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Long-term patient-reported outcomes for open surgery of the triangular fibrocartilage complex

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Aims

Studies on long-term patient-reported outcomes after open surgery for triangular fibrocartilage complex (TFCC) are scarce. Surgeons and patients would benefit from self-reported outcome data on pain, function, complications, and satisfaction after this surgery to enhance shared decision-making. The aim of this study is to determine the long-term outcome of adults who had open surgery for the TFCC.

Methods

A prospective cohort study that included patients with open surgery for the TFCC between December 2011 and September 2015. In September 2020, we sent these patients an additional follow-up questionnaire, including the Patient-Rated Wrist Evaluation (PRWE), to score satisfaction, complications, pain, and function.

Results

A total of 113 patients were included in the analysis. At ≥ 60 months after an open TFCC reinsertion, we found a mean PRWE total score of 19 (SD 21), a mean PRWE pain score of 11 (SD 11), and a PRWE function score of 9 (SD 10). The percentage of patients obtaining minimum clinically important difference rose from 77% at 12 months to 83% at more than 60 months ($p < 0.001$). Patients reported fewer complications than surgeons, and overall complication rate was low.

Conclusion

Outcomes of patient-reported pain, function scores, and satisfaction are improved five years after open surgery for the TFCC.

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Keywords: triangular fibrocartilage complex, TFCC, open reinsertion, wrist, long-term outcomes, Patient-Rated Wrist Evaluation, PRWE

Introduction

Patients can expect improvement in reported pain and functional outcome during the first year after open reinsertion of the triangular fibrocartilage complex (TFCC).[1] Short-term reports are favourable. However, long-term patient-reported outcome measures (PROMs) of this procedure are still unclear.[2–4] Robba et al[4] identified in their review study just one study on open repair that reports baseline, as well as late follow-up for PROMs in 24 patients with a mean follow-up of 31 months.[5] Thus, not much evidence is available for patients and physicians on the expected results in the long-term after open surgery of the TFCC. To facilitate preoperative decision-making, we need to be informed of the long-term outcome.

The aim of this study is to determine the patient-reported pain and function, measured by the Patient-Rated Wrist Evaluation (PRWE), as well as patient-reported satisfaction, at least 60 months after an open TFCC reinsertion. Our secondary aim is to identify the patient-reported complications and the number of patients who required a revision or another treatment for their residual complaints. Our hypothesis was that pain and function continue to improve after 12 months post-surgery.

Methods

Setting. For this prospective cohort study, we used data from Xpert Clinics, which consists

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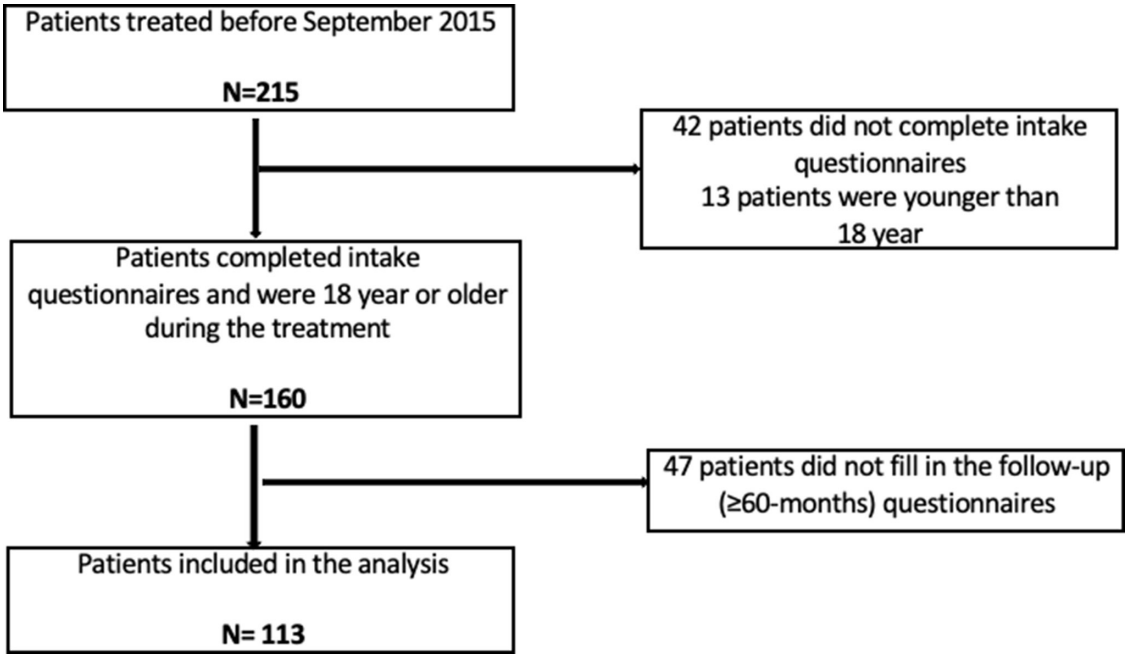

Fig. 1

Flowchart of the included patients with open surgery of the triangular fibrocartilage complex.

Table I. Demographic details for the 113 included patients.

Variable	Data
Sex, female, n (%)	83 (74)
Age, yrs, mean (SD)	40 (12)
Duration of symptoms, months, mean (SD)	22 (36)
Dominant side operated on, n (%)	72 (64)
Profession, n (%)	
Not working (including retirement/unable to work)	16 (14)
Light physical work (e.g. office work)	31 (27)
Moderate physical work (e.g. working in a store)	32 (28)
Heavy physical work (e.g. construction)	34 (30)

SD, standard deviation; TFCC, triangular fibrocartilage complex.

Table II. Demographics for included (responder) and excluded (non-responder) patients. No differences were signalled between these groups at baseline.

Demographic	Responders	Non-responders	p-value*
Total, n	113	47	
Age, yrs, mean (SD)	40 (12)	39 (14)	0.635
Male sex, n (%)	30 (27)	10 (21)	0.616
Duration of symptoms, months, mean (SD)	22 (36)	17 (21)	0.820
PRWE scores, mean (SD)			
Total score intake	62 (20)	63 (16)	0.746
Pain score intake	32 (11)	33 (7)	0.489
Function score intake	29 (11)	29 (9)	0.976
Total score at 12 months	26 (25)	24 (24)	0.695
Pain score at 12 months	15 (13)	14 (13)	0.842
Function score at 12 months	11 (13)	10 (11)	0.558

*Unpaired *t*-test.
PRWE, Patient-Rated Wrist Evaluation; SD, standard deviation.

of 23 clinics throughout the Netherlands specializing in hand and wrist care. All hand surgeons from the clinics are fellowship trained and/or certified by the Federation of European Societies for Surgery of the Hand.

Patient selection. We included patients who had open surgery of the TFCC between December 2011 and September 2015. These patients had already been invited to participate in a routine system for outcome measurements, after their first consultation with the surgeon. If they agreed, they received online questionnaires at baseline, as well as three and twelve months after surgery. For each round of the online questionnaires, three reminders were sent. This routine system also included measurements of the range of motion at three-month and 12 -month follow-up. More detail about these routine outcome measurements has been described by Selles et al.[6]

In September 2020, we contacted patients who had an open TFCC reinsertion before September 2015 with a minimum of 60 months of follow-up. The exclusion criteria was patients who did not answer the PRWE questionnaire at baseline or failed to answer follow-up questions, and those under the age of 18 years.

Ethical approval. Institutional Board Review was obtained from the ethics committee of The Erasmus University Medical Center, the Netherlands, that approved our study protocol (NL/sl/MEC-2018-1088). All patients provided written consent for their data to be used in scientific research.

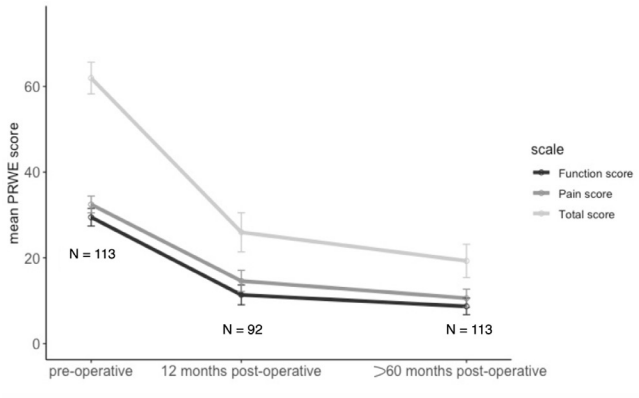

Fig. 2

Patient-Rated Wrist Evaluation (PRWE) total score and subscore mean and standard deviation at baseline, 12 months, and ≥ 60 months postoperatively.

Procedure for open TFCC reinsertion. All operations were undertaken under regional block, axillary or supraclavicular, by anaesthetists who each provide > 800 upper-extremity blocks per year. Surgeons undertook their preferred method of open TFCC reinsertion. Most used the method initially described by Garcia-Elias et al,[7] which consists of a Bruner incision of the dorsal and volar sheath of the fifth compartment. The fifth intercompartmental supraretinacular artery, which can usually be found in the ulnar and volar aspects of the fifth compartment, was protected as much as possible. Foveal reattachment was obtained by reinsertion of the cartilage disc to the distal ulna[8] with a bone anchor (Mitek, USA; JuggerKnot Soft Anchor; Zimmer Biomet, USA) first roughened. This facilitated the adhesion and reinsertion process. The threads of the anchor suture were used to tighten the dorsal capsule and then close the floor and roof of the fifth compartment firmly after relocation of the extensor digiti minimi. Soft tissues were layered with Vicryl (Ethicon, Germany). The skin was closed with Monocryl or Prolene (Ethicon) based on surgeon preference.

Rehabilitation. The routine postoperative immobilization protocol consisted of a double-slab plaster of paris cast for three to five days, followed by a below-elbow volar wrist splint, for six weeks. Patients were offered an extensive programme of hand rehabilitation comprising six weeks of active mobilization followed by six weeks of strengthening exercises. Immobilization postoperatively varied slightly in the first week depending based on the surgeon's preference; some chose a sugar-tong or upper-arm cast instead.

Outcome measurement. Patients had already received the online Dutch version of the PRWE questionnaire[9] and a satisfaction questionnaire prior to surgery and 12 months after surgery. For this study, we sent a PRWE questionnaire and a long-term TFCC follow-up questionnaire ≥ 60 months after the surgery. Patients were automatically reminded to respond three times in total; thereafter, we called them personally to request participation. These procedures were designed to maximize the response.

The PRWE is a validated questionnaire that measures the patient's reported pain and hand function. This questionnaire consists of 15 questions: five for pain and ten for hand function.[10] Questions can be answered on a scale from 0 ("no pain and no dysfunction") to 10 ("severe pain and severe dysfunction"). A score between 0 and 50 is calculated for both subscales. Patients also used a visual analogue scale (VAS) to score pain and function concurrently. Our additional TFCC follow-up questionnaire consisted of seven questions, focused on patient-reported complications and patient satisfaction. We asked patients whether they:

1. Experienced any complications;
2. If so, what treatment they received for these complications?;
3. Sought additional treatment for the same wrist pain;
4. If so, which additional treatment they received?;
5. Are still satisfied with the result of the treatment?;
6. Would choose the same surgery for the TFCC if they would experience the same wrist problem again, and finally;
7. If "no", why this was the case? (This question is an open text format and will thus not be included in the analysis, but only for improving clinical practice).

Primary outcome was patient-reported pain and function after at least 60 months. The secondary outcomes were patient-reported complications and the number of reoperations.

Statistical analysis. Responder and non-responder demographics were compared to ascertain if data were missing at random. "Non-responders" were defined as patients who failed one or more questionnaires and were not lost to follow-up in general. We used an unpaired *t*-test to determine any differences between deresponders and non-responders. A paired *t*-test was used to compare differences in continuous data between time points, for the same patients. Categorical data (e.g. satisfaction) was analyzed using a chi-squared test. Both groups appeared to be similar.

We determined the percentage of patients who achieved the minimum clinically important difference (MCID) after at least 60 months, assuming a MCID of ≥ 14 as defined by Sorensen et al.[11] We stratified satisfaction into satisfied and unsatisfied to compare the percentage of satisfied patients over time. When patients reported "good" or "excellent" satisfaction, they were classified as satisfied. A p-value < 0.05 was considered significant.

Results

A total of 215 patients had open surgery for the TFCC between 2011 and 2015. In all, 165 patients were approached to complete follow-up questionnaires, and

Table III. Patient-Rated Wrist Evaluation (PRWE) scores at baseline, one year, and ≥ five years postoperatively. PRWE scores improve significantly in the first year, and again significantly between one and ≥ five years postoperatively.

Category	Baseline	One yr	> Five yrs	p-value, 0 to five yrs*	p-value, one to five yrs*
Patients, n	113	92	113		
PRWE total score, mean (SD)	62 (20)	26 (25)	19 (21)	< 0.001	0.002
PRWE pain score, mean (SD)	32 (11)	15 (13)	11 (11)	< 0.001	0.002
PRWE function score, mean (SD)	29 (11)	11 (13)	9 (10)	< 0.001	0.012

*Paired *t*-test.
PRWE, Patient-Rated Wrist Evaluation; SD, standard deviation.

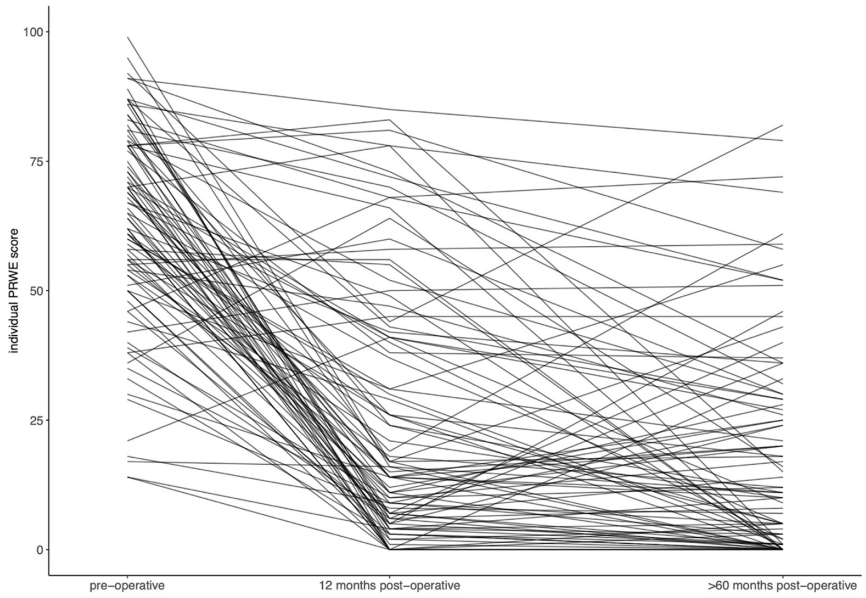

Fig. 3
Individual Patient-Rated Wrist Evaluation (PRWE) total score at baseline, one year, and five years postoperatively.

102 patients were excluded from the final analyses based on the exclusion criteria. The selection procedure of patients is shown in Figure 1.

Of the included patients, 83 (73%) were female. The mean age of the included patients was 40 years (standard deviation (SD) 12). The dominant hand was affected in 72 patients (64%). We found a mean of 22 months (SD 36) of complaints prior to surgery. Baseline characteristics of the included patients are shown in Table I. Table II shows that the demographics of responders and non-responders were not significantly different.

The mean PRWE total score improved significantly from 62 at baseline to 19 after five years ($p < 0.001$, paired *t*-test) (Figure 2 and Table III). Pain and function subscales showed similar improvement. We also found significant improvement for the five years outcome as compared to the one-year outcome; with a mean PRWE total score of 26 (SD) 25) to 19 (SD 21) (paired t-testp = 0.002) (Table III). Figure 2 shows the PRWE scores during the follow-up period. The percentage of patients who reached the MCID increased from 77.2% after one year follow-up to 83.2% after more than 60 months ($p < 0.001$, chi-squared test).

Figure 3 shows individual improvement of mean PRWE total scores. Overall, 54 patients (48%) continued to improve at one and five years follow-up. In all, nine patients (8%) showed an improvement after initial deterioration at 12 months, 27 patients (24%) first improved but then deteriorated at five years, and in two patients (2%) there was no change at any timepoint.

In all, ten patients self-reported complications after five years, two of whom reported an unsuccessful TFCC reinsertion, and one reported symptoms consistent with complex regional pain syndrome. The remaining patients reported different complications, such as hand allergy, recurrent pain, tendinitis, loss of strength, loss of sensation, and vomiting. Overall, six of the ten patients were treated for their complaints: two had a reoperation, and four had other treatments. The surgeons reported complications in 16 patients, of which some had multiple complications. Patient-reported complications and their treatments are shown

Table IV. Patient self-reported complications and treatment.

Complication (n)	Treatment (n)
Total (10)	Interventions (6)
TFCC reinsertion failed (2)	Revision (2)
Light vegetative disturbance (1)	Rehabilitation programme with physiotherapy and occupational therapy (1)
Hand allergy (2)	Shampoo and hormone ointment (1) Custom splint (1)
Severe pain (1)	Analgesics (1)
Tendinitis (1)	Untreated (1)
Loss of strength (1)	Untreated (1)
Loss of sensation (1)	Untreated (1)
Vomiting (1)	Untreated (1)

Table V. Surgeon-reported complications and treatments.

Complication (n)	Treatment (n)
Total (23)	
DRUJ instability (4)	Revision surgery (6)
CRPS (1)	Hand therapy (1)
Pisiform-related complaints (3)	Splinting and hand therapy (3)
Recurrent pain (4)	Hand therapy (4)
Tendinitis (6)	Hand therapy (6)
Inflammation (2)	Antibiotic therapy (2)
Altered sensation DBUN (1)	Desensitization (1)

CRPS, complex regional pain syndrome; DBUN, dorsal branch of ulnar nerve; DRUJ, distal radial ulnar joint.

in Table IV, and surgeon-reported complications and treatments are shown in Table V.

We observed an increase in satisfaction in the period from one to five years post-surgery. After five years, 45 patients (39.8%) stated excellent on the question whether they were satisfied with the achieved result after ≥ 60 months, while this was 24 patients (26.1%) after 12 months. Moreover, five patients (5.7%) stated poor and ten (10.2%) stated mediocre on satisfaction after 12 months, while at ≥ 60 months we noticed five patients (4.4%)patients stated poor, and six patients (5.3 %) stated mediocre. Overall, patients were more satisfied after five years when compared to 12 months ($p < 0.001$, chi-squared test). Figure 4 provides an overview of the patient satisfaction after open TFCC reinsertion at 12 and ≥ 60 months. When we asked our patients one year after surgery whether they would choose the same procedure again if they had identical complaints, 89/105 (85%) responded positively. When asked at five years post-surgery, 112/129 (87%) responded positively.

Discussion

The aim of this study was to determine the long-term outcomes of open surgery for the TFCC. We found ongoing improvement in the patient-reported pain and function after the first 12 months post-surgery. In addition, 94 patients (83.2%) achieved the MCID after more

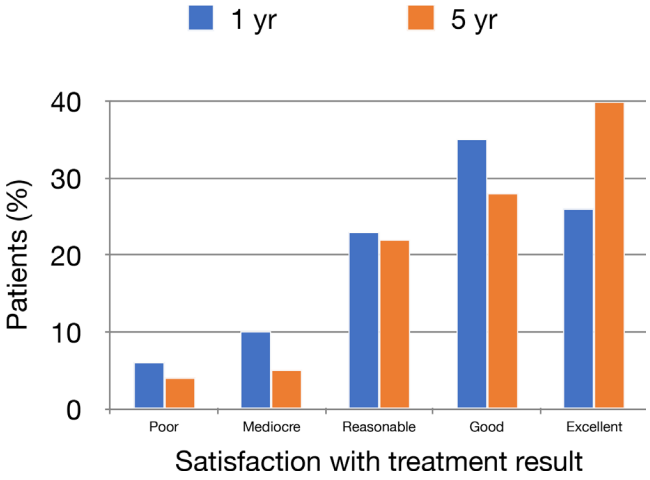

Fig. 4

Patient-reported satisfaction with the treatment result. Patients reported to be more satisfied at late follow-up.

than 60 months, which is a significant improvement as compared to 12 months.

We found a discrepancy between patient-reported complications and complications reported by the physicians. Where ten patients still remember a complication after ≥ 60 months, the doctors reported a complication in a total of 16 patients. The most frequent complication was revision surgery for DRUJ instability that was performed in four patients (3.5%), while Anderson et al[12] reported a 17% revision rate in their population. We postulate that patients have a tendency to under-report unfavourable events in late-follow up questionnaires as compared to surgeon reported outcome.

Luchetti et al[5] reported follow-up for open surgery of the TFCC in 24 patients; the mean PRWE improved from 69 (SD 29) to 42 (SD 29) in their study. Follow-up in his study was a mean of 31 months (six months to six years). We report more improvement for pain and function as demonstrated by the PRWE total scores: 62 (SD 20) to 19 (SD 21). Anderson et al[12] only reported postoperative PRWE as 28.9 (6.6) with a mean follow-up of 53 months in 39 patients. Moloney et al[13] reported on 15- to 25 -year follow-up in 23 patients with open TFCC repair. They reported a long-term follow-up value of the PRWE total of 22.5. Abe et al[14] reported on eight open repairs, with a follow-up of 34 months on average, with an absolute pain relief preoperatively of NRS 10 to NRS 0 postoperatively.

Patients were more satisfied with the surgery after five years than at one year. We found the gain in satisfaction of interest; in knee and hip surgery, there are reports of similar satisfaction or small gains from year one to year five postoperatively.[15,16] We cannot compare our findings to other patient reported outcome for TFCC surgery as follow-up data is scarce, follow-up times vary, or baseline values are not reported. So, we tried to find other studies

in hand surgery on patient satisfaction at one and five years; however, we could not find similar reports. Patient-reported outcome on satisfaction is becoming increasingly important. We had not expected a further gain in satisfaction with the treatment result after one year. Possibly, this gain suggests that patients tend to reflect on the satisfaction question more to their present overall wellbeing as opposed to the satisfaction with the surgery. A large study on 5,869 total knee arthroplasties reported that knee functional outcome scores were imperfect predictors of satisfaction.[17] However, we did also find a significant improvement in functional scores (PRWE), suggesting an overall gain in function, less pain, and more satisfaction at five years follow-up.

Limitations. A limitation of this study is that we have complete data on 53% of the population, which could indicate a selection bias. Patients were not lost to follow-up, but failed to answer their questionnaires. Yet, with complete data from > 100 patients, and since there were no differences between responders and non-responders, we may conclude that open surgery for the TFCC results in early and late improvement of pain and function. As grip strength and range of motion had improved in the first 12 months compared to baseline, we did not ask patients to return to our centre for repeated measurements after five years. This could also be perceived as a possible limitation of this study.

In conclusion, open surgery for TFCC repair results in significant early and late improvements in pain and function. Satisfaction with the treatment result increases from one to ≥ five years. Both patients and surgeons report few complications.

Take home message

- Open surgery for triangular fibrocartilage complex repair results in early and late improvements in pain and function.
- Both patients and surgeons report few complications.
- Satisfaction with the end result increases > five years post-surgery.

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Ethical review statement:
- Institutional review board approval was obtained from the ethics committee of the Erasmus University Medical Center approved our study protocol (NL/sl/MEC-2018-1088). All patients provided consent for their data to be used in this study.

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