

Original Article

Joint cavity injection combined with manual reduction and stabilization splint treatment of anterior disc displacement

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Abstract: Aim: This study aimed to compare the clinical efficacy of upper and lower joint cavity treatment (UJCT vs. LJCT) in patients with anterior disc displacement without reduction (ADDw/oR) of temporomandibular joint (TMJ). Material and methods: A total of 56 patients with unilateral ADDw/oR were randomly divided into two groups: UJCT group and LJCT group. Manual reduction was done in all the patients after joint cavity rejection of sodium hyaluronate. Then, they were treated with stabilization splint for one or two months. At last, Friction index was calculated to evaluate the therapeutic efficacy at 6 to 12 months follow-up. Results: The maximal mouth-opening degrees in the both groups increased significantly when compared with pre-treatment group ($P < 0.01$), and the Friction index decreased significantly when compared with pre-treatment group ($P < 0.01$); In LJCT group, the degrees of maximal mouth-opening increased significantly as compared to UJCT group ($P < 0.05$), and Friction index were also markedly lower than that in UJCT group ($P < 0.05$). Conclusion: In the patients with ADDw/oR of TMJ, the clinical efficacy of LJCT is superior to that of UJCT, especially in the TMJ pain relief, mouth-opening degree and mandibular movement improvement.

Keywords: Temporomandibular joint disc, friction

Introduction

Temporomandibular joint (TMJ) with anterior disc displacement without reduction group (ADDw/oR) is the most common type of temporomandibular disorders (TMD). In recent years, a large number of studies have used about simple joint cavity lavage and injection for the treatment of ADDw/oR [1-4]. Because the lower cavity lavage and injection are more difficult than operation is, procedures are carried out in the upper cavity in more cases. This study aimed to compare the clinical efficacy of upper and lower joint cavity injection combined with manual reduction and stabilization splint treatment in ADDw/oR of TMJ, and the clinical use of lower joint cavity treatment was discussed.

Materials and methods

Clinical characteristics and methods

A total of 56 patients (56 unilateral TMJs; 35 women and 21 men; age range: 14-48 years;

mean age: 25.70 ± 8.57 years) were diagnosed with TMJ ADDw/oR by physical examination, radiographies, contrast examination and magnetic resonance image (MRI), and so on. All the patients didn't receive any other treatments before admission. ADDw/oR patients were randomly divided into two groups: upper joint cavity treatment group (UJCT; 28 patients, 28 TMJs) and lower joint cavity treatment group (LJCT; 28 patients, 28 TMJs). Manual reduction was done in all the patients after joint cavity rejection of sodium hyaluronate. Then, stabilization splint treatment was done for one or two months.

The joint cavity treatments in our study included upper and lower joint cavity lavage and sodium hyaluronate injection, manual reduction and stabilization splint treatment. The procedures for stabilization splint treatment were as follows: the splints were made with thermo-hardening plastics (**Figure 1**). Well-occlusion was gained by adjustment after they were worn in the mouth (**Figure 2**). The thickness of bilat-



Figure 1. Stabilization splints made with thermo-hardening plastics.

eral posterior areas of the splints was about 3 mm. All the patients were instructed that the splints should be worn continuously except eating and tooth-brushing, re-examination should be performed every one or two weeks, and the treatment continued for one or two months [5, 6].

Regular follow-up and observation of index

Every patient in our study received joint cavity injection of sodium hyaluronate twice (once fortnightly). Pain, maximal mouth-opening degree, opening type, articular clicking, mandibular movement and clinical manifestations in Schuller's position radiography and arthrography of the superior cavity were recorded after 6-12 months' follow-up. At last, Friction index was determined to evaluate the therapeutic efficacy [7].

Statistical analysis

Data were compared with analysis of variance (ANOVA) and two-sample t-test and statistical analysis was done with SPSS version 14.0 for windows. A value of $P < 0.05$ was considered statistically significant.

Results

The mean mouth-opening degree, mouth-opening degree improvement and Friction index in three groups were expressed as means \pm standard deviation ($\bar{x} \pm s$) (**Table 1**).



Figure 2. Well-occlusion gained by adjustment after worn in the mouth (3 mm in thickness in bilateral posterior areas of the splints).

In our study, 28 (28 TMJs) of 56 patients with unilateral ADDw/oR received upper joint cavity treatment and the remaining patients received lower joint cavity treatment. All the patients after treatment received regular follow-up. The average duration of follow-up was 6-12 months.

Maximal mouth-opening degrees in UJCT and LJCT groups increased significantly when compared with pre-treatment group ($P < 0.01$), and the Friction index decreased significantly as compared to pre-treatment group ($P < 0.01$).

In LJCT group, the improvement of degrees of maximal mouth-opening was better than that in UJCT group ($P < 0.05$), and the Friction index was also markedly lower than that in UJCT group ($P < 0.05$).

In the follow-up period, articular clicking in two groups after manual reduction treatment disappeared after splint treatment; the pain, maximal mouth-opening degree and opening-type in patients with unfinished disc-reduction were also improved dramatically after splint treatment.

Discussion

When TMJ ADDw/oR occurs, the articular disc locates in front of the condyle, the anterior state was kept in the mouth-closed position, and the normal structure relationship with the condyle cannot be restored in the mouth-opened position. This leads to a series of temporomandibular joint dysfunctions, such as limitation of mouth-opening, abnormal change in mouth-opening type, opening-pain, and so

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Table 1. Mean Maximal Mouth-opening Degree, Mouth-opening Degree Improvement and Friction Index in three Groups ($\bar{x} \pm s$)

Groups	Maximal mouth-opening degree (mm)	Mouth-opening degree improvement (mm)	Friction index					
			Mandibular movement (MM) (0-16)	Joint noise (JN) (0-4)	Joint pressure (JP) (0-6)	Dysfunction index (DI) DI = (MM + JN + JP)/26	Palpation index (PI) PI = MP/28	Craniomandibular index (CMI) CMI = (DI + PI)/2
Before treatment	19.51 ± 1.02		3.95 ± 1.01	2.32 ± 0.43	2.63 ± 0.81	0.34 ± 0.06	0.17 ± 0.03	0.26 ± 0.05
A	32.40 ± 2.26*	11.23 ± 2.85	2.21 ± 0.32*	1.23 ± 0.09*	1.97 ± 0.02*	0.21 ± 0.01*	0.09 ± 0.02*	0.15 ± 0.02*
B	36.77 ± 1.38*	19.17 ± 1.55 ^Δ	1.38 ± 0.49*	0.41 ± 0.12*	1.16 ± 0.37*	0.11 ± 0.03* ^Δ	0.05 ± 0.01*	0.08 ± 0.03* ^Δ

Footnotes: A: upper joint cavity treatment group, B: lower joint cavity treatment group; * $P < 0.01$ vs. pre-treatment group; ^Δ $P < 0.05$ vs. A group.

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on. TMJ ADDw/oR is the most common type of TMD. In recent years, simple joint cavity lavage and injection have been used as the most common strategy for the treatment of ADDw/oR, which may abolish or alleviate the symptoms, but most of treatments are carried out in the upper cavity [1-3, 8-11]. Patients often fail to receive a complete or effective treatment and the best time for treatment is delayed due to noncompliance to a logical and reasonable treatment procedure. In our study, manual reduction and stabilization splint treatment were done after joint cavity lavage and intra-articular injection treatment, achieving favorable clinical efficacy. In addition, the clinical efficacy of LJCT was superior to that of UJCT.

In the present study, TMJ ADDw/oR was treated at three steps: joint cavity lavage and intra-articular injection, manual reduction, and stabilization splint treatment.

First, the abnormal joint synovial fluid containing intra-articular inflammatory mediators and cytokines, impurities, and so on may be removed by joint cavity lavage. Intra-articular injection was done with sodium hyaluronate. Hyaluronic acid is a major component of joint synovial fluid and joint cartilage matrix proteoglycans. The exogenous hyaluronic acid with large molecular weight has the following important physiological advantages: 1) Hyaluronic acid is an effective lubricant of joint surface interface; 2) Hyaluronic acid with the capability of molecular sieve not only provides essential nutrients for the joint cartilage and other organizations, but becomes a natural barrier for bacteria, toxins, immune complexes, and so on; 3) Hyaluronic acid with gel-like feature uneasily extravasate through the joint capsule, and can easily relieve the intra-articular "vacuum" effect generated by excessive load and unusual pressure of joint. 4) Exogenous hyaluronic acid with large molecular weight (such as sodium hyaluronate) can coat the pain-producing substances or block the pain receptors or nociceptors. This may exert an analgesic effect; 5) Hyaluronic acid is an important component of the cartilage matrix proteoglycans. Exogenous hyaluronic acid with high molecular weight (such as sodium hyaluronate) can significantly inhibit the degradation of proteoglycans, cover and protect the damaged cartilage cells, and promote proteoglycan synthesis; 6) Exogenous hyaluron-

ic acid with large molecular weight (such as sodium hyaluronate) can also restore and promote the synthesis function of synovial cells; 7) Exogenous hyaluronic acid with large molecular weight can increase the viscoelastic function of synovial fluid, enhance intra-articular rheology state, and promote the restoration of joint function; 8) The toxic effects of sodium hyaluronate injection treatment have not yet been reported. Sodium hyaluronate can be injected at multiple time points, the interval between injections can be shortened, and it can also be applied in children or even infants [12-14]. The splint was used in our study for stabilization. The splint has following advantages: 1) The splint covers the entire surface of the bite and cutting edge of all the dentition. Its masticatory surface is much smoother and more spot-contact with no teeth tip and fossa locking relationship between maxillary and mandible. This relationship will help the self-adjustment of the lower jaw position and the disc-condyle relationship restoration; 2) The leverage produced by the splint can keep a constant negative pressure in the joint cavity. This also helps to restore the disc-condyle relationship or joint rebuilding. 3) The stabilization splint therapy can relax masseters and relieve joint pain [15, 16].

On the whole, the joint pain caused by inflammatory mediators can be eliminated or relieved by joint cavity lavage. The joint cavity injection of sodium hyaluronate can not only relieve the intra-articular "vacuum" effect generated by excessive load or unusual pressure of joint, but improve the lubrication and increase the articular cavity. This may further help the manual reduction. The subsequent stabilization splint treatment will help the self-adjustment of the lower jaw position and the disc-condyle relationship restoration or consolidation. Otherwise, the disc displacement without reduction impedes the slide and rotation of the condyle, leading to the limited mouth-opening and other joint dysfunctions. Therefore, it is essential to reduce the disc as soon as possible for the restoration of anterior disc displacement without reduction treatment, and the best time for manual reduction usually is four weeks after injury. The disc reduction for more than three months has a poor efficacy because of intra-articular adhesion and disc deformation, and pseudo-disc may form at the extension department (bilaminar zone) of the disc.

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In our study, results showed, for patients with ADDw/oR of TMJ, the therapeutic efficacy of upper and lower joint cavity injection combined with manual reduction and stabilization splint treatment was better than that of simple joint cavity lavage and intra-articular injection treatment. The clinical efficacy of lower joint cavity treatment was also superior to that of upper joint cavity treatment, especially in the TMJ pain relief, mouth-opening degree and mandibular moving improvement. This may be related to following factors: Lower joint cavity is smaller than upper joint cavity in the temporomandibular joint, the disc mainly covers the condylar surface, and TDJ disease or degenerative change in TDJ mainly occurs in lower joint cavity and condyle. Therefore, in lower joint cavity treatment, the drug used may exert effect at the injured area, and the disc is easier to reduce because of tension factors. There are significantly more patients in whom articular clicking appeared once more in the LJCT group than those in the UJCT group, and the reason is that anterior disc transformed from displacement without reduction to displacement with reduction after treatment. However, most of the articular clicking can be corrected by stabilization splint treatment [9, 17, 18].

Conclusions

In summary, in patients with ADDw/oR of TMJ, both LJCTr and UJCT (LJCT and UJCT followed by manual reduction and stabilization splint treatment) have favorable clinical efficacy, and the clinical efficacy of LJCT is much better than that of UJCT, especially in the TMJ pain-relief, mouth-opening degree and mandibular moving improvement.

Disclosure of conflict of interest

None.

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