Short-Term Results after Total Trapeziectomy with a Poly-L/D-Lactide Spacer

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Abstract

Background Proximal migration of the first metacarpal can be seen after total trapeziectomy and various techniques have been described to prevent this subsidence.

Purpose We hypothesized the insertion of a poly-L/D-lactide spacer to prevent proximal migration of the first metacarpal without the need of an additional ligament reconstruction, allowing early mobilization and less demanding rehabilitation.

Patients and Methods Ten thumbs were treated with a total trapeziectomy and insertion of a poly-L/D-lactide scaffold. Clinical and radiological evaluation was performed after 6 months and 1 year. Patient satisfaction, pain, Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) score, mobility of the thumb, and strength were assessed.

Results Pain according to the visual analog scale decreased ($p = 0.01$) and QuickDASH score decreased ($p = 0.02$) significantly after 1 year. Radiological evaluation after 12 months showed a collapse of the scaphometacarpal distance of 45% ($p = 0.01$). Osteolysis of the distal scaphoid pole and/or proximal metacarpal was seen in 6 out of 10 cases. Because of the osteolysis, the use of the poly-L/D-lactide scaffold was discontinued in our practice.

Conclusion In this limited series, total trapeziectomy with the use of the poly-L/D-lactide scaffold provides significant pain reduction and improvement of overall function. Radiographic evaluation shows significant collapse of the scaphometacarpal distance after 1 year and frequent signs of osteolysis. We do not encourage the use of the poly-L/D-lactide scaffold with total trapeziectomy before long-term clinical and radiological follow-ups of the osteolysis are available.

Keywords
- trapeziometacarpal osteoarthritis
- poly-L/D-lactide spacer
- osteolysis
- proximal migration

Basal thumb osteoarthritis is one of the most common sites of osteoarthritis in humans. Although often asymptomatic, it can be a very painful and invalidating condition, occurring mostly in women.[1,2] Since the basal thumb is a complex, multilevel joint, pain can be generated by trapeziometacarpal (TMC) osteoarthritis, scaphotrapeziotrapezoid (STT) osteoarthritis, or a combination of both.

Multiple surgical interventions exist to treat symptomatic thumb base osteoarthritis after failure of conservative treatment. When combined symptomatic TMC and STT

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osteoarthritis are present, a total trapeziectomy, with or without interposition arthroplasty and/or ligament reconstruction, is usually performed. Although ligament reconstruction and tendon interposition (LRTI) provides good long-term results, rehabilitation can be demanding. When a trapeziectomy is performed without additional procedures, proximal migration of the first metacarpal is encountered frequently.[3–6]

A poly-L/D-lactide (RegJoint; Scaffdex Oy, Tampere, Finland) implant has been described to reconstruct small joints in low-demand patients suffering from rheumatoid arthritis.[7] This bioabsorbable scaffold theoretically acts as a temporary spacer after resection arthroplasty, allowing scar tissue to form in the empty void.[7,8]

We hypothesized the poly-L/D-lactide implant to be a valid option after total trapeziectomy to prevent proximal migration of the first metacarpal without the need of an additional ligament reconstruction.

Patients and Methods

Patients

In 2016, 10 thumbs in nine patients were treated with a total trapeziectomy and insertion of a poly-L/D-lactide implant. Inclusion criteria were symptomatic combined primary TMC and STT osteoarthritis after failure of 3 months of conservative treatment or painful posttrapeziectomy status, requiring revision surgery due to proximal migration of the first metacarpal. Approval of the local institution's ethical board was acquired, and informed consent was provided by all patients.

Operative Technique

All surgeries were performed by the same hand surgeon (B.K.) under combined locoregional and general anesthesia. Single shot cefazolin 2 g was administered intravenously before inflation of a tourniquet on 250 mm Hg. A dorsal approach was used to access the trapezium. After incision of the skin, the sensory branches of the radial nerve were identified. A longitudinal capsular incision was performed to open the TMC joint. After removal of the entire trapezium, the poly-L/D-lactide implant trial spacers were used to measure the distance between the distal pole of the scaphoid and proximal base of the thumb metacarpal. Two 4.5 mm height scaffolds were used to fill up the gap, resulting in a 9-mm spacer. Diameters range from 10 to 18 mm. The scaffolds were attached to the surrounding tissue with absorbable sutures. The capsule was closed using absorbable sutures and the skin was closed using staples.

Postoperative Care

A forearm cast including the thumb was used continuously for 2 weeks. Staples were removed after 2 weeks and a removable thermoplastic thumb splint was used for another 2 weeks, allowing intermittent automobilization without force application. Physiotherapy was started 1 month postoperatively.

Assessment

All patients were assessed 6 and 12 months after surgery by an independent researcher. Patients were asked for general satisfaction and scar appearance. The Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) score system was used to determine pre- and postoperative functions. Pre- and postoperative pains were measured using a visual analog scale (VAS) score (0–10).

Thumb mobility and strength were assessed for operated and nonoperated sides. As one patient underwent a bilateral procedure, only eight nonoperated sides were measured. Thumb opposition (0–10) and retropulsion (0–3) were measured as described by Kapandji.[9] Opening of the first web space and mobility of the metacarpophalangeal (MP) joint were measured using a goniometer. Grip strength was measured using a calibrated hydraulic ping gauge, and key pinch and precision pinch were measured using a calibrated hydraulic hand dynamometer. Radiographic assessment was done before surgery, 1 day, 6, and 12 months after surgery. Distance between the distal pole of the scaphoid and proximal border of the first metacarpal (scaphometacarpal distance) was measured, and osteolysis was noted when present.

Statistical Analysis

Statistical analysis was performed using the software SPSS (IBM), version 25. Differences in pre- and postoperative pains, QuickDASH and scaphometacarpal distance, and differences in operated and nonoperated thumb mobilities and strength were analyzed using a Wilcoxon's signed-rank test. Statistical significance was accepted when $p \leq 0.05$.

Results

All patients were right-handed females. Three dominant and seven nondominant sides were operated. Mean age was 64 (range: 50–80) years. Eight procedures were performed for combined TMC and STT osteoarthritis and two for painful posttrapeziectomy status. One patient underwent a bilateral procedure. After 1 year, six out of nine patients were satisfied with the overall result and five out of nine patients would undergo the same procedure again. All were satisfied with the scar appearance. One patient complained of paresthesia at the dorsal side of the thumb after 6 months which resolved spontaneously after 1 year. Two patients developed a trigger thumb after 1 year (►**Table 1**).

Overall pain using a VAS score system decreased significantly, both after 6 months ($p = 0.036$) and after 1 year ($p = 0.011$). QuickDASH score decreased significantly after 1 year ($p = 0.022$) (►**Table 2**). Opening of the first web space decreased significantly ($p = 0.027$) compared with the nonoperated side after 1 year. Opposition decreased significantly after 6 months ($p = 0.017$) but not after 1 year ($p > 0.05$) compared with the nonoperated side. Retropulsion did not change significantly compared with the nonoperated side after 6 months and 1 year. MP flexion decreased significantly ($p = 0.011$) after 6 months but not after 1 year ($p > 0.05$). MP extension did not change significantly compared with the nonoperated side. Grip strength decreased significantly ($p = 0.043$) after 6 months but not after 1 year compared with the nonoperated side. Key pinch decreased significantly ($p = 0.012$) after 6 months but only marginally significantly

Table 1 Patient demographics and PROM

Patient	Age	Gender	Indication	Dominant side	Operated side	QuickDASH			VAS		
						Preop	6 mo	12 mo	Preop	6 mo	12 mo
1	72	Female	TMC + STT osteoarthritis	R	R	30	70	50	7	9	7
2	77	Female	TMC + STT osteoarthritis	R	L	82	57	64	7	5	3
3	80	Female	TMC + STT osteoarthritis	R	R	66	32	16	9	3	1
4	63	Female	After trapeziectomy	R	L	84	55	18	7	1	1
5	66	Female	TMC + STT osteoarthritis	R	L	64	55	39	8	6	6
6	50	Female	TMC + STT osteoarthritis	R	L	75	39	2	7	4	1
7	58	Female	TMC + STT osteoarthritis	R	L	35	27	25	5	7	4
8	58	Female	TMC + STT osteoarthritis	R	R	58	55	27	9	4	7
9	56	Female	TMC + STT osteoarthritis	R	L	50	27	32	9	2	1
10	64	Female	After trapeziectomy	R	L	61	41	55	7	7	7

Abbreviations: QuickDASH, Quick Disabilities of the Arm, Shoulder, and Hand; Preop, preoperative; PROM, patient-reported outcome measures; STT, scaphotrapeziotrapezoid; TMC, trapeziometacarpal.

Table 2 PROM pre- and postoperatively

	Preop (SD)	6 mo (SD)	*p*-Value	12 mo (SD)	*p*-Value
Number of measurements	10	10		10	
Pain (VAS)	7.5 (1.27)	4.8 (2.49)	0.036[a]	3.8 (2.74)	0.011[a]
QuickDASH	60.5 (18.15)	45.8 (14.65)	0.074	32.8 (19.28)	0.022[a]

Abbreviations: QuickDASH, Quick Disabilities of the Arm, Shoulder, and Hand; Preop, preoperative; PROM, patient-reported outcome measures; SD, standard deviation; VAS, visual analog scale.
[a]Significant statistical result.

after 1 year ($p = 0.049$). Precision pinch decreased significantly ($p = 0.011$) after 6 months but not after 1 year ($p > 0.05$) (►**Table 3**).

Scaphometacarpal distance after 6 months and 1 year decreased significantly ($p = 0.011$) compared with direct postoperative results. Erosion and osteolysis of the distal scaphoid and/or proximal metacarpal were seen in five patients after 6 months and in six patients after 1 year (►**Table 4**) (►**Fig. 1**).

Discussion

The poly-L/D-lactide implant is designed to maintain the void after resection arthroplasty and allow ingrowth of

Table 3 Range of motion of MP joint and strength after 6 and 12 months compared with nonoperated side

	Nonoperated side (SD)	6 mo (SD)	*p*-Value	12 mo (SD)	*p*-Value
Number of measurements	8	8		8	
Opening of the first web space (deg)	71.25 (9.54)	65.00 (10.00)	0.172	55.00 (16.90)	0.027[a]
Opposition	9.63 (0.52)	7.38 (1.30)	0.017[a]	8.25 (1.98)	0.121
Retropulsion	1.88 (0.35)	1.25 (0.71)	0.059	1.25 (0.71)	0.059
MP flexion (deg)	36.88 (18.70)	15.00 (15.12)	0.011[a]	16.88 (19.81)	0.078
MP extension (deg)	7.50 (22.68)	16.88 (9.23)	0.158	20 (19.27)	0.292
Grip strength (kg)	15.75 (5.28)	8 (5.93)	0.043[a]	14.75 (4.50)	0.750
Key pinch (kg)	3.63 (1.55)	1.50 (0.93)	0.012[a]	1.81 (1.25)	0.049[a]
Precision pinch (kg)	3.44 (1.15)	1.25 (0.76)	0.011[a]	1.69 (1.13)	0.068

Abbreviations: MP, metacarpophalangeal; SD, standard deviation.
[a]Significant statistical result.

Table 4 Radiological outcome

	Preop (SD)	Postop (SD)	6 mo (SD)	*p*-Value	12 mo (SD)	*p*-Value
Number of measurements	8	8	8		8	
Scaphometacarpal distance (mm)	9.63 (2.13)	8.63 (0.69)	5.94 (1.47)	0.011[a]	4.5 (2.07)	0.011[a]
Osteolysis (*n*)	0	0	5		6	

Abbreviations: Preop, preoperative; Postop, postoperative; SD, standard deviation.
[a]Significant statistical result.

Fig. 1 (**A**) Preoperative scaphotrapeziotrapezoid and trapeziometacarpal osteoarthritis; (**B**) trapeziectomy 1 day postoperative; (**C**) trapeziectomy 1 year postoperative showing subsidence and signs of osteolysis.

fibrous tissue over a period of 2 to 3 years. It has been used to replace small joints in rheumatoid patients and promising results with good functional outcome have been published after MP arthroplasty and TMC arthroplasty for inflammatory osteoarthritis.[7,8,10,11] Recently, the poly-L/D-lactide implant has been used in primary TMC osteoarthritis after partial trapeziectomy, but to our knowledge, it has not yet been used after total trapeziectomy for combined TMC and STT osteoarthritis.[12]

This study has some limitations. It is a retrospective study with a small sample size and inclusion criteria are both primary and revision procedures. Measurements for non-operated side were only available in eight procedures and direct postoperative radiographs were only available in eight procedures. This can be a potential source of bias.

Our study demonstrates pain and function improvement after the procedure, but the radiological evaluation after 6 and 12 months shows progressive subsidence of the first metacarpal, resulting in a significant decrease of the scaphometacarpal distance and resenting our hypothesis. Ligamentous instability after resection of the dorsal capsule and ligaments by using a dorsal approach may affect the migration of the first metacarpal.[13] A volar Wagner approach may hypothetically be less ligamentous invasive.

Mattila et al reported on the outcome of partial trapeziectomy with the use of a poly-L/D-lactide implant for primary TMC osteoarthritis. Although overall functional results improved, radiographs demonstrated an unacceptable incidence of osteolysis after 1 year, which resulted in three revision procedures after 3 years of follow-up.[12,14] After this publication, we decided to discontinue the use of the poly-L/D-lactide spacer in our institution. Our radiographic results are comparable with frequent worrisome erosion and/or osteolysis. Its future clinical impact still needs to be determined: as the spacer degrades over a period between 2 and 3 years, further follow-up is necessary to determine the amount of osteolysis after complete resorption of the spacer. A possible explanation for the osteolysis might be the presence of a foreign body reaction. This was already described for other trapezial implants such as the Swanson prosthesis and the Artelon spacer, but histologic evidence is missing for the current implant.[15] Revision possibilities after poly-L/D-lactide implant failure are still to be investigated. Until further radiological and clinical follow-ups are available, we do not encourage the use of the poly-L/D-lactide implant spacer in primary osteoarthritis. Other options are described to compensate for the subsidence of the first metacarpal such as the suture-button suspensionplasty or LRTI.[16,17]

Conclusion

In our small sample study, the poly-L/D-lactide spacer cannot compensate for proximal migration of the first metacarpal after total trapeziectomy. Moreover, signs of severe osteolysis were frequently found on radiographic evaluation after 1-year follow-up.

Authors' Contributions

Kjell Van Royen wrote the article, collected data, and assisted with the surgery. Bart Kestens performed the surgery. Sven Van Laere performed statistical analysis. Jean Goubau internally reviewed the article and helped with the language. Chul Ki Goorens developed the study design and assisted with data collection and writing.

Note

Approval of the local ethical review committee was acquired (RZ Tienen hospital). Most of the work was also done at the RZ Tienen hospital.

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Conflict of Interest

None.

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