MRI) of the TMJ was also performed for the radiological diagnosis. The patients were divided randomly into three treatment groups: SPA type 1, SPA type 2, and DPA.

Arthrocentesis procedure

After disinfecting the skin with povidone–iodine, an auriculotemporal nerve block was administered using 1–2 ml of 2% articaine hydrochloride (DS Forte Ultracain; Sanofi Aventis); this was injected into the joint cavity and the needle was withdrawn gently. All of the surgical interventions were performed by the same surgeon (M.F.Ş).

For the DPA technique, a posterior puncture method was performed, as described by Alkan and Etöz[18]. The puncture points were marked 10 mm anterior and 2 mm inferior to the tragus for the first cannula, and 7 mm anterior and 2 mm inferior to the tragus for the second cannula. Irrigation of the upper joint space was achieved by means of two 21-gauge cannulae. After the insertion of the two 21-gauge needles into the upper joint space, the joint was irrigated under high pressure with a flow of 100 ml sterile saline solution.

For the SPA type 1 technique, one 21-gauge needle was used. The first reference point used in DPA was marked on the skin. With this technique, the inflow and outflow occurred through the same cannula and lumen, as described by Guarda-Nardini et al.[10]. The joint was irrigated under high pressure with a flow of 100 ml sterile saline solution.

For the SPA type 2 technique, the same reference point as in the SPA type 1 technique was marked on the skin. The procedure was performed using a soldered Y-shaped disposable cannula made up of two 21-gauge needles, which enabled fluid inflow and outflow through the same cannula but separate lumens, as described by Rahal et al.[11]. The joint was irrigated under high pressure with a flow of 100 ml sterile saline solution.

No intra-articular injections of any medication were administered into the joints at the end of the procedures. Postoperative anti-inflammatory drugs were prescribed for 7 days. Postoperative recommendations for the patients included mouth opening exercises 10 times daily, the use of occlusal splints (which were prepared preoperatively), and a soft diet for 10 days.

Measurement variables

Following the completion of all procedures, data were recorded for statistical analysis. These included demographic data (patient age and sex), number of cannula relocations, occurrence of complications, the ease of the procedure, and the duration of the procedure. The operating surgeon graded the ease of the procedure using a 10-point Likert-type VAS, with 0 representing extremely simple and 10 representing extremely difficult procedure. The duration of the procedure was defined as the period between the insertion and extraction of the TMJ arthrocentesis cannulae from the skin, measured in minutes. The occurrence of complications was recorded as 'yes' or 'no'.

Statistical analysis

IBM SPSS Statistics version 21.0 (IBM Corp., Armonk, NY, USA) was used for the data analysis. The Shapiro–Wilk test was used to evaluate the normality of the data distribution. Data relationships were analyzed using the Kruskal–Wallis *H*-test or χ^2 test, with a significance level of 0.05 ($P < 0.05$). When significance was detected using the Kruskal–Wallis *H*-test, a post-hoc multiple comparisons test was performed to determine which data group exhibited a significant difference.

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