Results of the Modified Brunelli Technique for Chronic Static Scapholunate Instability

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1 Introduction

Scapholunate instability is the most common pattern of carpal instability. Despite their frequency, these lesions are often missed or poorly treated, and this may lead to an important amount of wrist dysfunction and degeneration [1]. Treatment of chronic scapholunate instability remains controversial. There is no consensus between different stabilization procedures such as capsulodesis, tenodesis, and intercarpal fusions [1].

In 1995, Brunelli and Brunelli [2] introduced a new technique in the treatment of chronic scapholunate dissociation, using a flexor carpi radialis (FCR) tendon slip to reduce the rotatory subluxation of the scaphoid and to reduce the scapholunate distance. Van Den Abbeele et al. [3] developed a three-ligament tenodesis based on Brunelli's technique, reconstructing the scapholunate interosseous ligament, the scaphotrapeziotrapezoidal ligament and the dorsal radiotriquetral ligament. This study evaluates the outcome of the treatment of chronic, static scapholunate instability with a three-ligament tenodesis at our institution.

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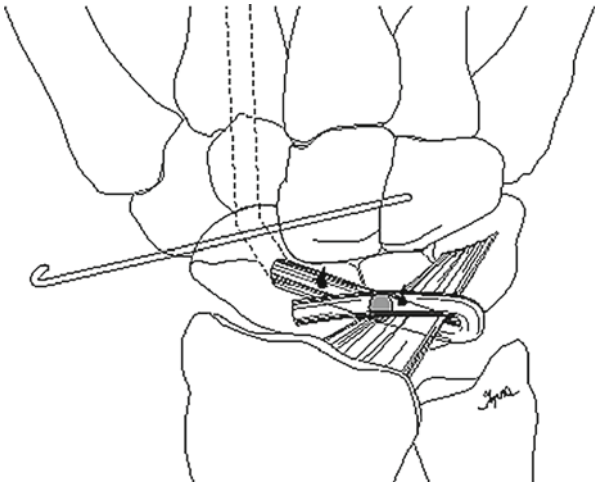

Fig. 1 Schematic represenatation of the technique used

2 Material and Methods

At UZ Leuven, 46 patients with chronic static scapholunate instability underwent a modified Brunelli procedure between 1998 and 2010. Twelve patients were excluded for this review because they needed a salvage procedure (wrist arthrodesis or proximal row carpectomy), and two patients were excluded because of a fall on the operated hand. Of the remaining 32 patients, 21 were willing to come to the hospital for clinical and radiological evaluation. In this group of 21 patients, mean age at the time of surgery was 39 years (range 26–47) and male to female ratio was 16:5. Mean follow-up was 33.5 months (range 8–69). In ten patients diagnosis was made on plain radiographs, three patients needed an MRI scan, and in eight patients, diagnosis was made arthroscopically. Nineteen patients sustained a fall on the outstretched hand more than 1 year before the diagnosis was made.

Postoperative pain, grip strength (Jamar dynamometer), and range of motion (hand held goniometer) were clinically evaluated. A quick DASH score was calculated. Standard radiographs were taken to measure scapholunate distance and angle and to evaluate carpal collapse using the Nattrass coefficient (carpal height divided by length of the capitates).

The modified Brunelli technique as described by Van Den Abbeele et al. [3] and Garcia-Elias et al. [4] was used.

A dorsal approach to the wrist joint described by Berger was made. First the scapholunate interval was evaluated, and then the scaphoid was released distally and reduced. A tunnel was made in the distal pole of the scaphoid from dorsal to volar. A suture anchor was placed in the lunate. A transverse palmar incision was made along the flexor carpi radialis (FCR), proximal to the scaphoid, and the cutaneous nerve branch of the radial nerve is protected. A second transverse palmar incision was made more proximally, over the musculotendinous junction of the

FCR, and the radial half of the tendon was retrieved to form a distally based FCR tendon strip. The tendon strip was then passed through the tunnel in the scaphoid, from volar to dorsal. The end of the tendon strip was passed under the dorsal radiocarpal ligament slip and attached to the lunate with the suture anchor placed earlier (Fig. 1). The tendon slip does not pass the radiocarpal joint. One or two K-wires were placed: one from scaphoid to capitate and (occasionally) one from scaphoid to lunate. Wrist capsule and skin were carefully sutured. A short arm and thumb cast is applied for 6 weeks. After 6 weeks of immobilization, K-wires were extracted and mobilization was initiated (Fig. 1).

3 Results

Mean satisfaction was 7.5/10 (range 2–10), mean pain visual analog score was 2.7/10, and mean quick DASH score was 15.5 (range 5–33) with a maximum possible DASH of 55. All patients would have the same surgery again and only two patients had not returned to work because of the wrist. Range of motion was significantly reduced compared to the contralateral side as illustrated in Table 1 but was in all case within the functional range. Grip strength was also significantly reduced (Table 1). Results of the radiographical measurements are shown in Table 2. No significant differences are seen here.

Table 1 ROM and grip strength of the operated hand compared to the contralateral side

	Mean (range)		
	Operated hand	Normal hand	*p*-value
Flexion	50 (20–75)	74 (40–90)	<0.001
Extension	51 (28–90)	71 (45–100)	<0.001
Ulnar deviation	33 (30–50)	42 (25–50)	<0.001
Radial deviation	19 (10–30)	29 (20–50)	<0.001
Grip strength	39 (21–61)	47 (26–71)	<0.001

Table 2 Preoperative radiological measurements compared to postoperative values

	Mean (range)		
	Preoperative	Postoperative	*p*-value
SL angle	66.5 (32.9–94.4)	61.9 (30–97.2)	0.03
SL interval	3.3 (1.5–7.9)	2.9 (1.5–5.4)	0.15
Nattrass coefficient	1.394 (1.27–1.51)	1.385 (1.22–1.55)	0.41

4 Discussion

Isolated rupture of the scapholunate ligament leads to dynamic scapholunate instability. If the scaphotrapeziotrapezoidal ligament and the dorsal radiotriquetral ligament are also damaged, a static scapholunate instability occurs [3].

In 1995, Brunelli and Brunelli [2] designed a new technique using a FCR tendon slip to reduce the scaphoid, correct the scapholunate dissociation and restore carpal height. They report on 13 cases with a short follow-up period of maximum 2 years. There is a limitation in wrist flexion of 30–60 % compared to the contralateral wrist and a limitation in grip strength of mean 35 % less than the contralateral hand. All 13 patients could return to work, 11 had no pain left and all 13 patients were satisfied.

Van Den Abbeele et al. [3] slightly modified Brunelli's technique by tunneling the FCR tendon slip under the dorsal radiolunotriquetral ligament and attaching it upon itself or directly to the lunate. Consequently the radiocarpal joint is not longer crossed in order to avoid loss of radiocarpal flexion. As this tendon reconstruction actions as the scapholunate, lunotriquetral and scaphotrapeziotrapezoid ligament, it is called a three-ligament tenodesis. Twenty-two patients with a mean follow-up period of 9 months were included in this study. Fifteen of them had predynamic instability, 4 dynamic instability and 3 had static scapholunate instability. Postoperative radiographic evaluation showed no changes in the average scapholunate angle compared to the preoperative X-rays. Postoperative ROM was compared to preoperative ROM resulting in a loss of wrist flexion of 18 % and a loss of extension of 20 %. Mean grip strength was 58 % of the contralateral hand. Fourteen patients had returned to work at the time of follow-up and 17 told they would have the operation again. Two patients needed a neuroma excision and two patients developed a reflex sympathetic dystrophy.

Talwalkar et al. [5] clinically reviewed 55 patients: 32 of them had static instability, 23 had dynamic instability. An additional 62 patients answered a questionnaire. Thirty-one percent loss of flexion, 20 % loss of extension and 12 % loss of radioulnar deviation was noted when compared to the contralateral wrist. Mean grip strength was reduced by 30 % of the contralateral side. A difference between the static and dynamic group was not found. Mean pain VAS was 3.7, 79 % of the patients were satisfied and 88 % would have the same procedure again after a mean follow-up period of 4 years. Two patients needed scaphocapitate fusion, two needed wrist fusion, two needed an ulnar shortening. Four patients needed a neuroma excision and one patient developed a reflex sympathetic dystrophy.

They conclude three-ligament tenodesis has a role in the treatment of scapholunate dissociation in patients with a reducible scaphoid and without degenerative changes.

In 2006, Garcia-Elias et al. [4] reported their results of the three-ligament tenodesis. They reviewed 38 patients with an average age of 31 years: 21 had a dynamic instability and 17 had a static instability. After a mean period of 46 months, 28 patients were completely pain free at rest, and 29 patients had returned to their normal activity level. Measurement of ROM resulted in a flexion of 74 % of the contralateral side, an extension of 77 %, an ulnar deviation of 92 % and a radial deviation

Table 3 Reported outcome data in the recent literature

Study	Patient number	Mean follow-up (months)	ROM		Grasp strength	Mean age	Male/female	No pain (%)	Mean pain VAS	Satisfied (%)
			Flexion	Extension						
Brunelli's original report	13	15	30–60 % CL		65 % CL			85		100
Van Den Abbeele	22	9	82 % Pre Op	80 % Pre Op	58 % CL	30	1/1		3/10	77
Talwalkar	117	47	69 % CL	80 % CL	70 % CL	38	50/67	62	3.7/10	79
Garcia-Elias	38	46	74 % CL	77 % CL	65 % CL	31	24/14	74		
UZ Leuven	21	33.5	68 % CL	72 % CL	83 % CL	39	16/5	77	2.7/10	85

of 78 %. Average grip strength was 65 % of the contralateral side. Two patients developed a DISI deformity and nine patients developed degenerative changes. Secondary surgical treatment was not necessary.

When comparing our results (excluding those patients who needed a salvage procedure) to those given in literature (Table 3), we can conclude similar results although our study only includes patients with static scapholunate instability, whereas other studies include patients with predynamic, dynamic, and static instability.

5 Conclusion

The results of our study are similar to those published in literature so far. We also report encouraging results on satisfaction, pain relief, ROM, and grasp strength. There are however two difference between our study and previously published works. Firstly, we report a large need for salvage procedures in our patient population. Additional research is needed to search for an explanation for this difference. Secondly, our study only includes patients with a chronic, static scapholunate instability, whereas other studies include patients with predynamic, dynamic, and static instability. Finally, we can conclude a modified Brunelli's tenodesis has its place in treating chronic, static scapholunate instability.

References

1. Walsh JJ, Berger RA, Cooney WP (2002) Current status of scapholunate interosseous ligament injuries. J Am Acad Orthop Surg 10:32–42
2. Brunelli GA, Brunelli GR (1995) A new technique to correct carpal instability with scaphoid rotatory subluxation: a preliminary report. J Hand Surg Am 20:S82–S85
3. Van Den Abbeele KL, Loh YC, Stanley JK, Trail IA (1998) Early results of a modified Brunelli procedure for scapholunate instability. J Hand Surg Br 23:258–261
4. Garcia-Elias M, Lluch AL, Stanley JK (2006) Three-ligament tenodesis for the treatmend of scapholunate dissociation: indications and surgical technique. J Hand Surg Am 31A:125–134
5. Talwalkar SC, Edwards ATJ, Hayton MJ, Stilwell JH, Trail IA, Stanley JK (2006) Results of tri-ligament tenodesis: a modified Brunelli procedure in the management of scapholunate instability. J Hand Surg Br 31B:110–117