

## Original Research Article

# Efficacy of intra-articular hyaluronic acid sodium injection in combination with arthroscopic surgery for temporomandibular joint disc displacement

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### Abstract

**Purpose:** To evaluate the effectiveness of intra-articular injection of sodium hyaluronate in conjunction with arthroscopic surgery for the treatment of temporomandibular joint disc displacement.

**Methods:** The study involved 120 patients with temporomandibular joint disc displacement treated at Cangzhou Central Hospital, Hebei Province, China between January 2019 and December 2022. These patients were randomly allocated into control and study groups comprising 60 patients each. Control group was treated with arthroscopic surgery, while the study group was received a combination of hyaluronic acid sodium intra-articular injection and arthroscopic surgery. Visual analogue scale (VAS), degree of mouth opening, recovery of joint function (TJFI) and recurrence of disease condition were evaluated one month and six months after surgery for both groups.

**Results:** Following the treatment, the study group exhibited notable advantages over the control group. Pain intensity in the study group was significantly lower than that in the control group ( $p < 0.05$ ). The study group demonstrated significantly improved mouth opening compared to the control group ( $p < 0.05$ ). The TJFI index of the study group was significantly superior to that of the control group ( $p < 0.05$ ). Furthermore, the study group experienced a substantially lower recurrence rate than the control group ( $p < 0.05$ ).

**Conclusion:** Intra-articular hyaluronic acid sodium injection in combination with arthroscopic surgery is a safe and effective treatment for temporomandibular joint disc displacement. This therapeutic strategy substantially improves mouth opening, mitigates pain, and reinstates joint function, while demonstrating a low recurrence rate. Future studies utilizing larger sample sizes, incorporating multiple centers for a more diverse patient population, and involving long-term follow-up to assess the efficacy and safety of combined treatments with hyaluronic acid sodium joint cavity injection and joint disc surgery will be required to establish the findings of this investigation.

**Keywords:** Sodium hyaluronate, Temporomandibular joint disc displacement, Joint disc surgery, Efficacy, Recurrence rate

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## INTRODUCTION

Temporomandibular joint disc displacement is a common disorder affecting the temporomandibular joint, often associated with poor coordination or injury involving the disc and the condyle [1]. This condition often manifests with distressing symptoms, including restricted mouth opening, pain, chewing difficulties, and joint noises, significantly diminishing the patient's quality of life and potentially affecting their mental well-being [2]. Presently, the prevailing treatment options for temporomandibular joint disc displacement involve conservative and surgical approaches [3]. Nevertheless, the effectiveness of conservative treatment is constrained, falling short of completely alleviating symptoms and restoring joint function, with a propensity for recurrence. Surgical treatment can indeed restore joint function but comes with substantial surgical risk and potential postoperative complications. Hence, it is of utmost importance to identify a treatment approach that is both safe and efficacious, with a reduced likelihood of recurrence. The combined use of intra-articular sodium hyaluronate (intra-articular hyaluronic acid sodium injection) in combination with arthroscopic surgery for the management of temporomandibular joint disc displacement has garnered significant attention in recent years as an emerging therapeutic approach. The administration of sodium hyaluronate injection into the joint cavity stimulates the production of joint fluid, thereby mitigating joint pain and inflammation, and facilitating the preservation and restoration of cartilage [4].

Joint disc surgery aims to re-establish the proper alignment and functional movement of joint disc, ultimately addressing the issue of temporomandibular joint disc displacement at its core [5]. Although the effectiveness of this treatment plan has been preliminarily verified, its application still faces some challenges and uncertainties. Hence, this study endeavors to assess the effectiveness and safety associated with the combined use of intra-articular hyaluronic acid sodium injection in combination with arthroscopic surgery in addressing temporomandibular joint disc displacement. The intention is to furnish scientific substantiation and a point of reference for treatment.

## METHODS

### Basic patient information

A total of 120 patients with temporomandibular joint disc displacement who visited the Cangzhou Central Hospital, Hebei Province, Cangzhou,

China between January 2019 and December 2022 were selected as the study population. Basic information such as age, gender, disease duration, pain severity, degree of mouth opening, and etiology were obtained. The 120 patients were randomly divided into control group and study group, with 60 patients in each group. Ethical approval for this study was obtained from Cangzhou Central Hospital, Cangzhou (approval no.197979793) and the study followed the guidelines of Declaration of Helsinki [6].

### Inclusion criteria

Patients within the age range of 18 to 50 years, diagnosed with temporomandibular joint disc displacement, having endurance of temporomandibular joint symptoms for a minimum of 6 months with classification as stage 3 to 5 according to the Wilkes-Bronstein system, indicating structural disorders of the temporomandibular joint and voluntarily willing to participate in this study, demonstrated by the signing of an informed consent form were included.

### Exclusion criteria

Presence of temporomandibular joint bone diseases, rheumatoid arthritis, systemic lupus erythematosus, or other autoimmune disorders; Affliction with organic conditions such as temporomandibular joint tumors, tuberculosis, purulent infections, or similar diseases; Suffering from severe heart, lung, liver, kidney, or other organ-related ailments; Prior history of temporomandibular joint surgery or other relevant surgical interventions; Refusal to sign the informed consent form or inability to fully cooperate with this study, for various reasons, which may include patient or familial factors.

### Surgical procedures and management

For control group, the arthroscopic surgery was conducted in the following manner:

Before surgery, patients underwent a series of relevant examinations, including temporomandibular joint X-rays, magnetic resonance imaging (MRI), and other assessments to determine surgical indications and methods. Patients were required to fast for 6 - 8 h before the scheduled surgery. General anesthesia was typically administered for surgery, although local anesthesia could also be considered. After the anesthesia was administered, patients were positioned semi-recumbent or laterally, with their mouths held open.

Following routine disinfection, draping, and the administration of local anesthesia, a double cannula was introduced into the upper articular cavity, and arthroscopy was employed to observe the displacement of the joint disc. A puncture was made on the lateral side of the anterior superior crypt, and a low-temperature plasma radiofrequency ablation head was introduced to release the anterior disc appendage fully. A long needle was passed through the junction of the posterior band of the articular disc, the posterior intervertebral disc area, and the posterior band respectively to reset the articular disc and fix it with sutures.

Following the surgery, the patient was hospitalized for 1 - 2 days for observation so that the joints are allowed sufficient rest and specific exercises. The focus was on avoiding excessive stress and activity to ensure the results of the surgery are not affected.

Study group underwent arthroscopic surgery combined with sodium hyaluronate intra-articular injection. The treatment method and operation for joint disc surgery were consistent with those of control group. Subsequently, 2 mL sodium hyaluronate intra-articular injection was administered once a week for 3 consecutive weeks. Both groups of patients were followed up for 6 months after treatment.

### **Evaluation of parameters/indices**

#### ***Visual analogue scale (VAS) [7]***

This was used to evaluate the pain level of patients before and one month after treatment. The VAS score ranges from 0 to 10, with 0 indicating no pain and 10 indicating the most severe pain. A higher score indicates a greater degree of pain.

#### ***Degree of mouth opening***

The degree of mouth opening of patients was quantified before and one month after treatment. The degree of mouth opening is an important indicator for evaluating the recovery of temporomandibular joint function. It was measured using calipers or a traction device, and the measurement standard was the degree of mouth opening.

#### ***Recovery of joint function***

The joint function recovery index (TJFI) [8] was used to measure patients' joint function recovery before and one month after treatment. The TJFI

score ranges from 0 to 30, with 0 indicating normal function and 30 indicating complete loss of function. A higher score indicates a poorer recovery of joint function.

### **Recurrence**

Six months after treatment, recurrence was observed through imaging examinations such as temporomandibular joint X-ray, CT or MRI, to evaluate the recurrence of patients.

### **Statistical analysis**

Microsoft Excel spreadsheet was used to analyze data obtained from the study. Continuous variables were expressed as mean  $\pm$  standard deviation (SD), and comparisons were conducted using *t*-test. Categorical variables are presented as n (%) and assessed using chi-square test. Statistical significance was set at  $p < 0.05$ .

## **RESULTS**

In the control group, there were 60 patients with a mean age of  $32.6 \pm 5.4$  years, comprising 35 males and 15 females. The duration of disease was  $18.3 \pm 3.2$  months. Visual Analog Scale (VAS) score averaged  $8.8 \pm 1.2$  points, and degree of mouth opening reached  $30.2 \pm 3.5$  mm. Etiological factors included 18 cases of trauma, 22 cases of chondritis, and 20 cases of disc ligament laxity. Similarly, study group consisted of 60 patients with an average age of  $33.2 \pm 5.1$  years, among whom 33 were males and 27 were females. Disease duration was  $19.1 \pm 3.5$  months, and the VAS score averaged  $8.9 \pm 1.3$  points, with a degree of mouth opening of  $29.5 \pm 3.1$  mm. Etiological factors in this group comprised 20 cases of trauma, 19 cases of chondritis, and 21 cases of disc ligament laxity. The baseline information of the two patient groups were comparable ( $p > 0.05$ ; Table 1).

Before treatment, there was no significant difference in pain intensity between the two groups of patients ( $p > 0.05$ ). After treatment, the pain intensity in study group was significantly lower than that in the control group ( $p < 0.05$ ; Table 2).

Before treatment, there was no significant difference in mouth opening between the two groups ( $p > 0.05$ ); after treatment, the mouth opening in study group was significantly better than that in the control group ( $p < 0.05$ ; Table 3).

**Table 1:** Comparison of baseline information between the two groups of patients (n = 60)

Characteristic	Control group	Study group	t/χ <sup>2</sup>	P-value
Age (years)	32.6±5.4	33.2±5.1	0.625	0.532
<b>Gender</b>			0.135	0.712
Male	35	33		
Female	25	27		
Duration of illness (months)	18.3±3.2	19.1±3.5	1.306	0.193
VAS score	8.8±1.2	8.9±1.3	0.0	1.0
Diameter of open mouth (mm)	30.2±3.5	29.5±3.1	1.159	0.248
<b>Etiology</b>			<b>0.154</b>	<b>0.694</b>
Trauma	18	20		
Chondritis	22	19		
Disc ligament laxity	20	21		

**Table 2:** Comparison of Pain Intensity between the two groups of patients (n = 60)

Group	VAS score (points)	
	Before treatment	After treatment
Control	8.8±1.2	4.2±1.7
Study	8.9±1.3	2.8±1.4
T	0.0	4.924
P-value	1.0	<0.001

**Table 3:** Comparison of mouth opening degree of two groups of patients (n=60)

Group	Diameter of open mouth (mm)	
	Before treatment	After treatment
Control	30.2±3.5	39.46±4.27
Study	29.5±3.1	42.74±3.95
T	0.159	4.367
P-value	0.248	<0.001

**Table 4:** Comparison of the degree of joint function recovery between the two groups of patients (n=60)

Group	TJFI index (points)	
	Before treatment	After treatment
Control	18.95±4.74	7.67±3.41
Study	18.76±4.82	5.13±2.82
t	0.217	4.446
P-value	0.828	<0.001

**Table 5:** Comparison of recurrence between the two groups of patients (n=60)

Group	Relapse	No relapse	Recurrence rate (%)
Control	11	49	18.33%
Study	2	58	3.33%
χ <sup>2</sup>	-	-	6.987
P-value	-	-	0.008

Before treatment, there was no significant difference in TJFI index between the two groups ( $p > 0.05$ ). After treatment, TJFI index of study group was significantly better than that of control group ( $p < 0.05$ ; Table 4).

At 6 months after the operation, the recurrence rate in the control group was 18.33%, while it was 3.33% in study group. The recurrence rate in study group was significantly lower than that in control group ( $p < 0.05$ ; Table 5).

## DISCUSSION

Temporomandibular joint disc displacement refers to the change in the relative position of the temporomandibular joint disc and the joint head. The disc no longer completely covers the joint head when opening the mouth, and even dislocates from joint cavity and moves forward [9]. This disease is usually accompanied by symptoms such as clicking or popping sounds, and pain [10]. Currently, the etiology of temporomandibular joint disc displacement is not well understood in practice. Some studies have

suggested that this disease may be related to factors such as abnormal development of the mandible and skull, abnormal joint structure and function, imbalance between the mandible and skull, and disordered or dysfunctional muscles around the temporomandibular joint [11].

The treatment methods for temporomandibular joint disc displacement are conservative treatment and surgical treatment. Conservative treatments are oral physical therapy, oral therapy, medication, acupuncture, massage, etc. The purpose of conservative treatment is mostly to help patients relieve their symptoms, but it has no significant effect on the restoration of the disc position and function [12]. Surgical treatment modalities encompass arthroscopic surgery, open surgery, and other approaches. The purpose of surgical treatment is to restore the position and function of patient's joint disc, thereby fundamentally solving the patient's condition [13]. However, in practice, studies have found that there are still some shortcomings in isolated joint disc surgery [14-16], primarily manifested in the following aspects: Solely addressing the issue of temporomandibular joint disc displacement without addressing its underlying causes. Temporomandibular joint disc displacement is a symptom that may be linked to various factors, such as abnormal temporomandibular joint structure, improper occlusion, or muscle disorders. Isolated joint disc surgery involves relocating the displaced joint disc, but it does not tackle potential underlying causes, which results in a higher risk of recurrence.

Moreover, joint disc surgery typically involves the surgical opening of temporomandibular joint, disc relocation, and subsequent suturing. This procedure leads to substantial surgical trauma and necessitates an extended recovery period. Some patients may also experience postoperative complications. While arthroscopy mitigates the need for a surgical incision, it is still an invasive procedure and does not eliminate the risk of postoperative complications.

Temporomandibular joint arthritis is a prevalent pathological condition affecting the temporomandibular joint, resulting in the degeneration and damage of the joint's cartilage and capsule. This leads to joint pain and functional impairments, and conventional joint disc surgery may offer limited efficacy in such cases. Therefore, isolated joint disc surgery only solves the problem of joint disc displacement, and does not effectively treat damage to joint cartilage and joint capsule.

To address the above shortcomings of joint disc surgery for the treatment of temporomandibular joint disc displacement, a study proposed to combine it with the sodium hyaluronate joint cavity injection method [17]. Sodium hyaluronate is a naturally occurring polysaccharide found in synovial fluid that exhibits properties that include lubrication, inflammation reduction, and the promotion of chondrocyte growth [18]. Injecting sodium hyaluronate into the joint cavity effectively alleviates temporomandibular joint inflammation and pain, while also promoting joint cartilage repair and regeneration. Following joint disc surgery, sodium hyaluronate joint cavity injection further enhances joint cartilage repair and regeneration, shortening the patient's postoperative recovery time, reducing pain, and enhancing the treatment outcome [19,20].

Based on the above reasons, this study investigated the efficacy and recurrence rate of intra-articular hyaluronic acid sodium injection in combination with arthroscopic surgery in the treatment of temporomandibular joint disc displacement, and compared it with simple joint disc surgery, in order to find a safer and more effective treatment method. The study's findings demonstrated that the combined treatment led to a significant reduction in pain among patients with temporomandibular joint disc displacement. Moreover, it significantly improved the degree of mouth opening, restored joint function and decreased the recurrence rate.

#### **Limitations of this study**

It is important to note that this study is based on a single-center design with a limited sample size. Consequently, there is a potential for selection bias and information bias in the results. Secondly, the study's follow-up period is relatively short, spanning only 6 months. This limited timeframe prevents an assessment of long-term treatment efficacy and recurrence rates. Moreover, detailed factors related to hyaluronic acid sodium joint cavity injection, such as dosage, frequency, and treatment duration, are not explored. These parameters could potentially impact treatment outcomes.

#### **CONCLUSION**

The utilization of intra-articular sodium hyaluronate injection in conjunction with arthroscopic disc surgery for the treatment of temporomandibular joint disc displacement produces a substantial enhancement in mouth-opening capability, pain reduction, and the restoration of joint function. Moreover, this approach maintains a low recurrence rate.

Studies aiming for larger sample sizes, incorporate multiple centers are recommended for a more diverse patient population and should include long-term follow-up to assess the efficacy and safety of combined treatments involving hyaluronic acid sodium joint cavity injection and joint disc surgery.

## DECLARATIONS

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None provided.

### Ethical approval

Ethical approval for this study was obtained from Cangzhou Central Hospital, Cangzhou (approval no.197979793).

### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Conflict of Interest

No conflict of interest associated with this work.

### Contribution of Authors

The authors declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. Xiaotong Wei and Jing Gao designed the study. Zhizhengrong Tian and Fengyun Zhao performed the investigations. Hao Wang and Wei Yan conducted experiments, analyzed the data. All authors contributed to editorial changes in the manuscript, and also read and approved the final manuscript.

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