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A Suspension Procedure Using the Extensor Carpi Ulnaris Tendon for Distal Radioulnar Joint Disorders

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Abstracts

Recently the Sauve-Kapandji (S-K) procedure has become popular for the treatment of various distal radioulnar joint (DRUJ) disorders. However, some complications, especially pain over the proximal stump of the ulna due to instability of the ulna have been reported in more recent follow-up studies. To prevent the occurrence of this pain, we devised a modified S-K procedure, which we called the suspension procedure, in which the extensor carpi ulnaris (ECU) tendon was used to suspend the proximal ulnar stump. We report here the surgical technique and compare clinical and radiographic results between the suspension procedure and the S-K procedure alone. We performed the S-K procedure alone on 8 patients (original group) and the suspension procedure on 5 (suspension group). Clinical results were assessed according to the clinical evaluation scoring system described by Inoue. Radiographic evaluations included the radio-ulnar distance, the gap of the ulna, and the distance between the articular surface of the wrist and the proximal ulnar stump. In the original group, 4 patients were rated as excellent, 2 as good and 2 as fair, whereas in the suspension group, 3 were rated as excellent, 2 as good and none as fair. In regard to radiographic evaluations, there were no significant differences in any of the 3 parameters between the 2 groups.

This suspension procedure had an advantage over the S-K procedure alone, especially in preventing the occurrence of stump pain. As there was no significant difference in radiographic findings between the two procedures regarding the site of osteotomy, the amount of bone resection, and radio-ulnar distance, stump pain may be attributed to dynamic instability rather than to static instability. (J Nippon Med Sch 2001; 68: 233–237)

Key words : Sauve-Kapandji procedure, ulnar proximal stump, ulno-carpal impaction syndrome

Introduction

The distal radioulnar joint (DRUJ) is important in providing support of the ulnar side of the wrist. Discrepancy in length between the radius and the ulna due to growth abnormalities of the distal radius (ulno-carpal impaction syndrome) and malunited radius

fractures often causes DRUJ disorders complicated with chronic ulnar wrist pain, a limitation of forearm rotation and decreased grasping power, which eventually results in the development of osteoarthritis of DRUJ.

Recently the Sauve-Kapandji (S-K) procedure¹ has become popular as a treatment for various DRUJ disorders. This procedure has been shown to be useful in

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improving wrist pain, DRUJ instability and grip strength. However some complications, especially pain over the proximal stump of the ulna, have been reported in more recent follow-up studies. To prevent the occurrence of stump pain due to the instability of the ulna, several modified S-K procedures with a tenodesis of the ulnar stump have been proposed. We devised a modified S-K procedure, which we called the suspension procedure, in which the extensor carpi ulnaris (ECU) tendon was used to suspend the proximal ulnar stump.

We report here the surgical technique as well as a comparison of the clinical and radiographic results in patients treated using the suspension procedure with those in patients treated by the S-K procedure alone.

Materials and Methods

(1) Subjects

Between May 1994 and April 2000, we performed the S-K procedure on 13 patients with DRUJ disorders. All patients had wrist pain and a limitation in forearm rotation due to osteoarthritic change or an incongruity of the DRUJ. Of these 13 patients, 8 were

treated with the S-K procedure (original group) and the remaining 5 with the suspension procedure (suspension group). The original group consisted of 3 men and 5 women with a mean age of 43.6 years (range from 24 to 67 years). Five patients had ulno-carpal impaction syndrome, 2 malunited radius fracture, and one dislocation of the DRUJ. The suspension group consisted of 1 man and 4 women with a mean age of 46.2 years (range from 27 to 65 years). Two patients had ulno-carpal impaction syndrome, 2 malunited radius fractures and one dislocation of the DRUJ. The mean follow-up period was 27 months for the original group (range from 42 to 16 months) and 14.5 months for the suspension group (range from 36 to 5 months).

(2) Surgery

The S-K procedure was carried out according to Sauve-Kapandji's method. The DRUJ was exposed through a dorsal skin incision. A 2-cm bone segment of the distal ulna with the periosteum was resected. The articular surfaces of the DRUJ were decorticated, and then the resected bone segment was inserted into the DRUJ, and fixed with a Kirschner wire and a screw (Fig. 1 a).

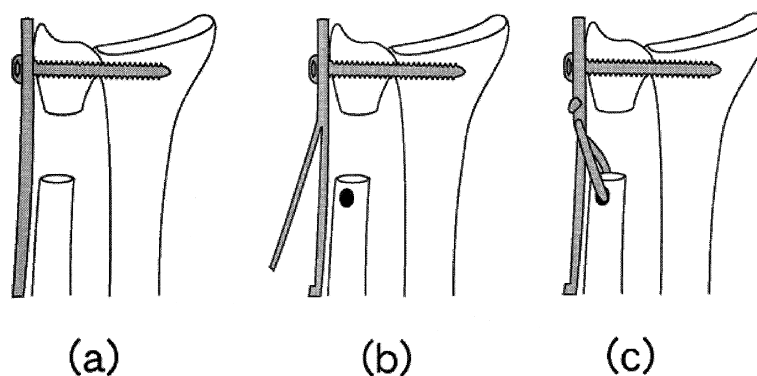


Fig. 1 Surgical Procedures. (a) Original Sauve-Kapandji's method, (b) Suspension method Part 1. Half of the ECU tendon was dissected longitudinally from the proximal portion, and a bone tunnel was made in the proximal ulnar stump, (c) Suspension method Part 2. The tendon was passed through the tunnel to suspend the ulna, and was fixed to the remainder of the ECU.

Table 1 Clinical evaluation scoring system

Point	0	1	2	3	4
Pain	severe	moderate	mild	—	none
Pro/Sup	<100°	100~200°	120~140°	140~160°	160~180°
Grip strength	<25%	25~40%	40~65%	65~80%	>80%
Overall results	Excellent : 11~12, Good : 9~10, Fair : 6~8, Poor : <6				

Regarding the suspension procedure, half of the ECU tendon was dissected longitudinally from the proximal portion. Then, a bone tunnel was made in the proximal stump of the ulna (**Fig. 1 b**). The tendon was passed through the tunnel to suspend the ulna, and was fixed under appropriate tension to the remainder of the ECU tendon with an interlacing suture (**Fig. 1 c**). The fascia of the pronator quadratus muscle was freed up from the distal ulna, and was then pulled into the gap of the ulna to suture with the dorsal subcutaneous tissue. After confirming the tension of the transferred tendon during forearm rotation, the wound was closed. A long-arm plaster cast in neutral forearm rotation was used in both groups for six weeks.

(3) Clinical and radiographic evaluations

Clinical results at final follow-up were assessed according to the clinical evaluation scoring system described by Inoue², including pain, range of motion (pronation-supination of the forearm, flexion-extension of the wrist) and grasping power. The overall results were rated into 4 grades as shown in **Table 1**. Radiographic evaluations of the posteroanterior view of the wrist included the radio-ulnar distance, the gap of the ulna, and ulnar distance (**Fig. 2**).

Results

In regard to the clinical results, postoperatively the wrist pain improved moderately or well in both groups. Three of the 8 patients (37.5%) in the original group had pain over the proximal ulnar stump, whereas none had pain in the suspension group. The improvement in the mean degree of pronation-supination of the forearm was 43° in the original group and 41° in the suspension group. The improvement in the mean degree of flexion-extension of the wrist was 5° in the original group and 3° in the suspension group. Grasping power improved from 17.5 to 22.0 Kg in the original group, and from 18.4 to 22.8 Kg in the suspension group with no significant difference.

Regarding the overall results, in the original group, 4 patients were rated as excellent, 2 as good and 2 as fair, and in the suspension group, were rated 3 as excellent, 2 as good and none as fair. We speculate that

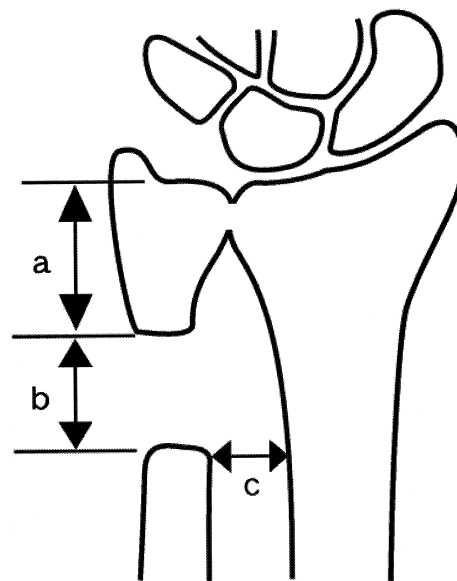


Fig. 2 Radiographic parameters in the posteroanterior view of the wrist. (a) Ulnar distance: The distance between the articular surface of the wrist and the distal ulnar stump. (b) Gap of the ulna: The distance between the proximal and distal ulnar stump. (c) Radio-ulnar distance: The distance between the radius and the proximal ulnar stump.

Table 2 Radiographic results

	ulnar gap (mm)	ulnar distance (mm)	Radio-ulnar distance (mm)
Original group	13.2 ± 2.4	19.7 ± 2.4	8.5 ± 1.9
Suspension group	12.5 ± 3.8	18.8 ± 2.7	8.0 ± 1.3

the overall results in the suspension group tended to be better than those in the original group in part due to the difference in the occurrence of stump pain.

In regard to radiographic evaluations, there were no significant differences in any of the 3 parameters studied between the 2 groups, as shown in **Table 2**.

As a postoperative complication, in one patient, the ECU tendon was found to be cut off from the bone tunnel during the follow-up. And although the patient had no pain, he did feel clicking of the ulnar stump during forearm rotation.

1. Presentative cases

Case 1 : a 67-year old woman

In November 6, 1994, the patient had fallen down and suffered distal radius fracture and was treated

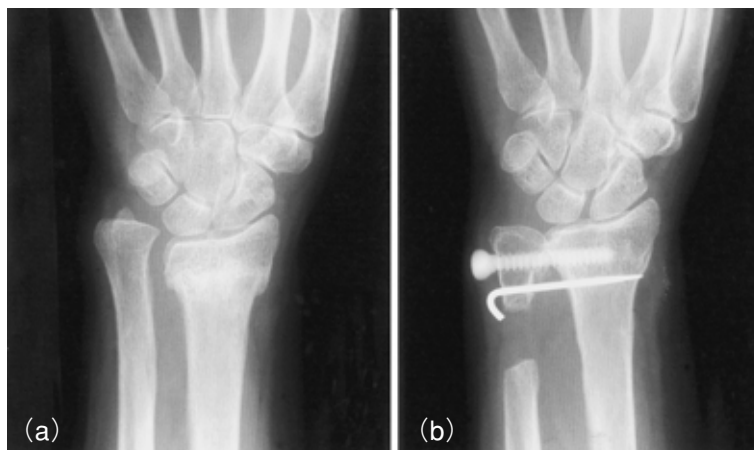


Fig. 3 Case: A 67-year-old woman with malunion 18 months after a distal radius fracture. (a) Preoperative radiography Radial shortening of 4 mm and incongruity of the distal radioulnar joint were observed. (b) Eight months after operation. Although she had ulnar stump pain, there was no narrowing of the radio-ulnar distance.

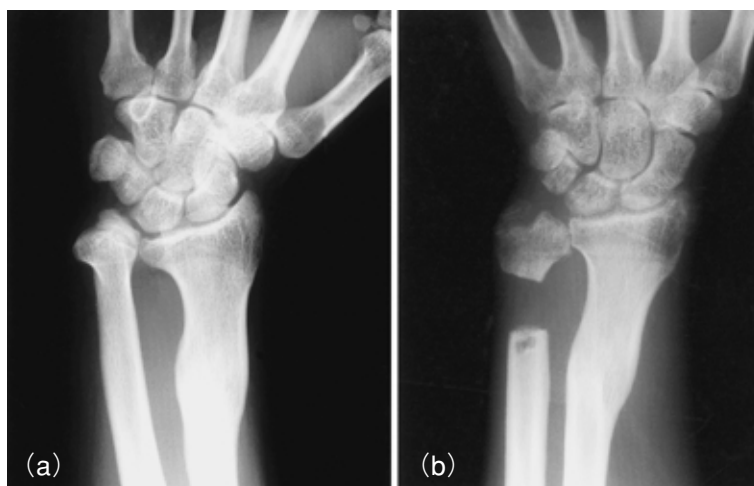


Fig. 4 Case: A 27 year-old man with malunion 14 years after a radial shaft fracture. (a) Preoperative radiography. Angulation of the radius shaft and radial shortening of 4 mm were observed. (b) Five months after operation. Incongruity of the distal radioulnar joint was corrected. He had no pain at follow-up.

conservatively. Subsequently, she had a malunited radius fracture with radial shortening of 4 mm and a dorsal tilt of 10° . Since pain over the ulnar side of the wrist continued with a limitation of forearm rotation, the S-K procedure was performed on October 12, 1995. Although the range of motion markedly improved with no narrowing of the radio-ulnar distance, the overall results were rated as fair due to severe ulnar stump pain during the forearm rotation (**Fig. 3**).

Case 2: a 27-year old man

The patient had a malunited fracture of the radius shaft in childhood, but received no treatment for the fracture. Subsequently, pain was elicited in the ulnar

side of the wrist, which and became gradually aggravated over time. He underwent the suspension procedure on April 11, 2000. Five months after surgery, he obtained an excellent result and returned to his manual labor job with no stump pain (**Fig. 4**).

Discussion

Several surgical procedures have been reported for the treatment of DRUJ disorders and the Darrach³ procedure (resection of the distal ulna) is widely used. Although this procedure provides relief of wrist pain, some problems have been reported such as wrist in-

stability, ulnar deviation of the carpal bones and the rupture of a finger extensor. Sauve and Kapandji suggested the arthrodesis procedure of DRUJ to reduce these complications. Results from several series of tests suggest that this procedure is reliable for stabilizing DRUJ and restoring forearm rotation regardless of the primary pathology. However, more recent studies have reported that proximal ulnar stump pain was occasionally complicated following surgery. Minami et al.⁴ reported that pain occurred in 7 of 15 patients during the early postoperative period, and persisted in 2 of 7 during follow-up. Also in this study, 3 of 8 patients in the original group experienced pain at a mean follow up of 28 months.

Kapandji et al.⁵ suggested that stump pain may be associated with the site of osteotomy and the amount of bone resection. He recommended a short distal ulnar segment and a small ulnar gap to prevent pain due to the instability of the proximal ulna. Wada et al.⁶ stated that an ulnar osteotomy should be performed almost 2.5 cm proximal to the articular surface of the radius, and Minami et al.⁴ speculated that the narrowing of the radio-ulnar distance may be linked to the pain mechanism. We devised the suspension procedure to prevent stump pain, and in this comparative study on radiographic parameters between the original and suspension groups, there was no significant difference in either the radio-ulnar distance or the gap of the ulna between the 2 groups. The site of osteotomy and the amount of bone resection, as well as the narrowing of the radio-ulnar distance have been thought to cause pain, but they may have little impact on the occurrence of pain. Upon the present results, the pain which occurs during rotation may be derived from a dynamic instability in the ulnar stump rather than a static one. Further investigations are necessary, such as using motion analysis of the ulna to clarify the pain mechanism.

With respect to the stabilization of the ulnar stump, flexor carpi ulnaris (FCU) (Gonzales et al.⁷), ECU (Ha-

mada et al.⁸) and ECU and FCU (Ichikawa et al.⁹) have been used to prevent stump pain with favorable results. In the results of the present study using ECU tendons, the success in restoring forearm rotation and grasping power in the suspension group was similar to that in the original group. All 5 patients in the suspension group were rated as good or better and no patients had stump pain. Our suspension procedure is a simple surgical technique that makes it possible to stabilize the proximal ulnar stump without limiting the range of forearm rotation.

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