Arthroscopic Treatment of Elbow Osteoarthritis and Arthroscopic Ulnar Nerve Decompression

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Although arthroscopic surgery has been used conventionally, it has not been widely adopted yet due to the risks of complications, including nerve damage, technical difficulties, and limited indications. As shown in other joints, however, the use of an arthroscope will gradually increased in the elbow joint (Arthroscopy always wins'). Herein, arthroscopic treatments and arthroscopic ulnar nerve decompression will be discussed in cases of elbow osteoarthritis.

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Elbow Osteoarthritis

The elbow joint is a non-weight bearing, hinge joint with a stable structure, and it is strongly supported by adjacent ligaments. Therefore, arthritis does not occur more frequently in the elbow joint as compared with other joints. In particular, idiopathic elbow osteoarthritis accounts for approximately 1% to 2% of all elbow arthritis cases. Moreover, it shows a male predilection. In addition, the incidence of posttraumatic arthritis is relatively higher. Furthermore, it is common in heavy workers or athletes who frequently use arms (e.g., weightlifting or baseball ones). In early stages, patients complain of pain in the final range of the joint (terminal pain). Then, they gradually complain of pain in the overall range of joint movement. They are characterized by decreased range of motion. Patients may also complain of grating or feeling of being trapped in a loose body (catching and locking). In late stages, patients may complain of ulnar neuropathy, where there is a decrease in sensation of the 4th and 5th fingers. These symptoms may get worse after the surgery. In particular, it is recommended that ulnar nerve decompression be performed in cases of flexion contracture with a severe restriction of the flexion range. An X-ray (Fig. 1) may confirm the presence of typical findings of hypertrophic bone spur or loose body. In addition, a 3-dimensional computed tomography (Fig. 2) is helpful for confirming the bony structures more accurately and making a treatment plan for surgery.

Primary elbow osteoarthritis is first characterized by the formation of osteophyte in the ulno-humeral joint (class I; Fig. 3A), which is followed by the formation of osteophyte in the radio-humeral joint (class II; Fig. 3B). Afterwards, it progresses to the dislocation of the radius (class III; Fig. 3C). Accordingly, osteophytes seen in most cases of elbow osteoarthrits are prevalently distributed in the ulnar-humeral joint. In early-stage arthritis, the effects of arthroscopic therapy are good. With the progress of arthritis, however, the effects show a diminishing trend. Treatments for elbow osteoarthritis are mainly divided into two forms: conservative and surgical. Surgical treatments can further be divided into open and arthroscopic ones. Indications for surgical treatments include pain that is refractory to conservative treatments, such as rest, behavioral correction, pharmacotherapy, physical therapy, and injection therapy, and rigidity whose range of motion is limited to 30° to 110°, thus

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restricting daily activities. The purposes of surgery are to alleviate this pain and to improve the limited extension to <20° and the range of flexion to >130°. To fulfill these objectives, open debridement arthroplasty, interposition and distraction arthroplasty, and open surgery of total elbow arthroplasty—including Outerbridge-Kashiwagi (O-K) procedure where holes are made in the distal part of the distal humerus—can be performed. Moreover, with appropriate indications, arthroscopic debridement may also be performed.  

**Arthroscopic Debridement for the Treatment of Elbow Osteoarthritis**

Often, arthroscopic debridement is used interchangeably with arthroscopic ulnohumeral arthroplasty or arthroscopic osteocapsular arthroplasty. Herein, arthroscopic debridement is used for convenience. Arthroscopic debridement causes less damages to the soft tissue, achieves more rapid recovery, produces less pain, and makes patients less vulnerable to recontraction of the articular capsule. Although this procedure has these advantages, it is to some degree a complex procedure. Moreover, there is a higher risk of nerve damages as compared with other joints. Bony ankyloses, severely destroyed joints, heterotrophic ossification, and severe ulnar neuropathy are not treated easily. Otherwise, the degree of treatment effect is relatively lower. Special attention should therefore be paid to its use. Indications of arthroscopic debridement include patients who failed in conservative treatments, younger patients with a higher level of activity, and those where a limited extension rather than a limited flexion is more problematic. Bony ankyloses, severely destroyed joints, blood coagulation disorder, heterotrophic ossification, anatomical deformity due to the same surgical procedure for the same sites and severe ulnar neuropathy are its contraindications. Synovectomy, the removal of impinging osteophyte or loose body and the anterior and posterior capsu-
pectomy can be performed through arthroscopic debridement. Additionally, medial collateral ligament posterior band release or ulnar nerve decompression may also be performed to resolve the limitations of flexion movement.

**Position and Portals for Elbow Arthroscopy**

Positions for arthroscopic surgery include supine, lateral decubitus, and prone postures. A supine position is good to approach the anterior structures. By contrast, a lateral decubitus or prone position is good to approach the posterior structures. We preferred the prone position since an arm supporter is not necessary and is easy to move the elbow during surgery. A portal for arthroscopic elbow surgery is placed on the anteromedial, anterolateral, proximal anteromedial, proximal anterolateral, and posterolateral sides. In addition, there are also trans-triceps and soft spot portals. It is, therefore, necessary to obtain a complete understanding of the location of each portal, detailed structures, and nerves deserving special attention (Fig. 4).

**Arthroscopic Surgical Process for the Treatment of Elbow Osteoarthritis**

For the treatment of elbow osteoarthritis, the procedures of arthroscopic surgery are as follows: First, a fluid is infused to the joint through a soft spot, inflating the joint. This makes it easier to place the arthroscope and minimize nerve damage. The anterior joint is accessed through the antero-medial port. Then, synovectomy is performed to acquire visual fields through the antero-lateral port. At this time, nerve damages should be minimized during the attachment of a shaver or an electrocautery to the bone as maximally as possible. This is followed by a removal of the loose body (Fig. 5) and osteophytes.

Osteophytes in the anterior joint mainly include those in the coronoid process and coronoid fossa, and they are removed using a burr, a shaver, or an osteotome. Osteophytes in the coronoid process should be removed to ensure that there are no remainders while the elbow is flexed (Fig. 6, 7).

If there are no sufficient visual fields in the medial osteophytes, surgery would be performed through the antero-medial port while monitoring the surgical sites through the proximal antero-lateral port. In removing removal of extremely large osteophytes, surgeons may consider removing them using an osteotome. In addition, if the loose body is too large to exit using the port, a burr, a shaver, or a punch may be used to reduce its size or to take it out in smaller pieces. Moreover, an anterior capsular release is also performed. In cases where osteophytes are removed from the coronoid fossa, an anterior capsulectomy is concomitantly performed. An anterior capsular release is classified into the method for dissecting the adhesion site using a
blunt periosteal elevator, capsulotomy using a punch, and capsulectomy, where the adhesion site on the synovial membrane is removed using a shaver or an electrocautery. During an anterior capsular release, there are risks of nerve damage. Therefore, it should be performed with caution. To ensure that there are no nerve damage due to the entrapment of soft tissues and nerves, it is not recommended to use suction during an anterior capsular release. Additionally, a radial head excision may also be performed in cases of severe radio-ulnar arthritis. However, the degree of its effects is not relatively higher, and there are reports that ulnar humeral arthritis may occur. Therefore, radial head excision is not widely performed.

Afterwards, surgery is performed on the posterior joint. We prefer the use of the postero-lateral port to obtain the appropriate visual field. Meanwhile, we perform surgical procedures through the trans-triceps port. To ensure that the directions can be chosen more easily, we stand in such a manner that we obtain a visual field in a direction from the shoulder to the elbow. Thus, we perform surgical operations while placing an auxiliary monitor on the contralateral side (Fig. 8).

Similar to the anterior joint, by removing the synovial sac, a visual field is obtained to the adjacent areas of the olecranon process and the olecranon fossa. Thereafter, the loose body is removed. However, there are some cases in which it is hidden in the medial or lateral gutter. This deserves special attention. Osteophytes in the posterior joint are removed mainly through the removal of those in the olecranon process and fossa. When removing the osteophytes in the olecranon process, remnants can also be removed during the extension of the elbow (Fig. 9, 10).

If a burr or a shaver are not sufficient for the removing sites that are attached to the joint surface, an osteotome could be used to solely remove them in order to secure the space so that
a burr can be used to remove the osteophytes. With respect to the olecranon fossa, holes are made even in the anterior part. Thus, the O-K procedure can also be performed to ensure that no collision would occur in the anterior part as well as the posterior part under the guidance of an arthroscope. This guarantees that a complete removal of osteophytes can be achieved and prevents the recurrence of motor restriction due to the reformation of osteophytes. From this context, this procedure may best be suitable for younger patients with a higher level of physical activity. However, the distal humerus becomes fragile from biomechanical perspectives. It is, therefore, disadvantageous as postoperative protection may become necessary (Fig. 11).

Further, not only bony structures but also the posterior band of the medial collateral ligament, serving as the major lesion causing restrictions of the flexion, may be dissected in patients with a severe restriction of flexion. Thereafter, the prophylactic use of ulnar nerve decompression may also be considered to take appropriate measures against the possible occurrence of ulnar neuropathy following the resolution of flexion restrictions. In these procedures, however, there are risks of nerve damage. Therefore, they should be performed with caution. An arthroscopic-assisted ulnar nerve decompression will be discussed later. Finally, a debris in the joint is removed. A hemovac is inserted after the confirmation of complete movement without entrapment through the maximal flexion and extension of the elbow, marking the completion of surgery. At the end of the surgery, a long-arm splint is applied with the forearm in neutral and...
the elbow in a 60-degree flexion. Since the next day of surgery, the flexion-extension can be performed, as tolerated. The splint is usually removed 2 or 3 days after the surgery, and a removable splint is used to facilitate the flexion-and-extension exercise. Rehabilitation is continuously performed for approximately 2–3 months until the joint is stabilized. The rehabilitation process is relatively faster than open surgery.

**Treatment Results after Arthroscopic Debridement in Elbow Osteoarthritis**

The overall treatment outcomes of surgical operations for elbow joint arthritis have been reported to be excellent. Kelly et al., Krishnan et al., and Adams et al. reported that there were improvements in the range of flexion from 111° to 132° (restrictions of the extension from 20° to 9°; mean age of 51 years old in 24 patients), from 60° to 122° (11 patients with a mean age of 36 years; a minimum follow-up period of 24 months), and from 117° to 132° (42 elbows, a mean age of 52 years old and a mean follow-up period of 44 months), respectively, following an arthroscopic debridement in patients with primary elbow osteoarthritis. Moreover, these authors also noted that there were also improvements in the severity of pain and the degree of patient satisfaction. Lim et al. also performed a follow-up analysis of 43 patients for a mean period of 38 months and reported that there were significant improvements in pain, range of motion, and functional outcomes. These authors also noted that the postoperative range of motion and functional outcomes were worse particularly in patients with severe restrictions of preoperative range of motion. Similarly, Merolla et al. also performed a follow-up analysis of 48 patients for a mean period of 44 months and reported that there were significant improvements in pain, range of motion, and functional outcomes. These authors noted that the degree of postoperative range of motion and functional outcomes was significantly higher in patients with post-traumatic arthritis as compared with those with primary arthritis. At a final follow-up, there was no recurrence of osteophytes in the coronoid fossa and olecranon fossa. This was also accompanied by a report that the maintenance of the gap between the ulnar and humeral joints was seen in approximately 79% and 80%, respectively. Yan et al. reported the treatment outcomes of arthroscopic-assisted elbow surgery in young professional sports players; according to which, the range of motion was improved from 111° to 127° after performing a follow-up of 36 patients (mean age, 23 years) for a mean period of 43 months. These authors noted that all patients achieved a recovery of training activity to the preoperative levels. Of the 36 patients, however, 16 had mild pain, 3 had moderate pain, and 2 had severe pain after training. There were 6 patients who complained of dissatisfaction with the treatment outcomes. They also reported that the treatment outcomes were poor particularly in patients undergoing O-K procedure. Both groups—Savoie et al. and Cohen et al.—compared between an arthroscopic-assisted O-K procedure and an open O-K procedure. They reported good treatment outcomes in association with improvements of pain and range of motion. However, Savoie et al. reported that there were no significant differences between the two groups. According to Cohen et al., however, the degree of improvement with respect to the range of flexion was significantly higher in patients undergoing open surgery, while that of reduction in pain was significantly higher in those undergoing arthroscopic-assisted surgery.

An arthroscopic-assisted elbow surgery shows a higher incidence of complications as compared with other joints (3%–14%). In particular, nerve damage is commonly seen and it is one of the complications for which special attention should be paid. According to a previous report, the incidence of nerve damage is estimated to be approximately 0% to 14% following an arthroscopic-assisted elbow surgery. It has also been reported that nerve damages to the radial nerve and posterior interosseous nerve occur most commonly. To reduce the occurrence of nerve damage, anatomical structures must be completely understood. In addition, special attention should be paid to obtain good visual fields during surgery. In using a burr and a shaver, special attention should also be paid to the use of suctions. Furthermore, the maintenance and recurrence of the contracture, infections and compartment syndrome have been reported to occur at a relatively lower incidence.

**Ulnar Neuropathy**

**Ulnar Neuropathy Associated with Elbow Osteoarthritis**

In patients with elbow osteoarthritis, ulnar neuropathy is not rare. In association with this, its incidence is assumed to be relatively higher since the symptoms of ulnar neuropathy are not presented due to the restrictions of flexion. In cases of elbow osteoarthritis, the degenerative osteophytes formed in the olecranon and trochlea, which are present on the lateral side of the anterior part of the ulnar nerve, as well as the entrapment of the ulnar nerve due to the fibrosis of the posterior band of the medial collateral ligament might contribute to the mechanisms by which ulnar neuropathy occurs. Anterior transposition of the ulnar nerve is a treatment modality for ulnar neuropathy. In the original locations, open, endoscopic, or arthroscopic in-situ decompression may also be performed. Here, we discuss an arthroscopic-assisted in-situ decompression.

**Arthroscopic Ulnar Nerve Decompression**

An arthroscopic-assisted ulnar nerve decompression causes a high incidence of nerve damage. As compared with this, there is a possibility of insufficient decompression. Thus, its effects remain uncertain. Therefore, it is performed very rarely. To date, an open procedure has been recommended as the treatment
for ulnar neuropathy to such an extent that there are indications of an arthroscopic-assisted procedure in the treatment of stiffness due to elbow osteoarthritis accompanied by the ulnar neuropathy.27) Indications of an arthroscopic-assisted ulnar nerve decompression are not greatly different from those of an open procedure. Preoperatively, there are ulnar nerve symptoms. In particular, symptoms may be aggravated during flexion of the elbow joint. In these cases, arthroscopic-assisted ulnar nerve decompression is performed. During the surgery, nerve entrapment is confirmed. Otherwise, it may also be performed for the prevention of postoperative development of ulnar neuropathy in cases of stiffness accompanied by severe restrictions of flexion. Even though there is no specific indication of preoperative elbow stiffness for the prophylactic arthroscopic ulnar nerve decompression, Papatheodorou et al.28) reported that if a preoperative elbow flexion is limited to less than 100 degrees, prophylactic ulnar nerve release should be considered. In cases in which it is determined that a sufficient decompression could not be achieved through an arthroscopic-assisted surgery or there is a high risk of nerve damage, surgeons would not hesitate to convert an arthroscopic-assisted nerve decompression to an open nerve decompression.

An arthroscopic-assisted ulnar nerve decompression is performed in such a manner that surgical procedures are performed towards the trans-triceps port while visual fields are obtained in the postero-lateral port. Surgical procedures are performed in a similar manner to the procedure that is performed for the posterior part of the joint in patients with elbow osteoarthritis. That is, the visual fields are sufficiently obtained toward the medial side of olecranon process and trochlea, which extends to the posterior band of the medial collateral ligament and the medial gutter. During this process, a shaver is advanced without a suction. Visual fields are obtained in a lateral-to-medial direction. If it is not easy to obtain the desired visual field, the proximal postero-lateral port is additionally created, in which a retractor is placed. Then, the desired visual field may be obtained. Thereafter, the dissection of the posterior band of the medial collateral ligament undergoing fibrosis is performed. At this time, nerve damage from a shaver or an electrocautery may be possible. Therefore, a punch or an arthroscopic scissor is used for dissection.

Dissection is performed in a proximal-to-distal direction. For inferior direction, it is advanced to the posterior part of the medial collateral ligament. For superior direction, the elbow is flexed and is advanced to the ligament of Osborne. Following the dissection of the posterior band of the medial collateral ligament, it can be confirmed that the ulnar nerve is present immediately posterior to it. Alongside with this, if there are scar tissues that adhere to the adjacent region to the nerve, dissection will also be performed (Fig. 12).

**Treatment Result of Arthroscopic Ulnar Nerve Decompression**

To the best of our knowledge, there are limited reports regarding arthroscopic-assisted ulnar nerve decompression in the literature. Porcellini et al.29) performed an arthroscopic-assisted ulnar nerve decompression and reported that more than 60% of patients were satisfied with the treatment outcomes. These authors also noted that there was an increase in the Bishop scores by more than 5 points, which was also accompanied by a report that the treatment effects continued for the duration of follow-up with a maximum period of 12 months. Kovachevich and Steinmann26) performed arthroscopic-assisted treatment of osteoarthritis concurrently with arthroscopic-assisted ulnar nerve decompression in 15 patients with elbow osteoarthritis accompanied by ulnar neuropathy (mean age, 51 years old; mean follow-up period, 47 months). They reported that there were 7 excellent cases, 5 good cases, 1 fair case, and 2 poor cases. In addition, there were 3 patients who underwent revision surgery due to persistence or recurrence of symptoms. These authors suggested and we also think that although arthroscopic-assisted ulnar nerve decompression may be a useful modality, it cannot be recommended as the treatment for patients with isolated ulnar neuropathy that is not accompanied by osteoarthritis. In the author’s practice, arthroscopic-assisted ulnar nerve decompression is performed additionally during the treatment of elbow osteoarthritis.

**Conclusions**

A sufficient understanding of arthroscopic-assisted elbow surgery is essential to obtain successful treatment outcomes. Arthroscopic-assisted treatment of elbow osteoarthritis would produce successful treatment outcomes through synovectomy—the
removal of osteophytes and loose body as well as the removal of anterior and posterior articular capsule—if it is performed for appropriate indications. In addition, arthroscopic-assisted ulnar nerve decompression may be performed through the removal of posterior band of the medial collateral ligament as well as the dissection of adjacent adhesive tissue in patients with ulnar neuropathy or severe restrictions of flexion. However, if there is a possibility of nerve damage or insufficient decompression, it should be converted to an open procedure.

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