

# Arthroscopic Treatment for Intra-Articular Adhesions of the Temporomandibular Joint

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**Purpose:** To introduce arthroscopic surgery of intra-articular adhesion of the temporomandibular joint (TMJ) upper compartment and evaluate its effect.

**Patients and Methods:** One hundred forty-two patients (159 joints) with intra-articular adhesions confirmed by arthroscope were treated with lysis of the adhesions, intra-articular cleanup surgery, or capsule radiofrequency catheter ablation. One hundred ten patients (123 joints) with disc displacement were treated with the disc repositioning and suturing technique. The follow-up index includes jaw movement, visual analog scale pain value, and patients' self-evaluation. The therapeutic effect was divided into excellent, good, and poor. Excellent and good patients were defined as effective. Jaw movement and visual analog scale pain value before and after the operation were evaluated by a paired *t* test.

**Results:** The average follow-up period was 10.3 months (range: 2–27 months), and 33.80% (48/142) of all joints were excellent; 56.34% (80/142) were good, and 9.86% (14/142) were poor. The total effectiveness rate was 90.14% (128/142). Of all patients, 93.66% (133/142) felt more comfortable than they had before the operation. The interincisal opening increased from a preoperative  $23.14 \pm 5.93$  mm (range: 10–40 mm) to postoperative  $37.48 \pm 3.51$  mm (range: 30–40 mm;  $P < .01$ ), and the pain scores were reduced from  $28.94 \pm 23.54$  (0–80) to  $4.44 \pm 10.10$  (0–40;  $P < .05$ ).

**Conclusion:** The effect of arthroscopic surgery on temporomandibular joint intra-articular adhesion was positive. It can increase the mouth's range of motion, improve jaw function, and reduce pain during jaw movement.

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*J Oral Maxillofac Surg* 69:2120–2127, 2011

Temporomandibular joint (TMJ) intra-articular adhesion (IA), a common symptom accompanying TMJ

capsule diseases, has a high incidence.<sup>1</sup> It is particularly common in chronic disc displacement but rare in

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0278-2391/11/6908-0014\$36.00/0

doi:10.1016/j.joms.2010.12.039

trauma, joint infection, and rheumatic arthritis. In the past, most cases were not treated effectively because of a lack of awareness. Today, however, we can diagnose and treat<sup>2,6</sup> IA with the effective application of arthroscopic techniques. In this study, we used lysis of adhesions, intra-articular cleanup surgery, and/or capsule radiofrequency catheter ablation to treat 142 TMJ IA patients (159 joints) and evaluate the effect of arthroscopic surgery.

## Patients and Methods

### PATIENTS

Arthroscopic surgery was performed on 142 patients (159 joints) who visited the TMJ clinic at the Ninth People's Hospital, Shanghai Jiao Tong University, School of Medicine, between May 2001 and August 2003. Each patient's TMJ internal derangement (ID) and IA were confirmed by arthroscope and pre-operative magnetic resonance imaging. The study included 26 male and 116 female patients with a mean age of 43.65 years (range: 12–73). The mean duration of symptoms was 32.43 months (range: 3–96). Among them, there were 4 patients (4 joints) with ID II, 51 patients (60 joints) with ID III, 33 patients (34 joints) with ID IV, and 54 patients (61 joints) with ID V, based on Wilkes-Bronstein's classification.<sup>7–11</sup> This study was conducted in accordance with the Ethics Committee of Shanghai JiaoTong University School of Medicine.

### INCLUSION CRITERIA

Patients first had an initial clinical examination and magnetic resonance imaging. Then the patients' TMJ ID was classified into 1 of the 5 stages based on Wilkes and Bronstein's classification criteria<sup>7</sup>; only patients with stages II to IV were included in this study. The classification is as follows: stage II: patients with occasional pain, mild obstacles in jaw function, restricted movement resulting from disc displacement with reduction and mild disc deformity; stage III: patients with chronic pain, more serious obstacles in jaw function, restricted movement due to disc displacement without reduction and mild to moderate disc deformity; stage IV: patients with chronic pain, more serious obstacles in jaw function, restricted movement due to disc displacement without reduction and mild to moderate disc deformity co-occurring with severe disc posterior band hypertrophy, and abnormal bone structure; stage V: patients with chronic pain, fricative, severe obstacles in jaw function, restricted movement due to disc displacement without reduction, disc perforation accompanied by obvious disc deformation, and degenerative bone changes.

### ARTHROSCOPY SYSTEM

A 2.4-mm arthroscope, including a video monitoring system and an image printer (Stryker, San Jose, CA) with a 2.7-mm outer protective cannula was used for diagnostic and therapeutic arthroscopy. The coblation device uses bipolar radiofrequency energy (ArthroCare System 2000; ArthroCare, Sunnyvale, CA) the power of which is classified into grades labeled 1 through 9. The probe is 0° and measures 1.5-mm in diameter. The arthroscopic system includes a 2.4 mm, 0° angle-view Stryker optical system, a Stryker light source, and a Sony video recorder and color monitor.

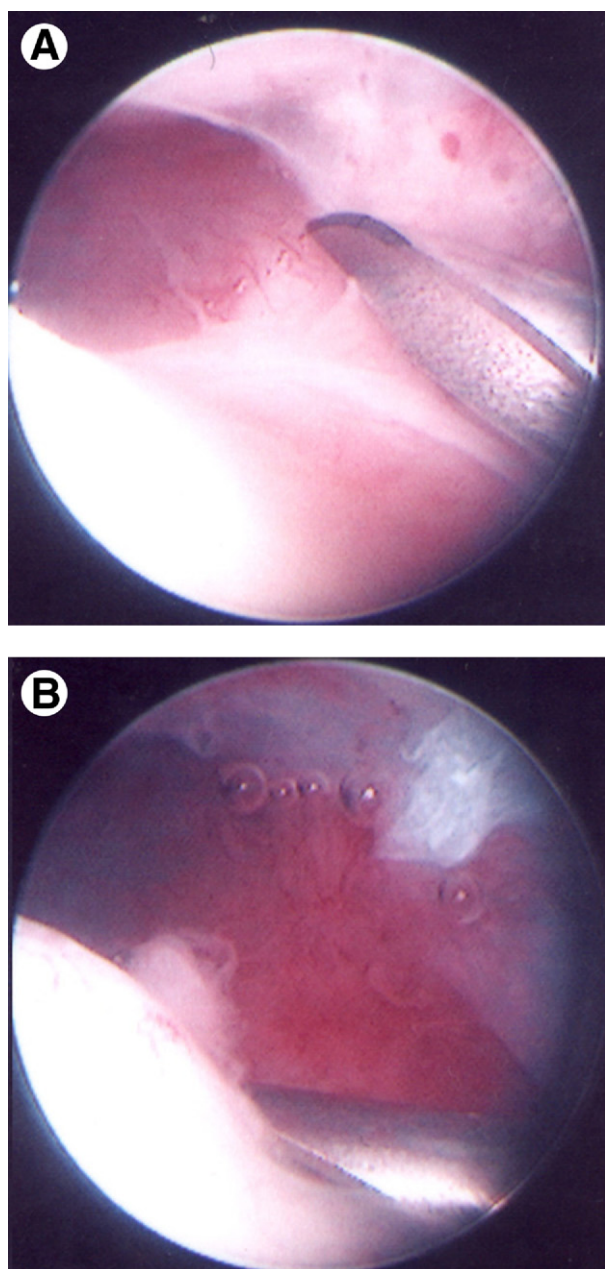
### OPERATION PRINCIPLES

Depending on the grade of adhesions (grades I–IV),<sup>12</sup> we use different types of arthroscopic procedures to treat IA. We mainly use disc repositioning and suturing to treat the disc displacement and IA in those patients with disc displacement and no obvious disc deformation.<sup>13</sup> We use disc repositioning and suturing plus arthroscopic lysis for grade I adhesions, disc repositioning, and suturing plus debridement and/or arthroscopic coblation for grade II or greater adhesions, and additional lateral pterygoid muscle lysis for those with disc displacement and disc deformation. According to the grade of joint disc perforation or rupture, we use different treatment methods: lysis of adhesions plus debridement and/or arthroscopic coblation for patients with grade 0 joint disc perforation; lysis of adhesions plus debridement and/or arthroscopic coblation and joint disc perforation repair for grade I; lysis of adhesions plus debridement and/or arthroscopic coblation and dealing with cartilage and bone lesions, if necessary, for disc excision in grades IV and above.

**Arthroscopic lysis (Figs 1–3):** Arthroscopic lysis can be performed in all grades of IA. For IA of grade I, we use a size 12-gauge needle (Fig 1) or probe (Fig 2) to perform lysis of adhesion or cut the adhesion when performing disc repositioning and suture under the surveillance of the arthroscopic system. For grade II, because of the flexibility of fiber, we first use scissors (Fig 3) to cut the adhesion and then take it out with a biopsy or cuplike forceps. For grade III, probe or scissors can be used to perform lysis of the adhesion; for grade IV, we use a blunt-headed needle.

**Arthroscopic debridement<sup>14</sup> (Figs 4, 5):** We apply manual and electric shaver cutting devices, used in grade II adhesions with degenerative cartilage, to debride the hyperplasia bones.

**Arthroscopic coblation<sup>15</sup> (Figs 6–8)** for grade II adhesion differs from the traditional cold melting technology of an electric knife and electric coagulation. It involves impressing a certain voltage on the conductive liquid between the electrode and the target tissue thus transforming the liquid into a vapor-



**FIGURE 1.** Arthroscopic lysis. A, The adhesion was cut using the needle. B, The adhesion fibers left after arthroscopic lysis.

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ized layer or plasma and breaking the molecule chain through the collision of charged particles and the target tissue. This is basically a cutting and clearing procedure. The working temperature varies from 40°C to 70°C, acting only on the 0.1 mm surface of target tissue and rarely causing thermal burns on adjacent tissues. While the target tissues are cleared, small blood vessels in adjacent tissues are coagulated.

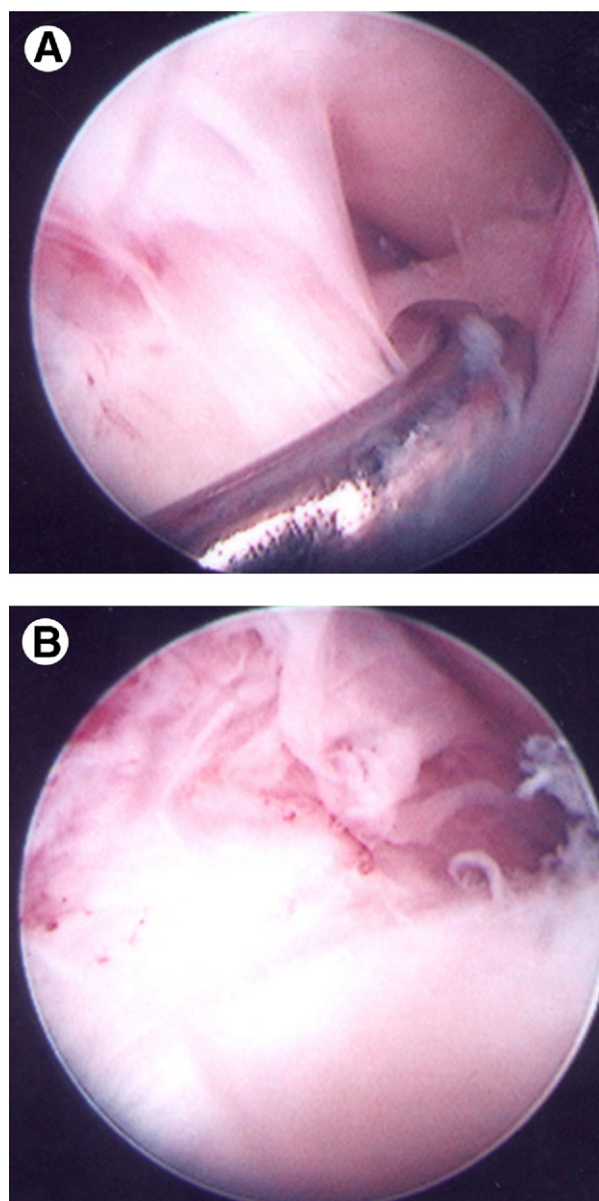
ArthroCare is convenient to operate. The electrode head can be freely aimed at target tissues, and it can

even be operated without contact to minimize thermal burns. In addition, ArthroCare can be used for smoothing cartilage surface, disc cutting, and anterior release.<sup>8</sup>

#### CLINICAL EVALUATION

The evaluation, including the methods and the successful criteria, was based on Yang (1998)<sup>14</sup> statistical analyses.

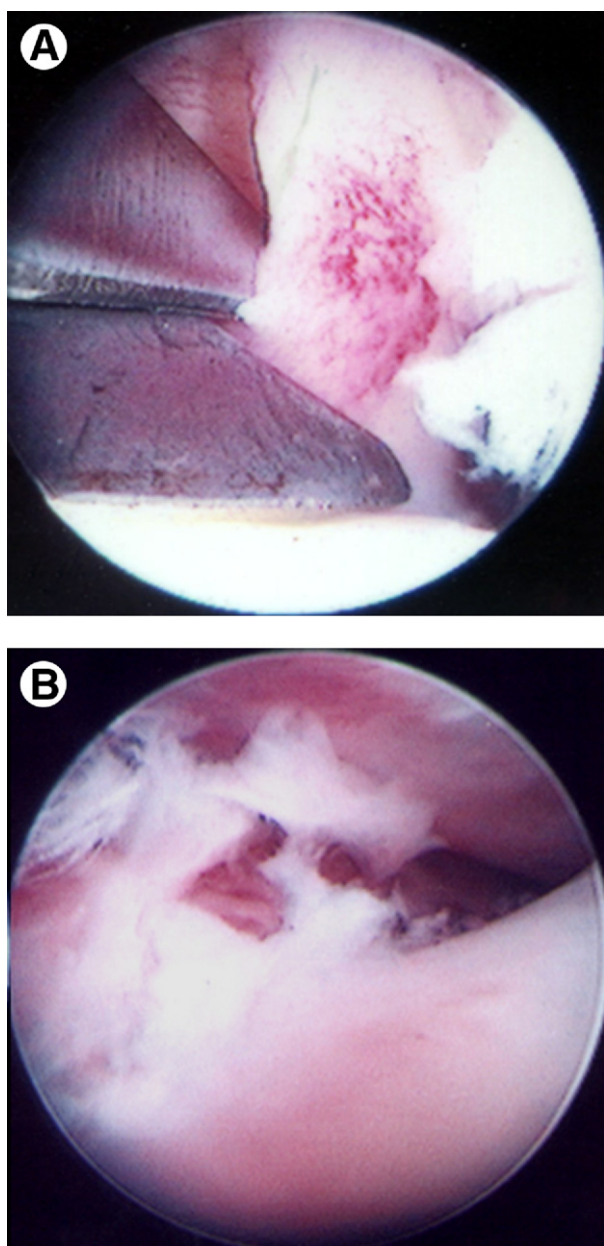
The mouth opening range and pain value, using a visual analog scale (VAS) before and after the operation, were evaluated by a paired *t* test using the SPSS



**FIGURE 2.** Arthroscopic lysis. A, The adhesion was cut using the probe. B, More adhesion fibers left after arthroscopic lysis.

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**FIGURE 3.** Arthroscopic lysis. A, The adhesion was cut using the scissor. B, More adhesion fibers left after arthroscopic lysis.

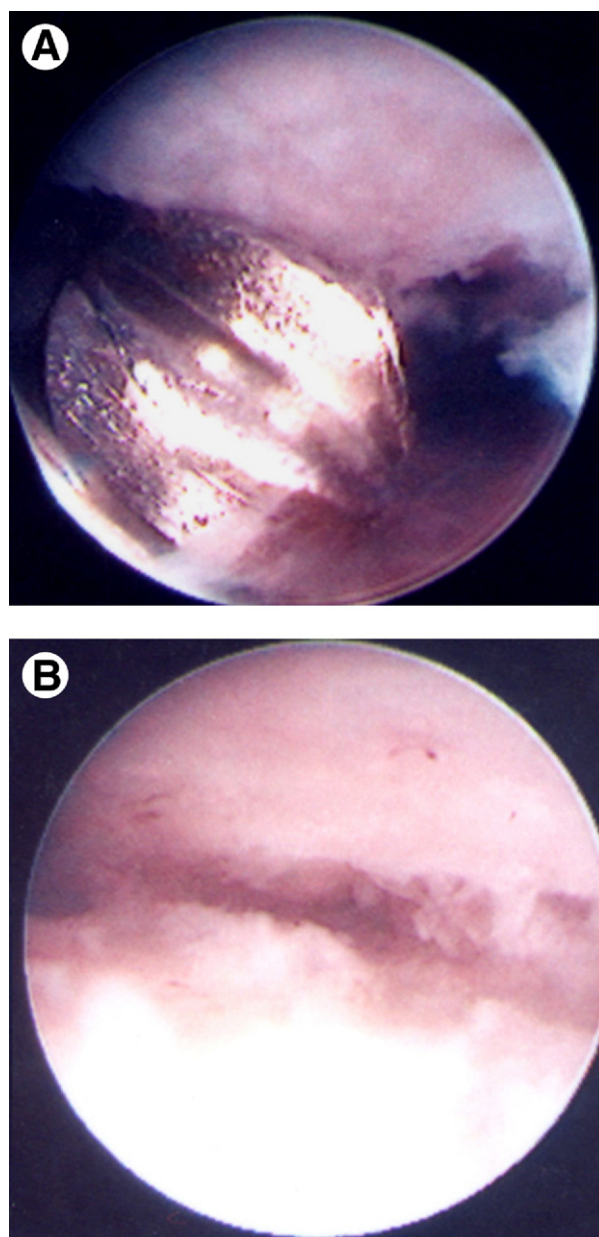
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16.0 software package (Version 16.0; SPSS, Chicago, IL).

## Results

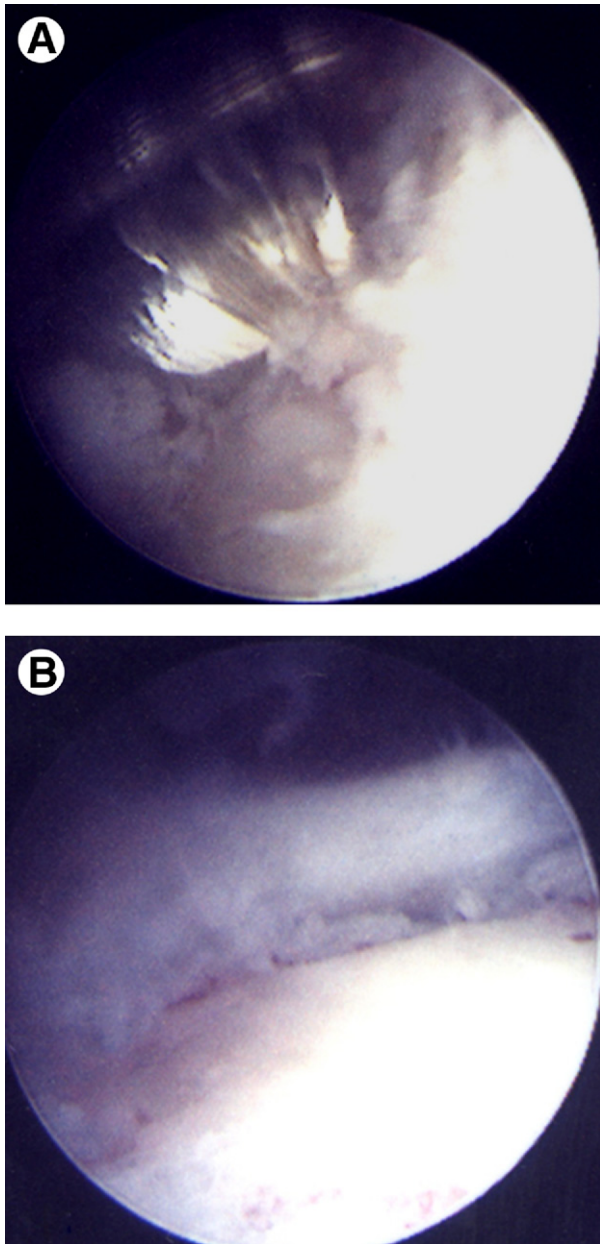
Of 142 patients (159 joints) with TMJ IA, 110 (123 joints) also had articular disc displacement, and 32 (26 joints) had osteoarthritis of the joints. The average follow-up period was 10.3 months (range: 1–27 months) with 33.80% (48/142) of all joints being excellent; 56.34% (80/142) good; and 9.86% (14/142)

poor. The total effective rate was 90.14% (128/142), and 93.66% (133/142) of all patients felt more comfortable than they did before the operation. The interincisal opening increased from preoperative ( $23.14 \pm 5.93$  mm; range: 10–40 mm) to postoperative ( $37.48 \pm 3.51$  mm; range: 30–40 mm;  $P < .01$ ), and the pain scores reduced from  $28.94 \pm 23.54$  (range: 0–80) to  $4.44 \pm 10.10$  (range: 0–40;  $P < .05$ ).



**FIGURE 4.** Arthroscopic debridement. A, The adhesion in the articular eminence was debrided using the electric shaver cutting device. B, More adhesion fibers left after arthroscopic debridement.

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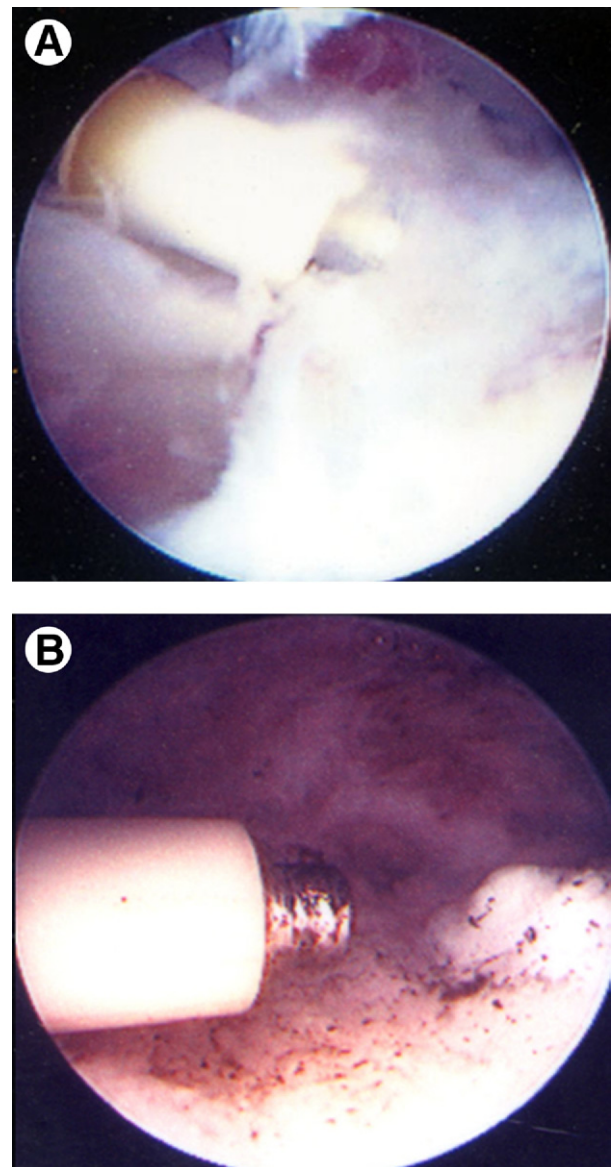
**FIGURE 5.** Arthroscopic debridement. *A*, The degenerative cartilage and hyperplasia bone were removed using the electric shaver cutting device. *B*, The articular surface was not completely smooth after arthroscopic debridement.

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## Discussion

In 1986,<sup>2</sup> Sanders first put forward IA treatment of adhesion lysis; however, it is difficult to remove the adhesion completely with this method alone, and relapse may occur. Mosby<sup>3</sup> obtained satisfactory results by applying adhesion lysis and debridement to treat IA. However, debridement can damage the adjacent synovial membrane, causing bleeding and leaving adhesion fibers. Some researchers<sup>4,5</sup> have achieved

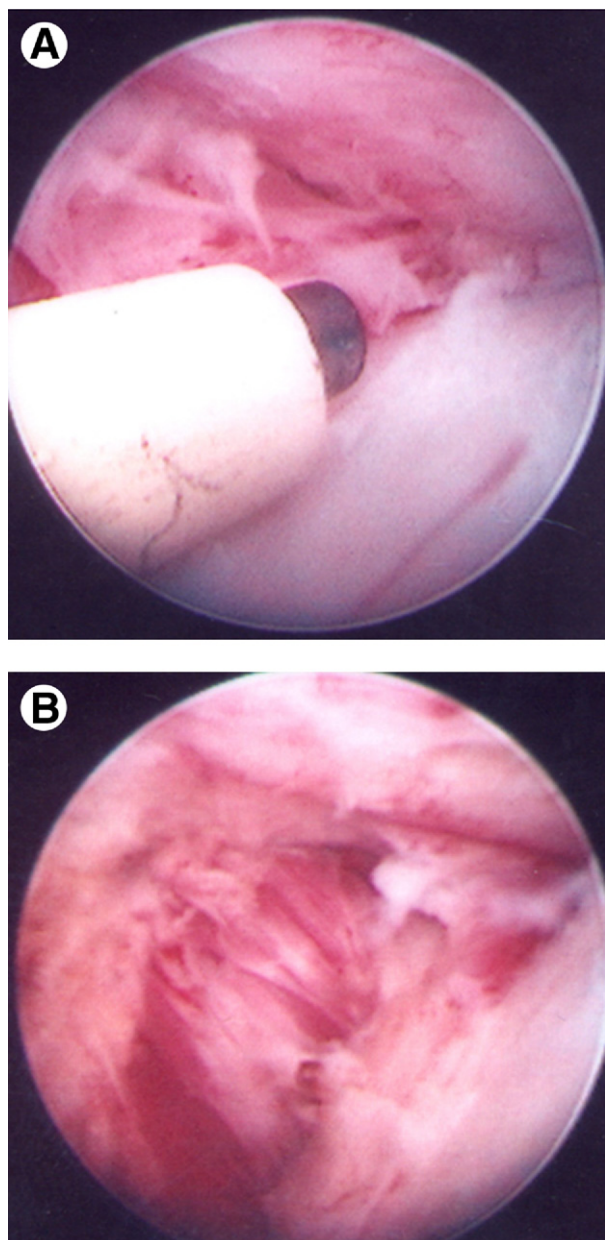
positive results by introducing laser release and cleaning adhesion, although this method often causes thermal burns. Therefore, it is a priority to explore and overcome such shortcomings in the treatment of IA. The advent and international recognition of the arthroscopic coblation instrument in the late 20th century triggered a revolution in the development of arthroscopic devices, exhibiting notable advantages, including low-temperature, minor trauma, no charring, no smoke, greater treatment accuracy (0.1 mm), and improved hemostatic function.<sup>6</sup> In the adhesion treatment of large joints, some researchers have reported<sup>6,16</sup> improved results and prevention of recur-



**FIGURE 6.** Arthroscopic coblation. *A*, The adhesion was removed using the arthroscopic coblation. *B*, The articular surface was smooth after arthroscopic coblation.

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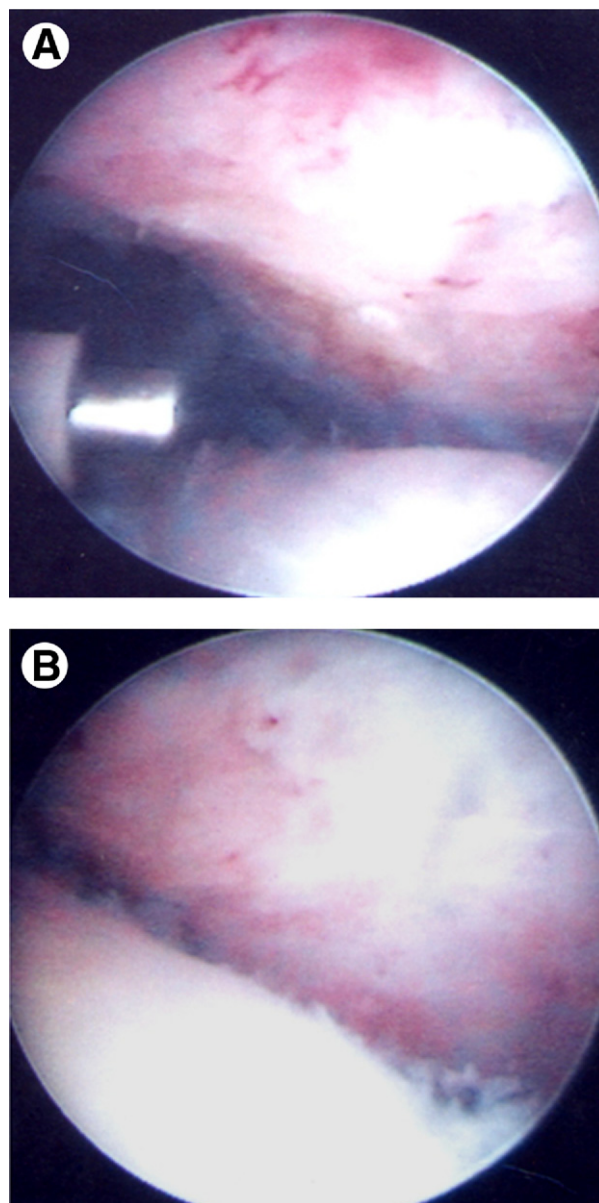
**FIGURE 7.** Arthroscopic release. A, The anterior release was carried out using the arthroscopic coblation. B, The view after arthroscopic coblation.

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rence by using arthroscopic coblation. Through this research, we will introduce this technology into TMJ surgery to treat IA and evaluate its postoperative effects. IA is an accompanying symptom of ID, and thus we cannot consider adhesion in isolation. We should adopt different therapies according to different phases of ID and grades of IA. From a total of 142 IA patients (159 joints), we applied intra-articular cleanup to 40 patients (44 joints), arthroscopic coblation to 48 patients (54 joints), and disc repositioning

and suturing with 110 patients with disc displacement (123 joints), accounting for 77.26% of all joints.

As shown by the numbers cited earlier, the arthroscopic coblation and disc repositioning and suturing are the main techniques used to treat IA, which differs from previous studies.<sup>3,16</sup> In this study, we did not use arthroscopic lysis, debridement, and arthroscopic coblation for adhesions but made reasonable choices to achieve satisfactory results. Clinically, disc repositioning and suturing is the main therapy used to treat patients with disc displacement, but the small adhesions are broken due to the repositioning



**FIGURE 8.** Arthroscopic coblation. A, The degenerative cartilage was removed using the arthroscopic coblation. B, The articular surface was smooth after arthroscopic coblation.

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of the disc. For those patients whose adhesions cannot be pulled off, manual, electric, or ablation devices and electric shaver cutting devices should be used to remove the degenerative cartilage and hyperplasia bone, cut the residual adhesion fibers, and smooth joint surface to obtain joint surfaces contour.

At present, researchers disagree on the indicators of success in arthroscopic treatment. Some regard improvement of mouth opening as an indicator of success, but a majority believe that the extent to which the pain affects patients' daily life should also be considered.<sup>17-19</sup> The evaluation method for mouth opening is different from that stated earlier. Some scholars compute or compare the change by the percentage of improvement in mouth opening, whereas others regard certain numerical values such as 35 mm,<sup>20</sup> 38 mm,<sup>21,22</sup> or 40 mm<sup>23-25</sup> as normal mouth-opening indicators. Pain is evaluated through description or VAS, and the success rate of most researchers<sup>17-19,21</sup> varies from 73% to 93%. As to the effect of these cases, on the basis of the criteria established by Professor Yang,<sup>14</sup> we achieved a total effective rate of 90.14%. Of all patients, 93.66% (133/142) felt more comfortable than before the operation, which was better than the results that most researchers have reported. This was probably because of different ID phases and evaluation criteria, especially with some new methods such as disc repositioning and suturing and arthroscopic coblation. In this case, 110 patients (123 joints) underwent disc repositioning and suturing, which was regarded as the unrealized objective in Mosby's study.<sup>3</sup> For the joints that were evaluated as "poor," it could be seen that 9 were in ID V; therefore, improvement of the effect on patients in ID V was an issue for further discussion. The results of the paired *t* test of mouth opening before and after the procedure and VAS pain scores show a significant difference before and after the operation. Thus, the effect of arthroscopic surgery on TMJ IA was statistically corroborated. These encouraging results may lead to more patients avoiding surgery with severe trauma and instead receiving arthroscopic treatment with minor trauma.

In conclusion, although the average follow-up period for patients in this group was only 10.3 months, which is a short-term clinical evaluation and requires longer-term follow-up, it can be concluded that the arthroscopic treatment for TMJ IA produced a positive effect by increasing patients' mouth-opening ability, improving jaw function, and reducing pain with jaw movement. Further investigation should be carried out on the degree of adhesion, the relationship of signs and symptoms, and recurrence after the operation. However, it is clear that the overall effect of arthroscopic surgery on TMJ IA was positive and contributed to increasing the range of motion in

patients' mouths, improving jaw function, and reducing the pain during jaw movement.

### Acknowledgment

This study was supported by grants from the Shanghai Leading Academic Discipline Project (Project No. S30206), the Shanghai Municipal Bureau of Health (Grant No. 2008160), the Shanghai "Phosphor" Science Foundation (Grant No. 04QMH1415), the Ph.D. Programs Foundation of Shanghai Jiao Tong University School of Medicine (Grant No. BXJ0926), the Research Fund of Medicine and Engineering of Shanghai Jiao Tong University (Grant No. YG2009MS42), the Ph.D. Programs Foundation of the Ministry of Education of China (Grant No. 20090073110068), and the National Natural Science Foundation of Shanghai (Grant No. 10ZR1418200).

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