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Corresponding author:
Young-Keun Lee
Department of Orthopedic Surgery, Medical School of Jeonbuk National University, 20 Geonji-ro, Deokjin-gu, Jeonju 54907, Korea
Tel: +82-63-250-2576
Fax: +82-63-271-6538
E-mail: trueyklee@jbnu.ac.kr
ORCID:
https://orcid.org/0000-0001-8749-4135

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Arthroscopic synovectomy of the wrist

Young-Keun Lee, Jong-Hong Kim

Department of Orthopedic Surgery, Research Institute of Clinical Medicine of Jeonbuk National University-Biomedical Research Institute of Jeonbuk National University Hospital, Jeonju, Korea

The theoretical rationale of synovectomy is to reduce or eliminate the aggressive inflammatory cell mass, thereby reducing swelling, decreasing pain, and improving joint function. Traditionally, open-wrist synovectomy is the standard treatment, as it allows an inspection of all compartments and extensor tendons. Arthroscopic synovectomy of the wrist was first introduced by Roth and Poehling in 1990. Since then, it has been successfully performed in selected patients. Arthroscopic synovectomy might be indicated in any disease that leads to long-standing synovitis of the wrist and when other treatment modalities do not provide satisfactory symptom reduction or may be contraindicated. Arthroscopic synovectomy is a surgical procedure with minimal morbidity. It results in less damage to the joint capsule and ligaments, thereby hastening rehabilitation and shortening the hospital stay. Therefore, we think that understanding the surgical technique for wrist arthroscopic synovectomy and appropriately applying it to patients could prevent disease progression in patients with wrist arthritis and overcome incapacitating dysfunction of the upper limb, including the wrist, hand, and forearm.

Keywords: Wrist, Arthritis, Arthroscopy, Synovectomy

Introduction: Rationale and advantage

The wrist is a crucial anatomical link between the hand and forearm with multiple articular surfaces. When it is afflicted by arthritis and conditions that limit motion, it can lead to incapacitating dysfunction of the entire upper limb. Early and adequate treatment must be introduced to prevent disease progression and overcome the incapacitating dysfunction of the upper limb.

Arthroscope plays an important role in the diagnosis and treatment of arthritic conditions in the wrist ranging from palliative procedures (such as joint lavage and debridement of osteophytes or radial styloidectomy in an early scapholunate advanced collapse wrist and synovectomy in inflammatory arthritis) to more advanced procedures (such as proximal row carpectomy, limited carpal fusion, radiocarpal fusion) [1-3]. Surgical synovectomy was first described more than 100 years ago. It is a widely accepted treatment method to reduce symptoms of arthritic joints now. The theoretical rationale of synovectomy is to reduce or eliminate aggressive inflammatory cell mass, thereby reducing swelling, reducing pain, and improving joint functions [4-7]. Its local and transitory effects on systemic arthritic diseases with recurrence mainly depend on activities of the patient and the underlying cause of arthritis. However, its effects on some conditions such as postinfection monoarthritis seem to be permanent and even curative in some cases [8]. An untreated end-stage rheumatoid wrist can lead to volar dislocation with complete destruction of carpal bones and complete dissociation of the radioulnar joint. Early surgical treatment can prevent such severe pattern of destruction. Previous studies have presented results of this procedure and shown a

marked reduction of pain and improved function in patients with rheumatoid arthritis (RA) [4-7,9-11]. Arthroscopic synovectomy offers advantages over open synovectomy. It is a surgical procedure with minimal morbidity. It also leaves less joint capsule and ligament damage, thus allowing hasten rehabilitation and reducing hospital stay. In addition, arthroscopic technique offers superior view and easier access to radiocarpal and midcarpal joints in comparison with open arthrotomy. It also facilitates effective removal of pathologic synovium. Moreover, it offers minimal scarring and subsequent reduction of postoperative pain [5,12-14].

Indications

Arthroscopic synovectomy may be indicated in any diseases that can lead to long-standing synovitis of the wrist and when other treatment modalities do not provide satisfactory symptom reduction or may be contraindicated. It is an effective modality for treating patients with RA, juvenile RA, systemic lupus erythematosus, or postinfection monoarthritis. Patients who have developed osteoarthritis, posttraumatic arthritis, or persistent septic arthritis of the wrist despite systemic antibiotics and lavage can also benefit from an arthroscopic synovectomy [4-6,15].

In rheumatoid patients, a good time to consider synovectomy is when there is no response after 4 to 6 months of medication treatment. If synovitis worsens again after it is well controlled with medication initially, then synovectomy should be considered if there is no improvement for 2 to 3 months. In addition, if a change in the joint space is narrowed compared to several months ago on the radiograph, it is judged that the damage to the articular cartilage is progressing quickly and synovectomy should be performed [5,11,14,16,17]. The most important purpose of synovectomy is to preserve articular cartilage. Therefore, if articular cartilage damage has progressed, the effect of synovectomy is inevitably reduced. To date, there is no criterion established to support postponing synovectomy until the extent of articular cartilage damage has progressed. Additionally, it should be kept in mind that the wrist is not a weight-bearing joint. Since most patients with RA have low activity levels due to their chronic disease, satisfactory results might be obtained by performing a synovectomy to reduce pain. Based on Larsen's staging system [16] which classifies radiographic progression of arthritis, stage 3 is an indication for synovectomy. Larsen's arthritis stages are as follows: stage 0, normal joint space; stage 1, reduced joint space; stage 2, less than 25% erosion and loss of articular surface; and stage 3, less than 50% loss of articular surface [9-11,14,17]. In contrast, if RA has progressed, arthrodesis should be considered preferentially for patients with occupations that require heavy wrist use or high activity levels [17].

Synovectomy is often an integral part of procedures for treating conditions of degenerative nature amenable for arthroscopic surgery, such as wafer resection for ulnar impaction syndrome (UIS), debridement in scaphoid-trapezium-trapezoid (STT) osteoarthritis, radial styloidectomy for styloid impaction on the scaphoid, scaphoid nonunion advanced collapse (SNAC), and triangular fibrocartilage complex (TFCC) resection for degenerative changes [18-22]. So far, in patients with osteoarthritis, the effect of arthroscopic synovectomy is probably short-term. In addition, arthroscopic synovectomy alone cannot be used as a treatment.

Synovitis may occur in connection with arthrofibrosis following trauma or surgery to the wrist. In these cases, synovectomy, release of adhesion, and occasionally capsular release can significantly reduce symptoms and improve joint mobility [6,23].

Contraindications

The arthroscopic synovectomy is contraindicated in patients with an unstable soft tissue envelope, patients who require extensive open-wrist procedures, patients with active rheumatoid disease, those who are medically unfit, and patients with psoriatic arthropathy. Surgery is not recommended for a patient with RA if active synovitis is evident. Surgical treatment is recommended based on accurate understanding of structural condition of the joint in patients whose synovitis is controlled or reduced. The reason is that RA is a disease that systemically invades not only bones and joints, but also organs such as the lung, airway, cervical spine, and heart. So, if the main cause of a symptom is not structural damage to the joint, an unexpected problem may occur when surgical treatment is performed. However, if synovitis is uncontrollable despite maximal medical therapy, immediate surgery may be necessary [24]. Although arthroscopic synovectomy has been performed for a small number of patients with psoriatic arthropathy, results are not encouraging because synovitis is less pronounced in this disease. There is a tendency for ankylosis to occur. Hence, arthroscopic synovectomy is not currently recommended for patients with psoriatic arthropathy [5]. Relative contraindications include patients with other severe arthritic manifestations in the same arm who may not be able to manage the position normally used for wrist arthroscopy, patients with previous arthro-

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plasties in finger joints, and patients with active infection aside from the wrist [13,25].

Surgical technique

Operation is performed under general anesthesia or regional anesthesia with the patient in a supine position. The operated arm is placed in a wrist traction tower. Vertical traction of 4 to 6-kg force is applied through plastic finger traps to the middle three fingers for joint distraction on a hand table. In RA patients, care is taken to minimize the amount of traction and to distribute the traction to all fingers because many patients have increased laxity of the wrist and finger joint ligaments with frail skin (Fig. 1). A pneumatic tourniquet is applied to the upper arm. Continuous irrigation using an automatic pressure-regulated pump is preferred. The pressure of the pump is usually set at approximately 30 to 60 mmHg. However, continuous sending irrigation with aid of gravity through the scope is possible. We normally use a 2.5- or 1.9-mm video arthroscope (Linvatec, CONMED Linvatec, Utica, NY, USA), 2.0- and 2.9-mm shavers, and a radiofrequency probe for surgical instruments. We make 3/4, 4/5, and 6R portals for the radiocarpal joint and midcarpal radial (MCR) with midcarpal ulnar (MCU) portal for the midcarpal joint. To gain access to all areas of the joint and to excise as much synovial tissues as possible, additional portals such as 1/2 for radiocarpal joint and accessory portal for STT and dorsal side of the midcarpal joint can be made (Fig. 2). Exact positions for these portals are identified by first introducing a needle and using a small blunt straight mosquito to spread the subcutaneous tissue to the capsule under direct vision.

The 3/4, 4/5, and 6R portals are used as standard entry portals for the radiocarpal joint. A 2.9-mm shaver is preferred. Occasionally, a 2.0-mm shaver can be used in narrow parts of joints. All visibly inflamed synovium membranes are resected down to the joint capsule. Synovium from the dorsal capsule is excised with the arthroscope in the 6U and/ or the 1/2 portal using a shaver in 3/4 and 4/5 portals (Fig. 3). The distal radi-

Fig. 1. Traction power in a rheumatoid arthritis patient. Given the laxity of the wrist and finger joint ligaments and frail skin, it is sufficient if the traction power is maintained below 10 lbs (approximately 4.5 kg).

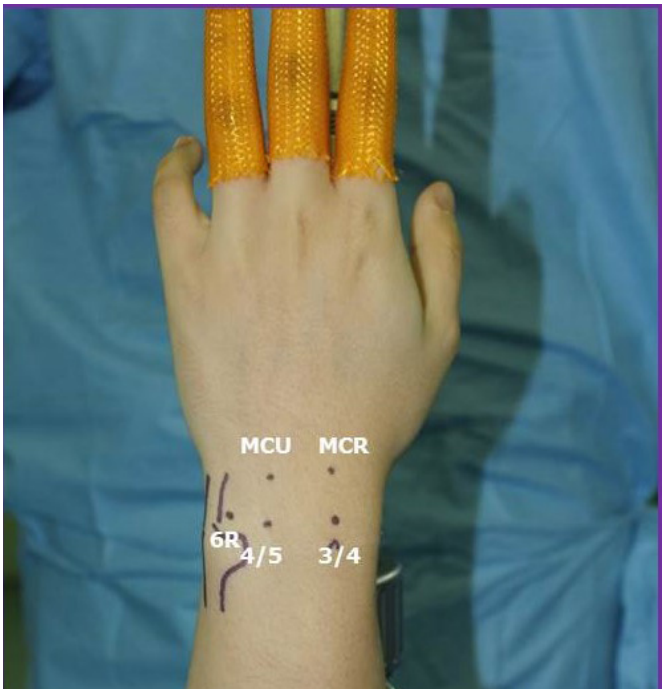

Fig. 2. Portals for basic wrist arthroscopic synovectomy. MCU, midcarpal ulnar; MCR, midcarpal radial. Written informed consent was obtained from the patient for using clinical images.

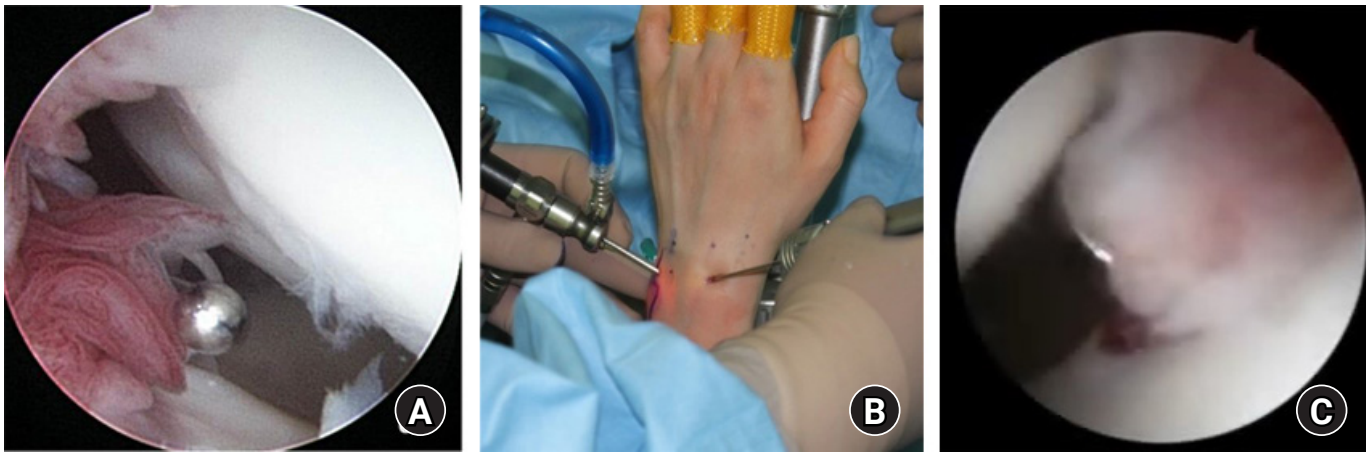

Fig. 3. Synovitis of the radiocarpal joint dorsal aspect (A). Arthroscope placed in the 6R portal and the shaver placed in the 3/4 or 4/5 portal to remove synovial tissue (B), performing synovectomy using a shaver (C). Written informed consent was obtained from the patient for using clinical images.

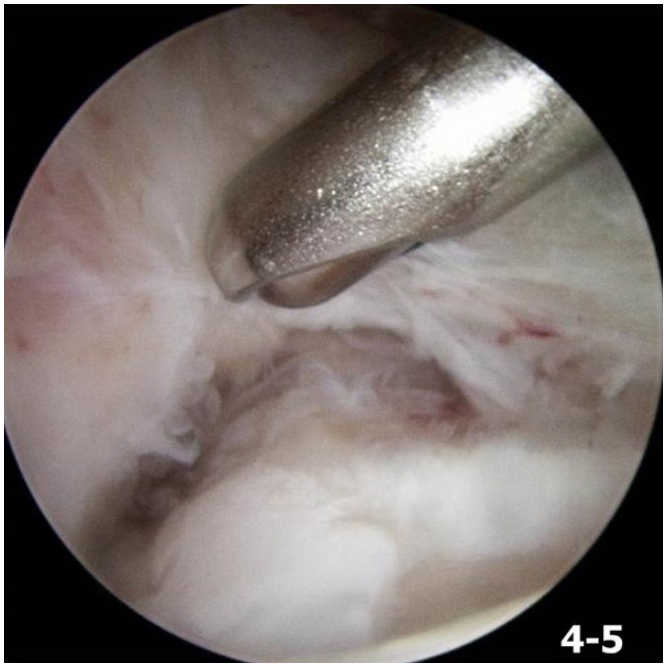

Fig. 4. Performing distal radioulnar joint synovectomy using a shaver through the 6R portal with the arthroscope placed in the 4/5 portal.

oulnar joint (DRUJ) is also often affected, frequently in conjunction with a degenerative TFCC lesion and increased laxity of the DRUJ capsule. The DRUJ can be approached through a central defect in the triangular fibrocartilage (TFC) from the radiocarpal joint. The 4/5 and 6U portals are useful for reaching and excising the synovium from the DRUJ (Fig. 4). A separate DRUJ portal can be used for synovectomy if a TFCC tear is not present. Meticulous and great care must be used at all times to avoid chondral damage to the articular cartilage. Radiofrequency probe has been advocated because small-diameter probes can facilitate access. This procedure is more rapid. It can decrease bleeding. It is essential to maintain adequate irrigation of the wrist when using a thermal probe to avoid heat buildup. Serious complications have been reported [26].

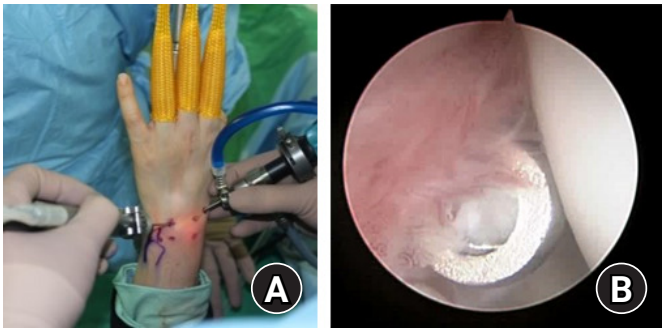

Fig. 5. Removing the synovitis of the midcarpal joint dorsal aspect with the arthroscope placed in the accessory portal and the shaver in the midcarpal ulnar portal (A). (B) Performing synovectomy using a shaver. Written informed consent was obtained from the patient for using clinical images.

MCR and MCU portals are used as standard portals for the midcarpal joint. Usually, an accessory portal to approach the STT joint about 1 cm radial and distal to the MCR portal is established. The hypertrophied synovium is removed from the STT area using the shaver from the accessory portal. Insertion of the arthroscope through this portal allows us to remove the synovium lining the dorsal midcarpal capsule with the shaver in MCR and MCU portals (Fig. 5).

In arthritis caused by RA or other connective tissue diseases, the synovitis is usually typically distributed in areas of the joint that are most mobile and where joint capsule is abundant. In

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the radiocarpal joint, most are found in the radial and ulnar recesses, on the dorsal capsule, and adjacent to the radioscapholunate ligament of Testut (Fig. 6). In the midcarpal joint, most of the synovitis can be found in the STT joint, on the dorsoulnar capsule, and beneath the capitohamate joint volarly (Fig. 7).

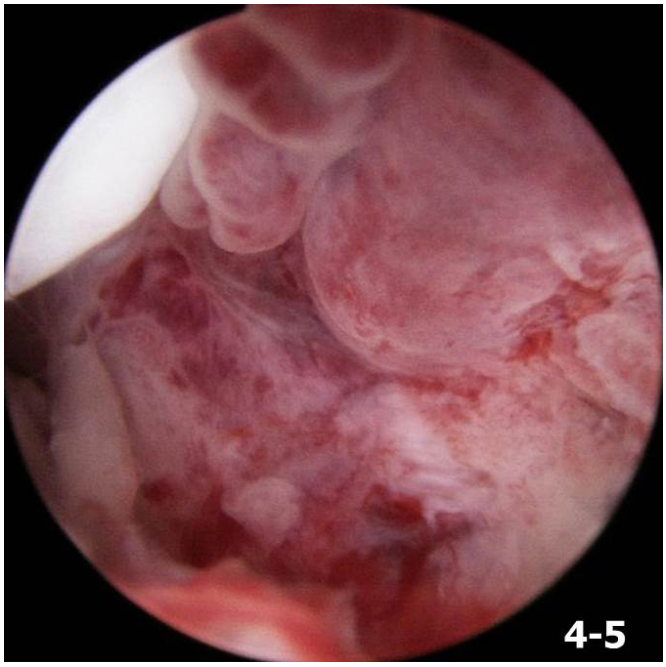

Fig. 6. Radiocarpal joint synovitis in a rheumatoid arthritis patient.

In patients with osteoarthritis caused by ulnar impaction or SNAC, synovitis is usually found in the radiaocarpal joint. However, this is different from synovitis in inflammatory arthritis such as RA, which is present along with degenerative changes in the joint membrane, ligaments, and cartilage. Therefore, sufficient debridement is performed with tissues that have undergone degenerative changes around the synovitis.

Postoperatively, a short arm splint with compressive dressing is applied and unrestricted wrist range of motion (ROM) exercise is allowed after 2 weeks postoperatively. Formal physiotherapy is not used. Patients are allowed to use their hands if comfort is permitted.

Results

It has been reported that arthroscopic synovectomy in rheumatoid wrist with no or mild radiographic changes can reduce pain and improve function, ROM, and grip strength [4-6,9,10], suggesting that long-term increased comfort can be expected in patients with rheumatoid wrist. Lee et al. [9] have reported long-term results following an arthroscopic synovectomy on 56 wrists in 49 patients with RA. The final follow-up visit was

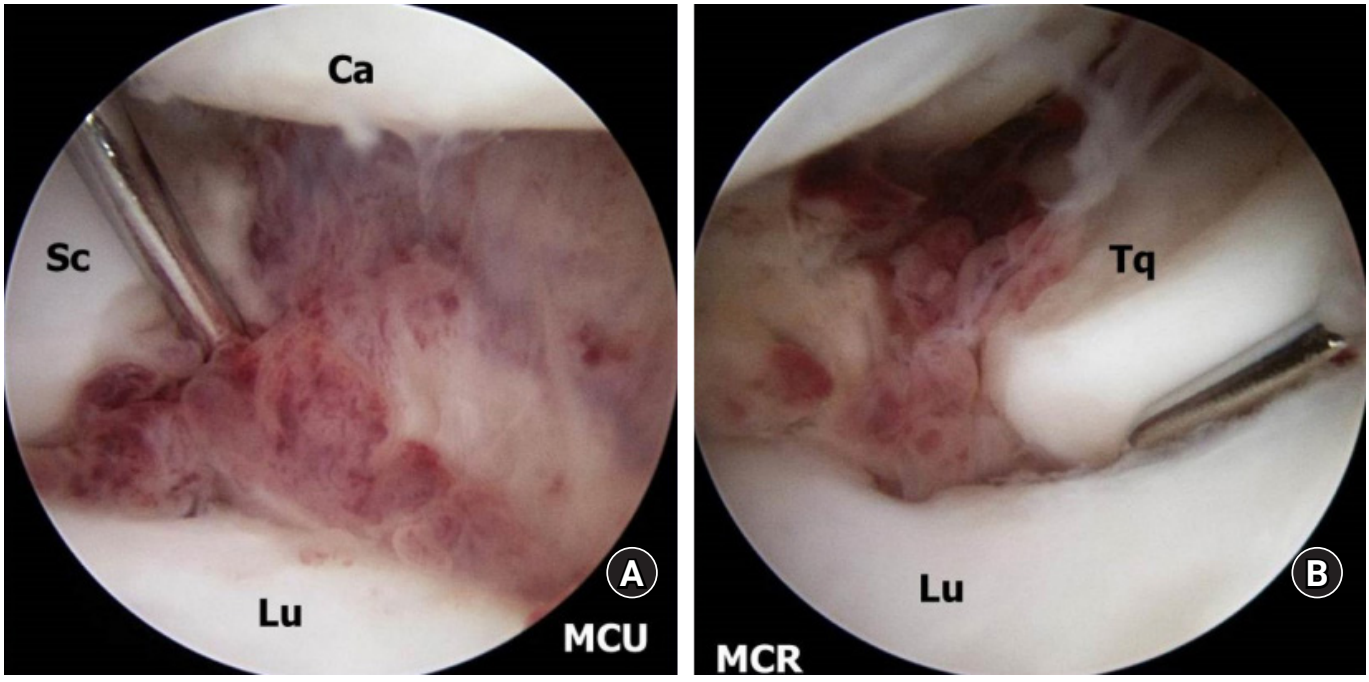

Fig. 7. Midcarpal joint synovitis in a rheumatoid arthritis patient. (A) Synovitis in the volar side of the scapho-lunate joint and midcarpal joint. (B) Synovitis in the volar side of the luno-triquetral joint and midcarpal joint. Ca, capitate; Sc, scaphoid; Lu, lunate; MCU, midcarpal ulnar; Tq, triquetrum.

completed in 33 patients (39 wrists) in an outpatient setting. The remaining 16 patients (17 wrists) were followed up by telephone interview. At a mean follow-up of 7.9 years, the mean visual analog scale (VAS) score for pain decreased from 6.3 to 1.7. The mean Modified Mayo Wrist Score (MMWS) improved from 48 to 76. Based on the MMWS, excellent results were observed in 7 wrists (18%), good results in 10 wrists (26%), fair results in 21 wrists (54%), and poor result in wrist 1 (3%). The mean preoperative wrist extension was 46° and the mean wrist flexion was 42°. Postoperatively, the mean wrist extension was 51° and the mean wrist flexion was 44°. At the final follow-up, synovitis was controlled in 42 wrists (75%) whereas it recurred in others. The mean Larsen stage progressed from 2.2 to 3.3. Analysis of preoperative variables revealed that factors such as sex, age, duration of wrist symptom, preoperative serologic inflammatory markers, and Larsen stage had no significant effect on clinical outcomes. In postinfectious arthritis patients, any discomfort from the wrist and radiographic abnormalities are not found [6,15].

In posttraumatic synovitis and arthrofibrosis, synovectomy and removal of intraarticular adhesion can improve mobility and reduce pain [15].

So far, in patients with osteoarthritis, the effect of synovectomy is probably short-term. In addition, synovectomy alone cannot be used as a treatment. Synovectomy is recommended to be performed together with a bony procedure [6,19,21,22]. UIS is a representative osteoarthritis disease of the wrist. Regarding treatment for UIS, Möldner et al. [27] have performed arthroscopic debridement for 50 patients with Palmer type 2C lesions [28]. In that study, nine out of 50 patients underwent ulnar shortening osteotomy (USO) for persistent wrist pain. The mean ulnar variance of patients who underwent USO was 2.4 mm (standard deviation [SD], 0.5 mm). However, the mean ulnar variance of patients who underwent arthroscopic debridement was only 0.5 mm (SD, 1.2 mm). It was found that Disabilities of the Arm, Shoulder, and Hand (DASH), MMWS, and VAS scores for pain measured at an average follow-up of 36 months and 38 months were significantly improved compared to those before surgery. In conclusion, in patients with Palmer type 2C lesions, arthroscopic debridement could be a sufficient and reliable treatment option. In addition, Möldner et al. [27] recommended USO for patients who complained of persistent ulnar-side wrist pain even after arthroscopic debridement with a preoperative positive ulnar variance of 1.8 mm or more. Nishizuka et al. [29] reported that simple debridement without TFCC central resection and debridement in patients without TFCC central perforation were of little benefit for the treatment of ulnar-side wrist pain. Löw et al. [18] reported results of arthroscopic TFCC debridement in 32 UIS patients by dividing them into two groups, with and without central TFCC perforation. There were 16 patients in each group. The dominant hand was damaged more in the group without central TFCC perforation than in the group with central TFCC perforation. The central perforation group showed a statistically significantly longer ulnar than the group without perforation. However, there was no difference in patient's age, duration of symptoms, or work disability between the two groups. For the group with central TFCC perforation, the margin of the TFCC lesion was first resected using a punch. Debridement was then performed using a shaver. For the group without central TFCC perforation with degenerative change of TFC mainly occurring on the proximal surface, TFC was perforated using a probe and resected using a punch for ulnocarpal decompression. After that, debridement was performed using a shaver [30,31]. During an average follow-up of 1.7 years, four patients in each group underwent USO due to persisting symptoms and two patients underwent repeated debridement, resulting in improved symptoms. Additionally, it was reported that pain, Krimmer, and DASH scores were significantly improved in both groups. In conclusion, Löw et al. [18] have achieved a reduction in ulnar-side pain and functional improvement through sufficient resection and debridement of TFCC in three-quarters of patients with or without central TFCC perforation. Therefore, arthroscopic central TFCC resection and debridement are recommended as the first-line treatment for UIS. USO is recommended as a secondary procedure. It is indicated for persisting or recurrent ulnar-side wrist pain.

Lee and Jung [20] have reported that in 15 SNAC stage I patients, pain in the radial side is improved by only performing sufficient arthroscopic debridement including joint capsule for synovitis and degenerative change around the radial styloid process without performing radial styloidectomy after correcting scaphoid nonunion. Therefore, for non-weight-bearing joints such as wrist in degenerative osteoarthritis patients, arthroscopic synovectomy including debridement is expected to lead to symptom improvement and joint movement increase. In particular, the authors first performed arthroscopic debridement for patients with UIS. If symptoms persist or recur, a repeated arthroscopic debridement or USO is recommended. In our opinion, if the activity level of the wrist is not high in patients such as drivers and housewives, it is not necessary to perform USO because symptoms could be improved through arthroscopic synovectomy and TFCC debridement without per-

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forming USO. However, in patients with high wrist activity levels or a positive ulnar variance greater than 1.8 mm, USO may be considered if ulnar-side wrist pain persists or recurs even after arthroscopic synovectomy and TFCC debridement. There are still very few published results to support the use of arthroscopic synovectomy as an isolated procedure. More results are expected to be published in the future.

Complications

Complications are rare. However, synovial fistula, immediate numbness of the superficial radial nerve territory, and injury to the posterior interosseous nerve have been reported during arthroscopy [6,9,32]. To avoid many potential complications, a blunt dissection to the level of the wrist capsule with a hemostat should be made to limit injury to sensory nerves and extensor tendons. In addition, instruments should not be forced into a joint because this can increase the potential for iatrogenic chondral lesions.

Summary

Arthroscopic synovectomy is safe and reliable with mild postoperative morbidity. In RA and other connective tissue diseases and postinfection monoarthritis, a relatively long period of increased comfort and improved function can be anticipated. The procedure may be considered in posttraumatic patients with joint contracture and as an adjunct to other measures for certain osteoarthritic disorders. However, it should be kept in mind that reported results must be viewed in relation to the level of activity of each patient.

ORCID

Young-Keun Lee, https://orcid.org/0000-0001-8749-4135
Jong-Hong Kim, https://orcid.org/0000-0003-4458-2260

Conflicts of interest

The authors have nothing to disclose.

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