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ORIGINAL STUDY

Ten-year outcomes of the Arpe prosthesis for the treatment of osteoarthritis of the trapeziometacarpal joint

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Outcomes of 66 Arpe prostheses in 50 patients treated for osteoarthritis of the trapeziometacarpal joint were investigated with a mean follow-up of ten years. Ten-year survival was 87% when failure was defined as implant removal followed by trapeziectomy and tendon interposition. Ten-year survival was 82% when revision of the cup was also considered as failure and it was 80% when replacement of the neck alone was also chosen as an endpoint. Of the 52 prostheses that were not revised mean DASH score was 11, mean pain score 1.2 and mean score for satisfaction 9.5. It can be concluded that the majority of patients who did not underwent revision surgery were satisfied and had little or no pain. However, long-term survival of the Arpe prosthesis was moderate and patients should be warned that after ten years the risk for reoperation might be up to 20%.

Keywords: trapeziometacarpal joint; osteoarthritis; joint prosthesis; arthroplasty; Arpe prosthesis; Thumb; survival analysis

INTRODUCTION

Osteoarthritis of the trapeziometacarpal joint is a common cause of pain and disability. Several surgical treatment options exist, but the gold standard remains simple trapeziectomy. Although there is no proof that total joint arthroplasty is better than trapeziectomy *(14, 24-27),* it is a popular procedure in Belgium. Total joint arthroplasty may have several advantages in comparison with trapeziectomy, such as faster recovery and better pinch strength *(6,18,21,24)*. However, high complication rates have been reported with thumb prostheses *(18)*.

Different types of total joint arthroplasty for the trapeziometacarpal joint are on the market and it may be interesting for surgeons to know which implant has the best survivorship. Currently, the standard 10-year survival rates for total hip replacement can be expected to be greater than 95% *(13)*. Reported survival rates of thumb prostheses are less good. However, it is difficult to compare survivorship as methods and endpoints differ between studies *(8,9)*.

Medium long-term results of the Arpe prosthesis of patients treated in our hospital were encouraging *(23)*. Vander Eecken et al. reported a 5-year survival of 97% *(23)*. The aim of the present study was to find out if these good results would be maintained at ten years and what was the influence of chosen

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endpoint on survivorship. Another aim was to assess subjective outcomes of patients.

PATIENTS AND METHODS

Between April 2001 and February 2014, 73 hands in 57 patients were operated on with a total joint prosthesis (Arpe, Biomet, Warsaw, IN) for painful trapeziometacarpal osteoarthritis. The operations were performed by two senior surgeons at our institute (NH and WV). Patient demographics are shown in table I. Patients were assessed by a medical student (AD), independently of the operators. Of 57 patients (73 prostheses), 7 (7 prostheses) were lost to follow-up (four had deceased and three could not be contacted). Fifty patients with 66 implants were included in the study (Fig 2) with mean age of 56 years (range: 38, 75). Nine prostheses were inserted in male and 56 in female patients

The study was approved by the ethical committee of the hospital.

Table I. — Patient demographics

Number of patients	57
Number of thumbs	73
F : M ratio	61 : 12
Operated side (%)	
Left	24 (42.1%)
Right	17 (29.8%)
Bilateral	16 (28.1%)
Mean age at operation, years (range)	57 (37, 79)
Mean follow-up period, years (range)	10 (3, 16)

*F= female, M= male

The Arpe prosthesis consists of a hydroxyapatite-coated stem and cup (Fig. 1). At the time patients were operated on, the stem was available in four different sizes and the cup in two (9 and 10 mm). The polyethylene cup could be constrained or unconstrained. The metal neck and head were made out of one piece and could be straight or with offset. Three different lengths were available: medium, long and extra-long (*10*).

The surgical technique has been published previously *(23)*.

Patients were interviewed by telephone to determine the disability of arm, shoulder and hand

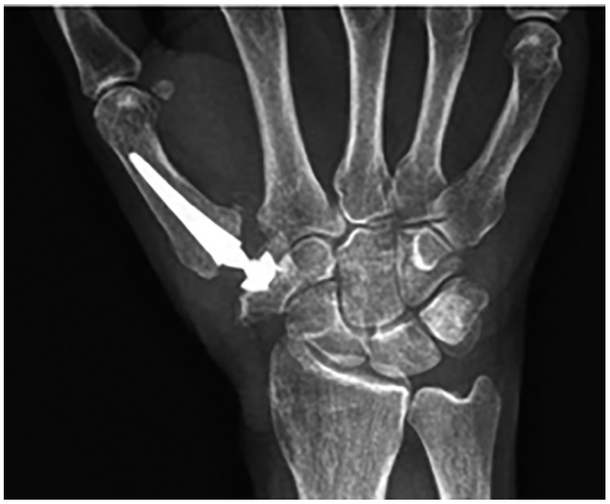

Fig. 1. — Arpe prosthesis in a 66-year-old woman 5 years postoperatively.

(DASH) (*15*) and scores for pain, satisfaction and willingness to have the same operation again. A modified DASH score was used if patients were operated on both hands. Instead of determining one DASH score, the DASH score was separated by operated side. A pain score of 0 indicates no pain and 10 the strongest pain imaginable. A score for satisfaction of 0 means extremely dissatisfied and 10 extremely satisfied. A score for willingness to have the same operation again of 0 indicates that the patient absolutely would not undergo the same operation again and a score of 10 that the patient would be strongly willing to undergo the same procedure again.

Information on additional surgical procedures was obtained from the medical files and patients were asked by telephone if they had been reoperated in another hospital.

Three different survival analyses were performed according to definition of endpoint or failure. In the first analysis, failure was defined as removal of the cup, neck and if possible also the stem. This group of patients underwent a trapeziectomy with ligament reconstruction and tendon interposition after removal of the implant. In the second analysis, failure was defined as removal of the cup and neck followed by trapeziectomy and tendon interposition or replacement with a new cup and if necessary a new neck. If only the neck was replaced to reduce

the risk of dislocation it was not considered as failure. In the third analysis, failure was defined as removal or replacement of stem, cup or neck.

The difference in subjective outcome between patients who underwent only one operation and those who had undergone revision surgery were tested with nonparametric methods (Mann-Whitney-U test, Chi-square test). The Kaplan-Meier method was used to calculate survival analysis. IMB SPSS Statistics Version 25 (SPSS, an IBM Company, Chicago, IL, USA). Level of statistical significance was with $P < 0.05$.

RESULTS

DASH, pain, satisfaction and willingness to undergo the same operation again were assessed in 63 hands with a mean follow-up of 10 years (range : 3, 16). Results could not be obtained in 3 patients.

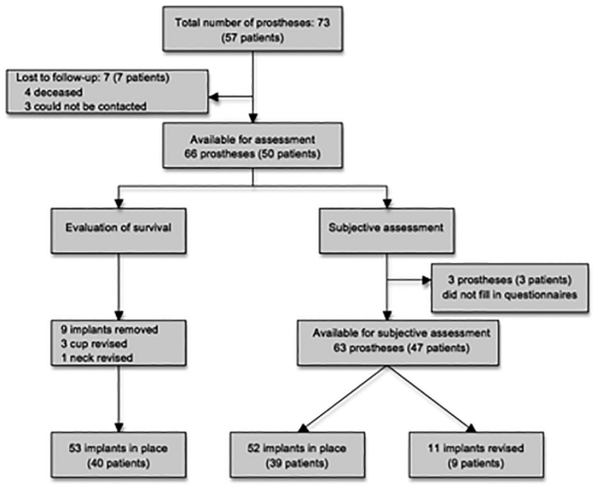

Fig. 2. — Schematic presentation of subjective assessment and evaluation of 10-year survival of prostheses.

Outcomes are shown in table II. Patients who still had their original implant had better subjective

Table II. — Subjective outcomes

	mean DASH (SD)	mean score for pain (SD)	mean score for satisfaction (SD)	mean score willingness (SD)
All (N= 63)	14.3 (15.7)	1.4 (1.9)	9.1 (1.6)	9.2 (1.5)
Without revision (N= 52)	11.2 (10.8)	1.2 (1.7)	9.5 (0.9)	9.6 (0.7)
With revision (N= 11)	29.4 (25.1)	2.1 (2.4)	7.6 (2.9)	7.6 (2.8)
p-value	0.04	0.14	< 0.01	0.01

*y= years, m= months, F= female, M= male, PE = polyethylene, explantation= implant removal and trapeziectomy with tendon interposition.

Table III. — Revisions

Case N	Age (y)	Gender	Time since surgery	Mode of failure	Mode of revision
1	75	F	<1y (11m)	Early dislocation	Neck revision
			13.5y	Dislocation	Explantation
2	52	F	4.5y	PE wear	Explantation
3	46	M	7.5y	PE wear	Explantation
4	46	M	9.5y	PE wear	Explantation
5	61	F	<1y (7m)	Early dislocation	Neck revision
			8y	PE wear	Cup revision (constrained)
6	69	F	<1y (1d)	Early dislocation	Cup revision (constrained)
7	55	F	6.5y	Cup loosening	Explantation
8	55	F	<1y (2m)	Cup loosening	Cup revision
9	47	F	1y	Cup loosening	Explantation
10	50	M	2y	Cup loosening	Cup revision
			3.5y	Cup loosening	Explantation
11	58	F	1y	Early dislocation	Neck revision
12	67	M	9 y	Subsidence cup	Explantation
13	46	F	1.5y	Cup loosening	Explantation

scores than those who underwent revision surgery. The difference was not significant for the pain score. Thirty-two out of 52 (61.5%) hands with the original implant still in place were completely pain free at last follow-up.

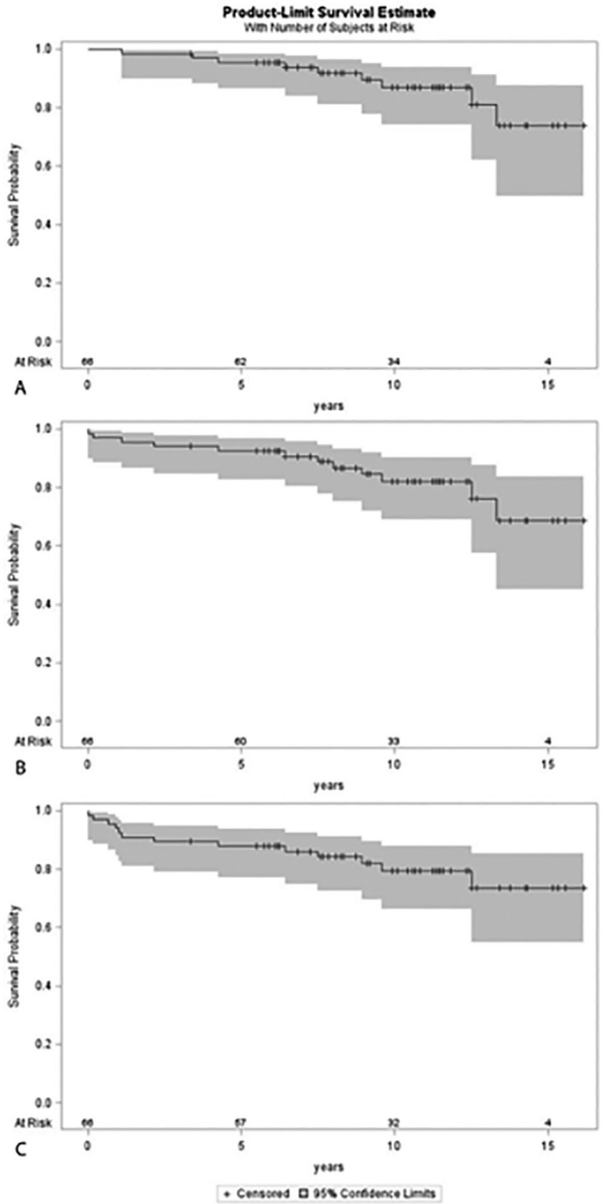

Fig. 3. — Kaplan-Meier graphics showing survivorship. Failure defined as (A) explantation of implant, (B) as explantation of implant or replacement of components (if only the neck was replaced it was not considered as failure) and (C) as explantation of implant or replacement of any component.

Information of additional surgical procedures could be obtained of 66 prostheses (50 patients). Revisions were performed in 13 prostheses (11 patients) (Fig 2). The cause of failure and mode of revision are listed in table III.

Early dislocation (< 1 year after surgery) occurred in 4 hands (6.1 %) and a late (> 1 year after surgery) in two (3%). In three cases the neck was replaced to treat instability after dislocation. In another case a constrained cup was inserted. In one patient with dementia the prosthesis had dislocated, but it was asymptomatic and no treatment was needed.

At ten year follow-up, 7 out of 66 implants were explanted (analysis 1), in 3 other hands the cup (with or without the neck) was replaced (analysis 2). In two other patients only the neck was revised (analysis 3). Ten-year survival depending on chosen endpoint was 87% (SD : 4.73) in analysis 1 (Fig. 3A), 82% (SD: 5.27) in analysis 2 (Fig. 3B), and 80% (SD: 5.40) in analysis 3 (Fig. 3C). Mean period between the first operation and removal of the prosthesis was 89 months (range: 12, 160). Mean time to the first reoperation was 51 months (range: 1 day, 150 months).

DISCUSSION

Results of the present study with the Arpe implant show a moderate survivorship at ten years, ranging between 80% and 87%, depending on the chosen endpoint. These results are comparable to the survival rate with the Arpe implant reported by Apard and Saint-Cast with an 11-year survival of 79% *(1)*. Martin-Ferrero et al reported a survivorship of 94% at ten years *(17)*, but replacement of the cup or neck was not considered as failure. There is a relative paucity of long-term follow-up studies on trapeziometacarpal joint prosthesis and the reported outcomes are very variable *(8,9)*. The cemented la Caffinière prosthesis is the most studied implant, with the longest follow-up studies. Chakrabarti et al reported 89% survivorship at 16 years, the 26 years follow-up of the same series was still 74% *(4,12)*. Van Cappelle et al., found 72% survivorship at 16 years *(22)*. Good long-term follow-up with the Rubis II was reported by Dehl et al with a 10-year survival of 89%. Only explantation was considered as failure.

However, the dropout rate in the study was high, 104 patients out of 199 (52%) were excluded from the analysis *(7)*. Survival of the Rubis II implant at 12 years was 90% in the series by Maes et al *(16)*. One study with the Roseland prosthesis reported a 10-year survival of 91%, but they did not use a cumulative survivorship analysis *(20)*. Thus, care should be taken when comparing survival rates, since results are dependent on chosen endpoint and method.

The two most reported complications in literature are dislocation and implant loosening *(8,19)*. In the present study dislocation rate was high, a total of 6 hands experienced a dislocation (9.1%), of which four (6.1%) in the early postoperative phase (<1 year). These results are comparable with those reported in other studies with the Arpe implant: 9.5% by Brutus and Kinnen *(3)*, 8% by Jacoulet *(11)*, 5% by Cootjans *(5)* and 10% by Robles-Molina *(18)*. Another problem with the ARPE implant is that if polyethylene wear occurs, it may cause instability and may require cup revision even though it may not be loose *(19,23)*.

In the present study, patients in whom the implant was still in place had good subjective outcomes. Even though one in five patients might need another operation, total joint arthroplasty may still be indicated in selected cases. The difficulty is to predict in which patients the prosthesis will fail. In previous reports, male gender and young age (<65 years) have been associated with inferior results *(4,22)*. Another study with the Maia implant found a significant association between the presence of preoperative thumb deformities, poor trapezium bone quality (very porous or sclerotic), incorrect positioning of trapezial cup and the need for revision surgery *(2)*.

Limitations of the present study are the retrospective design and the lack of comparison with the standard care (trapeziectomy). Preoperative DASH or pain scores were not available. Finally, patients were only investigated with questionnaires and neither a clinical examination nor a radiological follow-up was performed.

It can be concluded that subjective outcomes of patients with the Arpe prosthesis after a mean follow-up of ten years are good as long as no revision are needed. Patients should be informed that the risk of revision surgery after ten years might be as high as 20%.

REFERENCES

1. **Apard T, Saint-Cast Y.** [Results of a 5 years follow-up of Arpe prosthesis for the basal thumb osteoarthritis]. (in French). *Chir Main* 2007 ; 26 : 88-94.
2. **Bricout M, Rezzouk J.** Complications and failures of the trapeziometacarpal Maia(R) prosthesis: A series of 156 cases. *Hand Surg Rehabil.* 2016 ; 35 : 190-198.
3. **Brutus JP, Kinnen L.** [Short term results of total carpometacarpal joint replacement surgery using the ARPE implant for primary osteoarthritis of the thumb.] (in French). *Chir Main* 2004 ; 23 : 224-228.
4. **Chakrabarti AJ, Robinson AH, Gallagher P.** De la Caffinière thumb carpometacarpal replacements: 93 cases at 6 to 16 years follow-up. *J Hand Surg Br.* 1997 , 22 : 695-698.
5. **Cootjans K, Vanhaecke J, Dezillie M, Barth J, Pottel H, Stockmans F.** Joint Survival Analysis and Clinical Outcome of Total Joint Arthroplasties With the ARPE Implant in the Treatment of Trapeziometacarpal Osteoarthritis With a Minimal Follow-Up of 5 Years. *J Hand Surg Am.* 2017 ; 42 : 630-638.
6. **De Smet L, Vandenberghe L, Degreef I.** Long-term outcome of trapeziectomy with ligament reconstruction and tendon interposition (LRTI) versus prosthesis arthroplasty for basal joint osteoarthritis of the thumb. *Acta Orthop Belg.* 2013 ; 79 : 146-149.
7. **Dehl M, Chelli M, Lippmann S, Benaissa S, Rotari V, Moughabghab M.** Results of 115 Rubis II reverse thumb carpometacarpal joint prostheses with a mean follow-up of 10 years. *J Hand Surg Eur.* 2017 ; 42 : 592-598.
8. **Hollevoet N, Giddins G.** Systematic-review : total joint prosthesis. In: Giddins G, Leblebicioğlu G, editors. Evidence based data In hand surgery and therapy. Ankara, Turkey: Iris Publications 2017 ; 404-18.
9. **Huang K, Hollevoet N, Giddins G.** Thumb carpometacarpal joint total arthroplasty: a systematic review. *J Hand Surg Eur.* 2015 ; 40 : 338-350.
10. **Isselin J.** [ARPE prosthesis-preliminary results.] (in French). *Chir Main* 2001 ; 20 : 89-92.
11. **Jacoulet P.** [Results of the ARPE trapezometacarpal prosthesis : a retrospective study of 37 cases.] (in French). *Chir Main* 2005 ; 24 : 24-28.
12. **Johnston P, Getgood A, Larson D, Chojnowski AJ, Chakrabarti AJ, Chapman PG.** De la Caffiniere thumb trapeziometacarpal joint arthroplasty: 16-26 year follow-up. *J Hand Surg Eur.* 2012 ; 37 : 621-624.
13. **Junnila M, Laaksonen I, Eskelinen A, Pulkkinen P, Havelin LI, Furnes O, et al.** Implant survival of the most common cemented total hip devices from the Nordic

Arthroplasty Register Association database. *Acta Orthop.* 2016 ; 87 : 546-553.

14. **Krukhaug Y, Lie SA, Havelin LI, Furnes O, Hove LM, Hallan G.** The results of 479 thumb carpometacarpal joint replacements reported in the Norwegian Arthroplasty Register. *J Hand Surg Eur.* 2014 ; 39 : 819-825.
15. **MacDermid JC, Turgeon T, Richards RS, Beadle M, Roth JH.** Patient rating of wrist pain and disability : a reliable and valid measurement tool. *J Orthop Trauma* 1998 ; 12 : 577-586.
16. **Maes C, Dunaud JL, Moughabghab M, et al.** Results of the treatment of basal thumb osteoarthritis by Rubis II prosthesis after more than 5 years. A retrospective study of 118 cases. *Chir Main* 2010 ; 29 : 360-5.
17. **Martin-Ferrero M.** Ten-year long-term results of total joint arthroplasties with ARPE(R) implant in the treatment of trapeziometacarpal osteoarthritis. *J Hand Surg Eur.* 2014 ; 39 : 826-832.
18. **Robles-Molina MJ, Lopez-Caba F, Gomez-Sanchez RC, Cardenas-Grande E, Pajares-Lopez M, Hernandez-Cortes P.** Trapeziectomy With Ligament Reconstruction and Tendon Interposition Versus a Trapeziometacarpal Prosthesis for the Treatment of Thumb Basal Joint Osteoarthritis. *Orthopedics* 2017 ; 40 : 681-686.
19. **Schmidt I.** Thumb CMC total exchange arthroplasty with the ARPE implant. *Chir Main* 2014 ; 33 : 295-298.
20. **Semere A, Vuillerme N, Corcella D, Forli A, Moutet F.** Results with the Roseland((R)) HAC trapeziometacarpal prosthesis after more than 10 years. *Chir Main* 2015 ; 34 : 59-66.
21. **Ulrich-Vinther M, Puggaard H, Lange B.** Prospective 1-year follow-up study comparing joint prosthesis with tendon interposition arthroplasty in treatment of trapeziometacarpal osteoarthritis. *J Hand Surg Am.* 2008 ; 33 : 1369-1377.
22. **van Cappelle HG, Elgenga P, van Horn JR.** Long-term results and loosening analysis of de la Caffiniere replacements of the trapeziometacarpal joint. *J Hand Surg.* 1999 ; 24-A : 476-482.
23. **Van der Eecken SV, Vanhove W, Hollevoet N.** Trapeziometacarpal joint replacement with the Arpe prosthesis. *Acta Orthop Belg.* 2012 ; 78 : 724-729.
24. **Vandenberghe L, Degreef I, Didden K, Fiews S, De Smet L.** Long term outcome of trapeziectomy with ligament reconstruction/tendon interposition versus thumb basal joint prosthesis. *J Hand Surg Eur.* 2013 ; 38 : 839-843.
25. **Vermeulen GM, Slijper H, Feitz R, Hovius SE, Moojen TM, Selles RW.** Surgical management of primary thumb carpometacarpal osteoarthritis: a systematic review. *J Hand Surg Am.* 2011 ; 36 : 157-169.
26. **Wajon A, Ada L, Edmunds I.** Surgery for thumb (trapeziometacarpal joint) osteoarthritis. *Cochrane Database Syst Rev.* 2005 CD004631.
27. **Wajon A, Vinycomb T, Carr E, Edmunds I, Ada L.** Surgery for thumb (trapeziometacarpal joint) osteoarthritis. *Cochrane Database Syst Rev.* 2015 ; CD004631.