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Clinical and Patient-Reported Outcomes After Total Wrist Arthroplasty and Total Wrist Fusion

A Prospective Cohort Study with 2-Year Follow-up

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Background: The functional benefits of total wrist arthroplasty (TWA) over total wrist fusion (TWF) are unknown. The purpose of this prospective cohort study was to compare TWA and TWF with respect to functional outcomes and activity limitations at up to 2 years postoperatively.

Methods: Between 2015 and 2020, we enrolled all adult patients undergoing TWA or TWF for the management of symptomatic end-stage wrist arthritis at 1 hand surgery department. The primary outcome was the Patient-Rated Wrist Evaluation (PRWE). The secondary outcomes were the visual analog scale (VAS) for pain at rest, on motion, and on loading; grip strength; Disabilities of the Arm, Shoulder and Hand (DASH); and range of motion. Patients completed questionnaires and were examined by the same physiotherapist at baseline and at 3, 6, 12, and 24 months postoperatively. Mixed-model analyses adjusting for age, diagnosis, the preoperative value of the dependent variable, and time since surgery were performed to compare differences in PRWE scores, VAS pain scores, and grip strength between TWA and TWF.

Results: Of the 51 patients who had been included at baseline, 47 (18 in the TWA group and 29 in the TWF group) responded to questionnaires and underwent examinations at up to 2 years postoperatively. At baseline, the 2 groups did not differ in terms of age, sex, diagnosis (inflammatory or noninflammatory arthritis), PRWE score, VAS pain score, grip strength, DASH score, or range of motion. No differences between the groups were found for the PRWE (β, −0.1; 95% confidence interval [CI], −14 to 13; p = 0.99), VAS pain at rest (β, −3.3; 95% CI, −15 to 9; p = 0.58), VAS pain on loading (β, −5.3; 95% CI, −22 to 11; p = 0.52), or grip strength (β, −0.02; 95% CI, −0.18 to 0.14; p = 0.80) on the adjusted mixed-model analyses.

Conclusions: Among patients with symptomatic end-stage wrist arthritis, those who underwent TWA did not demonstrate short-term outcomes, including patient-reported disability, pain, and grip strength, superior to those of patients who underwent TWF. These findings call into question the widespread use of TWA.

Level of Evidence: Therapeutic Level II. See Instructions for Authors for a complete description of levels of evidence.

The traditional treatment for symptomatic end-stage wrist arthritis is total wrist fusion (TWF)[1]. Although TWF creates a stable wrist with minimal pain, the price is loss of joint motion[1]. Total wrist arthroplasty (TWA) is a motion-preserving alternative, but it has failed to achieve the same widespread use as other joint replacement procedures, in part because of historically high rates of implant subsidence and loosening, especially in early implant designs[2,3].

Previous systematic reviews and retrospective matched case-control studies comparing TWA and TWF have shown good pain control and satisfaction scores for both procedures[3-7]. Research has indicated that the performance of certain activities, such as perianal care, may be better after TWA, whereas grip strength may be better after TWF[5-7]. However, well-designed comparative studies are lacking[4]. The aim of this prospective cohort study was to evaluate short-term functional results at up to 2 years postoperatively among patients with end-stage wrist arthritis who underwent TWF or TWA. Our hypothesis was that patients who received the motion-preserving alternative would have better functional results than patients who received the motion-sacrificing one. The primary outcome was the Patient-Rated Wrist Evaluation (PRWE).

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJSOA/A588).

A **data-sharing statement** is provided with the online version of the article (http://links.lww.com/JBJSOA/A589).

Materials and Methods

This study was approved by the Lund University Ethical Review Board, Sweden (No. 2015/121), and was registered on ClinicalTrials.gov (NCT05693636).

Study Design and Population

In this pragmatic, single-center, prospective, longitudinal cohort study, all eligible patients with end-stage wrist arthritis who were undergoing TWA or TWF at 1 hand surgery department (Skåne University Hospital, Malmö, Sweden) between March 2015 and February 2020 were enrolled. The study center is the main health-care facility to which patients with wrist arthritis are referred and the only center that performs TWA in a region with approximately 1.9 million inhabitants. Patients were identified preoperatively at the outpatient clinic and enrolled after informed oral and written consent was received.

Individuals were included if they were ≥18 years old and had both radiocarpal and midcarpal arthritis due to an inflammatory arthritis (e.g., rheumatoid or psoriatic arthritis) or a noninflammatory arthritis (e.g., idiopathic or posttraumatic osteoarthritis or Kienböck disease). We excluded patients with wrist problems resulting from a hypermobility disorder or cerebral palsy and patients with severe cognitive disorders who were unable to complete questionnaires. A total of 58 patients, 39 of whom were undergoing TWF and 19 of whom were undergoing TWA during the study period, were eligible for inclusion. Three patients were excluded, and 4 patients were missed for inclusion (Fig. 1). Three patients dropped out after the 3-month visit and 1 patient dropped out after the 6-month visit (Fig. 1). Of the 32 included patients who underwent TWF, additional surgery on the same hand was performed in 15 patients. Of the 19 patients who underwent TWA, additional surgery was performed in 2 patients (Fig. 1).

Choice of Surgical Procedure

Patients were eligible for both procedures, but the treatment method was decided by the treating hand surgeon on the basis of the clinical evaluation of the patient, the radiographic appearance of the wrist, and the patient's own requests. The preoperative information was not standardized but rather was individually customized. At our department, the indications for performing either a TWF or a TWA are severe wrist pain and functional disability; radiographic evidence of end-stage arthritis in cases in which other treatment options, such as proximal row carpectomy or partial arthrodesis, are ruled out; and/or a previous surgery, such as wrist arthroscopy, proximal row carpectomy, or partial arthrodesis, with insufficient results.

All patients who underwent TWA in this study received the ReMotion Total Wrist System (Stryker). Of the patients who underwent TWF, 29 received either an AO wrist fusion plate (DePuy Synthes) or a Total Wrist Fusion Plate (TriMed); the remaining 3 patients had rheumatoid arthritis and underwent TWF with use of a Rush pin and clips because of poor-quality soft tissue.

Outcome Measures

Patients completed the validated Swedish versions of the PRWE and Disabilities of the Arm, Shoulder and Hand (DASH) questionnaires, which score disability on a scale from 0 (no disability) to 100 (severe disability)[8,9]. Patients rated the severity of wrist pain at rest, on motion without loading the wrist, and on loading the wrist with use of a visual analog scale (VAS) from 0 (no pain) to 100 (most severe pain). All outcome measures were collected at baseline (i.e., preoperatively), and at 3, 6, 12, and 24 months postoperatively.

Clinical Examination

At baseline and at 3, 6, 12, and 24 months postoperatively, the grip strength of each hand was measured with use of a dynamometer (Saehan Hand Dynamometer; Saehan)[10]. For each hand, 3 trials were recorded and the mean value was calculated. The range of motion during flexion, extension, radial deviation, ulnar deviation, pronation, and supination, when possible, was measured on the operative hand with use of a goniometer[11]. The measurements were made with the same equipment and performed by the same physiotherapist (S.L.) on all occasions.

Radiographic Examination

Standard wrist radiographs were obtained at baseline and at 3 months postoperatively. For patients who underwent TWA, radiographic examination was also performed at the 6, 12, and 24-month follow-ups. For patients who underwent TWF, radiographic examination was performed at the same time points (6, 12, and 24 months) until bone union was found or the study period ended. Two consultants in hand surgery (M.C. and A.A.), with no knowledge of the patient's self-reported pain and disability, evaluated the radiographs together to obtain consensus and uniformity in their evaluations. The severity of degenerative wrist arthritis was assessed on preoperative radiographs and graded according to the Wrightington classification[12] in patients with inflammatory arthritis and according to the Kellgren-Lawrence classification[13] in patients with noninflammatory arthritis. For patients who underwent TWA, the 24-month radiographs were evaluated for signs of radiolucency around the components according to the method utilized by Boeckstyns and Herzberg in a previous study[14]. For patients who underwent TWF, the date of the follow-up visit during which the surgeon judged the arthrodesis to be healed, as demonstrated radiographically and clinically, was noted. Signs of mechanical complications such as plate or screw loosening were noted at the time of the latest radiograph.

Complications

Postoperative complications were recorded and classified into early (occurring within the first postoperative month) and late complications (occurring after the first postoperative month). Prosthetic loosening was defined as osteolysis combined with a change in the position of the implant. Radiolucency without other radiographic signs was documented but not classified as loosening.

Sample Size

Sample size estimates were based on previously reported minimal clinically important differences for the PRWE ranging

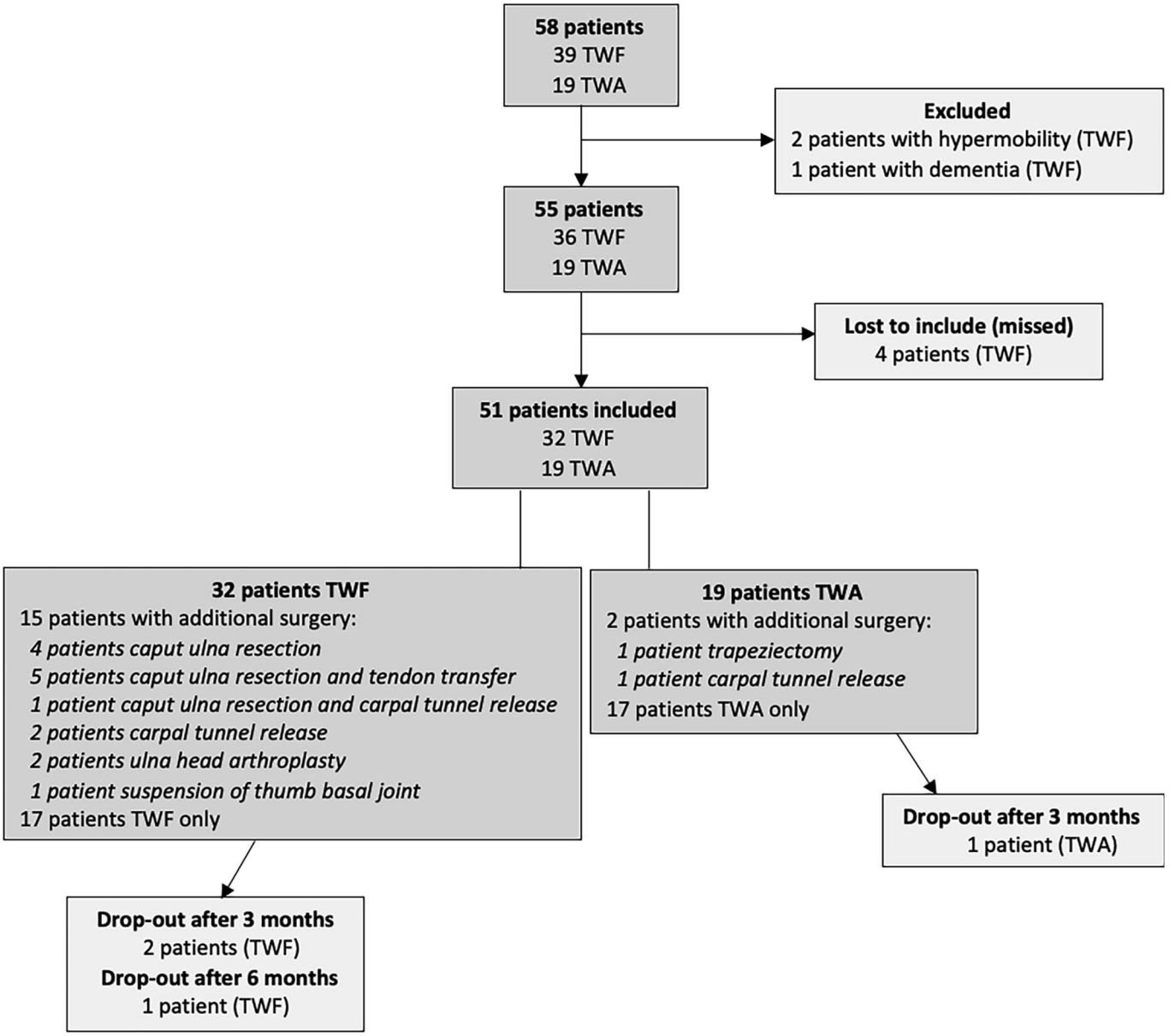

Fig. 1
Study enrollment flowchart.

from 11.5 to 14[15,16]. To detect a difference of 13 between the mean PRWE scores of the TWF group and the TWA group, with a standard deviation (SD) of 14, a power ($1 - \beta$) of 0.8, and a significance level (alpha) of 0.05, a sample size of at least 19 patients in each group was needed.

Statistical Analysis

A chi-square test was utilized to compare the distributions of sex, occupation, diagnosis, the grade of osteoarthritis, and the grade of rheumatoid arthritis between groups. An independent t test was utilized to compare the age at surgery between the groups, and a Mann-Whitney U test was utilized to compare the groups with respect to PRWE scores, VAS pain scores, grip strength, DASH scores, and range of motion. The grip strength of the operative hand is presented as a percentage of the grip strength of the contralateral hand, and range of motion is presented as the sums, in degrees, of flexion and extension, of radial and ulnar deviation, and of pronation and supination.

For our primary outcome, an analysis was performed with use of a mixed model for repeated measures to compare differences in PRWE scores between patients who underwent TWF and those who underwent TWA. Similar mixed-model analyses were also performed for the most important outcomes: VAS pain at rest, VAS pain on loading, and grip strength. To explore the effects of additional surgery, separate subgroup mixed-model analyses were performed of the 17

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TABLE I Patient Characteristics at Baseline*

	All (N = 51)	TWF (N = 32)	TWA (N = 19)	P Value
Sex *(no. [%] of patients)*				0.36
Female	28 (55)	16 (50)	12 (63)	
Male	23 (45)	16 (50)	7 (37)	
Age at surgery† *(yr)*	61 ± 12	61 ± 14	60 ± 10	0.93
Occupation‡ *(no. [%] of patients)*				0.09
White collar	15 (29)	8 (25)	7 (37)	
Blue collar	11 (22)	10 (31)	1 (5)	
Non-working	25 (49)	14 (44)	11 (58)	
Indications for surgery *(no. [%] of patients)*				0.06
Inflammatory arthritis	22 (43)	17 (53)	5 (26)	
Noninflammatory arthritis	29 (57)	15 (47)	14 (74)	
OA grade§ *(no. of patients)*				0.33
1	1	0		
2	3	0		
3	2	2		
4	9	9		
RA grade# *(no. of patients)*				0.72
1	0	0		
2	1	0		
3	5	2		
4	10	2		
PRWE score**††	76 (65-86)	76 (66-87)	78 (63-84)	0.95
VAS pain††‡‡				
At rest	42 (26-71)	50 (28-71)	31 (16-71)	0.26
On motion without loading	79 (60-90)	79 (64-95)	77 (48-87)	0.36
On loading	89 (76-97)	91 (77-98)	84 (75-93)	0.28
Grip strength††§§ *(kg)*	39 (24-78)	37 (22-77)	44 (27-88)	0.56
DASH score**††	52 (41-67)	51 (41-68)	54 (42-65)	0.82
Range of motion†† *(deg)*				
Flexion-extension	45 (33-68)	45 (34-56)	60 (25-75)	0.35
Radial-ulnar deviation	20 (10-25)	20 (10-28)	20 (10-25)	0.77
Pronation-supination	140 (125-154)	135 (120-150)	145 (129-163)	0.16

*TWA = total wrist arthroplasty, TWF = total wrist fusion, OA = osteoarthritis, RA = rheumatoid arthritis. †Values are given as the mean and standard deviation. ‡Occupations were classified as white collar (desk/administrative work), blue collar (manual work), or non-working (pension/long-term sick leave). §OA was graded according to the Kellgren-Lawrence classification[13]. The classification was not applicable in 3 patients, who were all in the TWA group. #RA was graded according to the Wrightington classification[12]. The classification was not applicable in 2 patients (1 in the TWA group and 1 in the TWF group). **Values were missing for 7 patients due to missing or incompletely filled out forms. ††Values are given as the median, with the interquartile range in parentheses. ‡‡Values were missing for 5 patients due to missing or incompletely filled out forms. §§Grip strength presented as the percentage of the contralateral wrist. Values were missing for 8 patients due to a missed test or the inability to perform the test because of pain.

patients who underwent TWF without additional surgery (i.e., the TWF-only subgroup) and the 17 patients who underwent TWA without additional surgery (i.e., the TWA-only subgroup). All models were adjusted for age, diagnosis, the preoperative value of the dependent variable (PRWE, VAS pain at rest, VAS pain on loading, or grip strength), and time since surgery. An AR(1) covariance structure was utilized, with study participants as random effects. The analysis was performed in R (version 4.1.2; R Foundation for Statistical Computing)[17], and the nlme package[18] was utilized for fitting the mixed models. Analyses were performed to compare the subgroup that underwent TWF only (17 patients) with the subgroup that underwent TWF with additional surgery (15 patients) with respect to demographic characteristics and PRWE scores.

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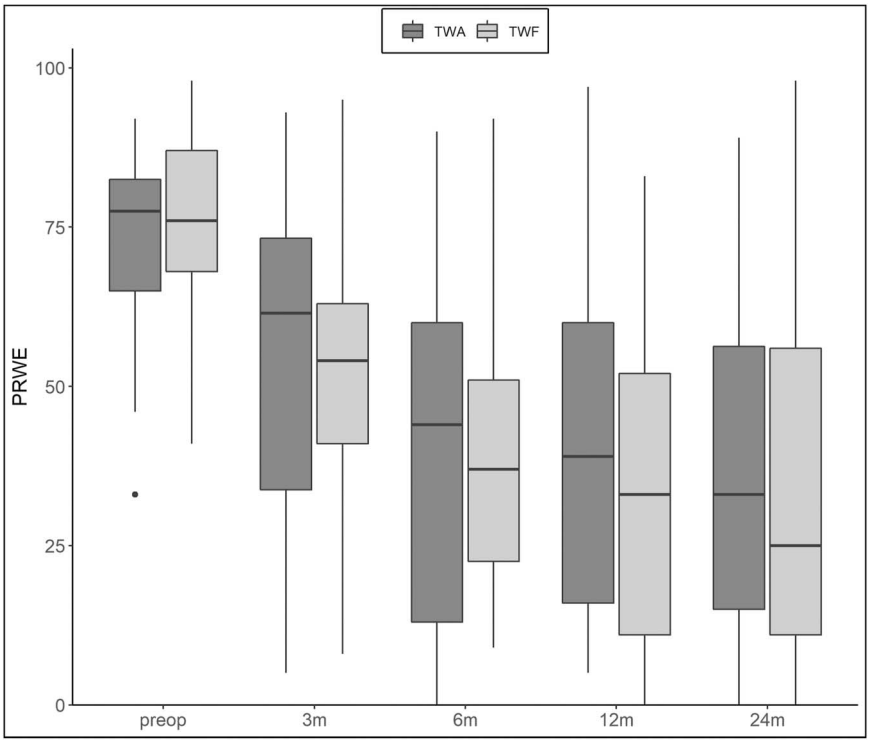

Fig. 2-A

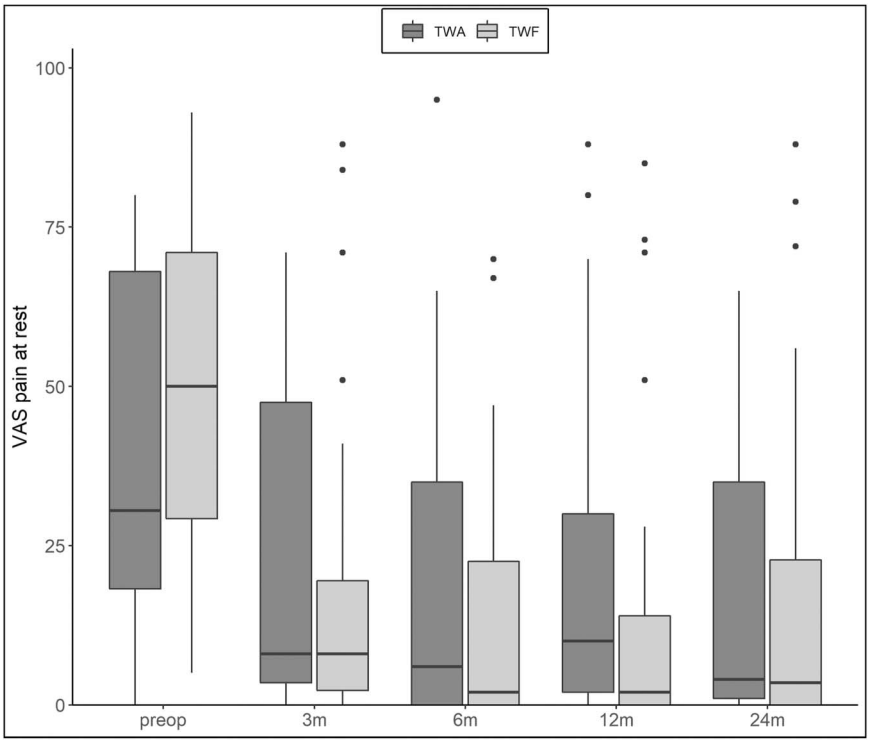

Fig. 2-B

Figs. 2-A through 2-F Box plots showing the median, interquartile range, and outlier values for the PRWE (**Fig. 2-A**), VAS pain at rest (**Fig. 2-B**), VAS pain on motion without loading (**Fig. 2-C**), VAS pain on loading (**Fig. 2-D**), grip strength (**Fig. 2-E**), and DASH (**Fig. 2-F**) for the TWF and TWA groups at baseline and at 3, 6, 12, and 24 months postoperatively. The whiskers indicate values within 1.5 times the interquartile range width. All other observed data points outside the boundary of the whiskers were plotted as outliers.

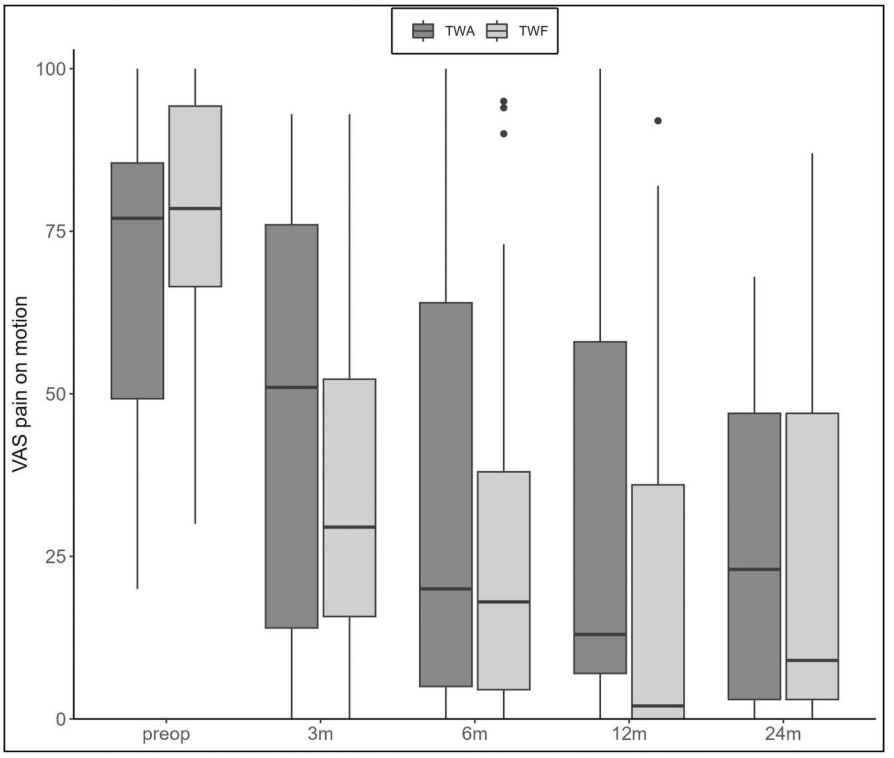

Fig. 2-C

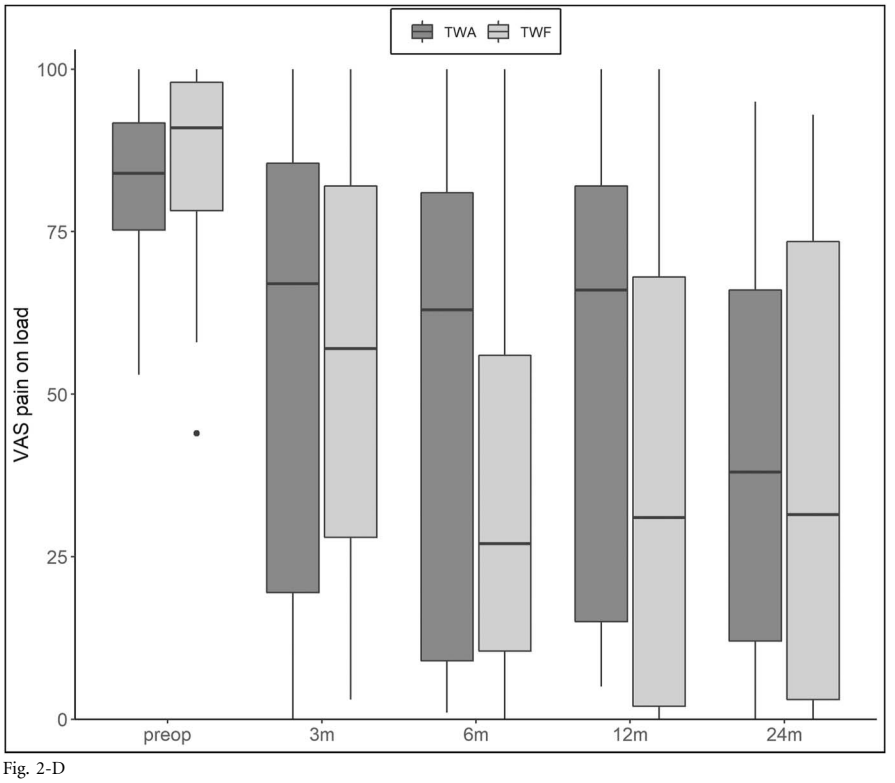

Fig. 2-D

Source of Funding

S.L. received funding from the Healthcare Academy at Skåne University Hospital and E.B. received funding from Skåne University Hospital, Region Skåne, the Kockska Foundation, and the Maggie Stephens Foundation for this work.

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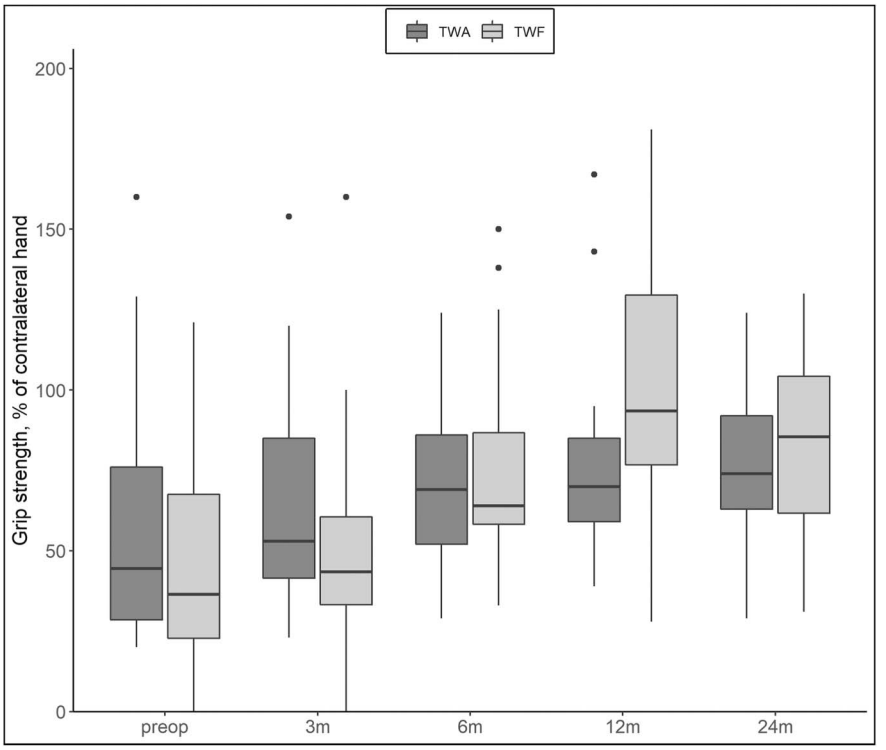

Fig. 2-E

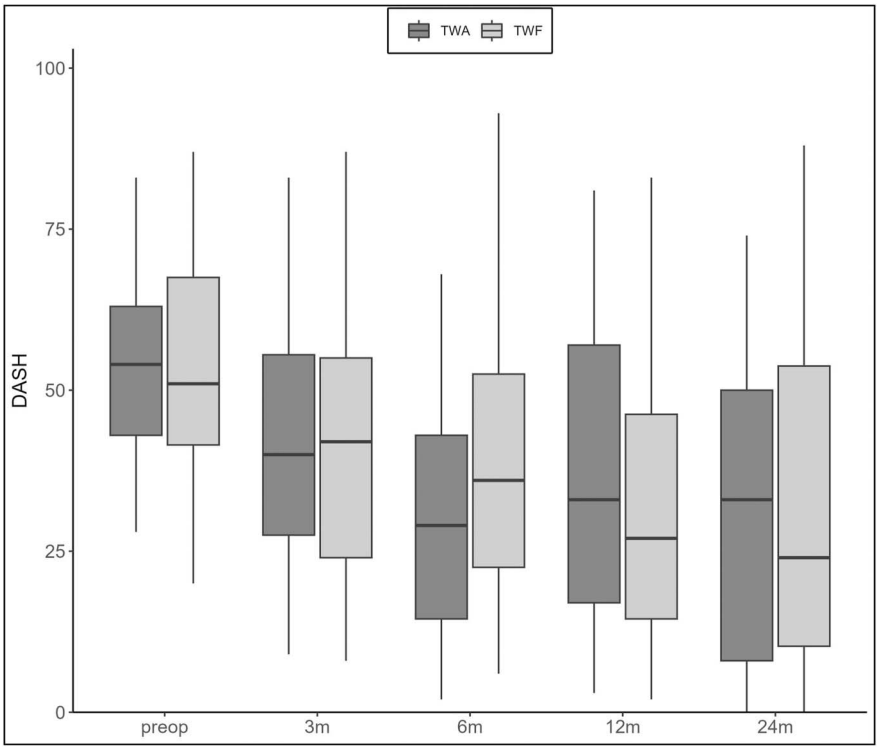

Fig. 2-F

Results

A total of 51 patients were included in the study. Demographic characteristics and baseline values did not differ between the TWA and TWF groups (Table I). PRWE values at 3 months postoperatively were missing for 2 patients because of an incompletely filled out form or missed data. There were no missing PRWE values at 6, 12, and 24 months postoperatively.

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There was no difference in PRWE scores, VAS pain scores, grip strength, or DASH scores between the TWA and TWF groups at any follow-up time point (Figs. 2-A through 2-F). Although there was large variability between patients, most patients in each group demonstrated overall improvement in PRWE scores, VAS pain scores, grip strength, and DASH scores postoperatively (Fig. 2).

The mixed-model estimates showed no difference in PRWE scores, VAS pain scores at rest, VAS pain scores on loading, or grip strength between patients who underwent TWA and those who underwent TWF (Table II). Compared with the primary analysis, the sensitivity analyses showed a larger estimated average difference in each of these outcomes except grip strength between the TWF-only subgroup and the TWA-only subgroup, but these differences did not reach significance (Table III).

Descriptive data for patients who underwent TWF only and those who underwent TWF with additional surgery showed no difference between the subgroups with respect to age, sex, PRWE score at baseline, or PRWE score at follow-up. However, additional surgery was more common among patients with inflammatory arthritis than among those with noninflammatory arthritis (Table IV). The postoperative range of wrist motion is presented in Table V.

During the first 24 months postoperatively, 8 of the 29 patients in the TWF group and 7 of the 18 patients in the TWA group had complications (Table VI). Bone union was observed in all patients in the TWF group, with a median time to union of 3 months (range, 2 to 24 months). At 24 months, 4 patients in the TWA group each demonstrated ≥2 mm (specifically, 2, 6, 16, and 20 mm) of radiolucency around the components. None of the patients in the TWA group showed signs of implant loosening during the first 24 months.

Discussion

The adoption of a new surgical therapy in clinical practice should depend on comparisons with the existing gold standard of care. Although TWA has been an alternative for treating symptomatic wrist arthritis for decades, the functional benefit of TWA compared with TWF has only been evaluated in systematic reviews[3-5] and retrospective case series, to our knowledge[6,7]. In this prospective cohort study, no difference between TWA and TWF was found in terms of patient-reported function, pain, or grip strength during the first 2 years postoperatively.

Systematic reviews have reported similar results in pain relief and patient satisfaction for TWA and TWF; however, these reviews were unable to compare such outcomes with use of meta-analyses because functional outcomes have been poorly reported in the literature, often using unvalidated assessment tools[3-5]. Only 2 retrospective studies have compared TWF with TWA performed with use of implants with newer designs[6,7]. Nydick et al. compared TWF (15 patients) with TWA (7 patients) and reported a better mean PRWE score for patients who underwent TWA but no difference between the groups in terms of DASH scores or pain scores[6]. A study comparing TWA and TWF among patients with rheumatoid arthritis, in which 23 patients who underwent TWA were retrospectively matched with 22 patients who had undergone TWF, showed no difference in PRWE or DASH scores between the groups[7].

Wrist pain is the main symptom affecting patients with an arthritic wrist joint and is probably the most important factor influencing a patient's decision to undergo major wrist surgery[19]. Both TWF and TWA offer a solution for chronic wrist pain, which may be 1 explanation for the improvement in patient-reported function or satisfaction observed after these treatments in the present study as well as in others[20-22]. Although the findings in the present study were not significant, our analyses showed a tendency toward better pain relief both at rest and on loading with TWF, especially in the subgroup of patients who did not undergo additional surgery. This pattern reflects either that there is no substantial difference in pain relief between TWF and TWA or that TWF has advantages in terms of pain treatment, but our study was undersized and therefore we were unable to make this determination. TWF also showed a tendency toward better PRWE scores in the subgroup analyses, but these results should be interpreted carefully considering the small sizes of the groups. However, there was no evidence in support of better functional outcome after TWA versus TWF.

TABLE II Mixed-Model Estimates for TWF Versus TWA for the Whole Study Population*

Outcome	β (95% CI) for TWF	P Value
PRWE score	−0.10 (−13.5 to 13.3)	0.99
VAS pain at rest	−3.32 (−15.3 to 8.6)	0.58
VAS pain on loading	−5.34 (−21.8 to 11.1)	0.52
Grip strength *(kg)*	−0.02 (−0.18 to 0.14)	0.80

*The effect of TWF compared with TWA for each variable, adjusted for age, diagnosis, preoperative value of the dependent variable, and time since surgery. A negative estimate indicates that patients who underwent TWF had a lower value (i.e., less disability and less pain) than patients who underwent TWA, whereas a positive estimate indicates the opposite. An estimate close to zero indicates that there was no difference between the 2 treatments. CI = confidence interval.

TABLE III Mixed-Model Estimates for TWF Only Versus TWA Only*

Outcome	β (95% CI) for TWF Only	P Value
PRWE score	−3.79 (−21.2 to 13.6)	0.67
VAS pain at rest	−9.26 (−24.2 to 5.7)	0.23
VAS pain on loading	−7.98 (−30.1 to 14.2)	0.48
Grip strength *(kg)*	0.008 (−0.14 to 0.15)	0.91

*The effect of TWF compared with TWA each variable, adjusted for age, diagnosis, preoperative value of the dependent variable, and time since surgery. A negative estimate indicates that patients who underwent TWF had a lower value (i.e., less disability and less pain) than patients who underwent TWA, whereas a positive estimate indicates the opposite. An estimate close to zero indicates that there was no difference between the 2 treatments. CI = confidence interval.

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TABLE IV Descriptive Comparisons of Patients Who Underwent TWF with or without Additional Surgery on the Same Hand

	TWF Only (N = 17)	TWF with Additional Surgery (N = 15)	P Value
Age* *(yr)*	60 ± 14	62 ± 13	0.66
Sex *(no. of patients)*			0.72
Male	9	7	
Female	8	8	
Diagnosis *(no. of patients)*			0.03
Noninflammatory arthritis	11	4	
Inflammatory arthritis	6	11	
PRWE score†			
Baseline	74 (69-83)	76 (56-92)	0.86
3 months	52 (37-65)	54 (36-61)	0.91
6 months	39 (20-71)	33 (23-48)	0.98
12 months	39 (10-52)	29 (10-72)	0.91
24 months	24 (9-56)	30 (2-70)	0.77

*Values are given as the mean and standard deviation. †Values are given as the median, with the interquartile range in parentheses.

Estimates of the functional range of wrist motion have indicated that nearly normal radial and ulnar deviation are needed in many activities of daily living[23]. In our study, the median range of wrist motion at 24 months after TWA (flexion-extension arc of 65°, radial-ulnar deviation arc of 30°) was similar to that reported in previous studies, demonstrating that radial and ulnar deviation are especially restricted after TWA[20,24,25]. The combination of a tendency toward better pain relief with TWF and poor preservation of radial and ulnar deviation following TWA might explain why patients who underwent TWA did not report better function than those who underwent TWF. Although pain and limited function have been shown to improve after both TWF and TWA, function is not likely to become normal, as illustrated by the relatively high pain on loading postoperatively and the relatively poor postoperative function scores among the patients in the present study as well as those in previous studies[21,26-29]. Since TWA is a more expensive and technically demanding procedure with a higher risk of severe complications, the justification for its widespread use remains doubtful. Careful preoperative evaluation of patient expectations and prerequisites for surgery, as well as information regarding the risks of and expected functional outcomes following both TWF and TWA, enables the patient to be part of the decision-making process[19]. The wish of an informed patient for a motion-preserving alternative may justify the use of TWA over TWF, even if the risk of deteriorating results over time is probably higher after TWA and the functional and pain-relieving benefits remain highly uncertain. In fact, 1 study reported that TWF is performed nearly 4 times more frequently than TWA in the U.S., with a decreasing trend in the number of TWAs performed over the last 2 decades[30]. A survey that explored the decision-making of hand surgeons treating patients with rheumatoid arthritis found that surgeons did not view TWA as superior to TWF[31].

Complication rates following TWAs performed with use of implants with older designs have been shown to be higher than those following TWFs[3]. In contrast, reviews that included TWAs performed with use of modern implants have reported postoperative complication rates similar to those for TWFs. This difference in TWA complication rates is likely attributable to developments in prosthesis design[4,5]. In the present study, as in previous reports, hardware-related issues were the most

TABLE V Range of Wrist Motion After TWA Versus TWF*

	TWA			TWF
Time Since Surgery	Flexion-Extension *(deg)*	Radial-Ulnar Deviation *(deg)*	Pronation-Supination *(deg)*	Pronation-Supination *(deg)*
3 months	50 (40-65)	20 (15-30)	150 (135-160)	140 (125-145)
6 months	50 (39-65)	20 (19-30)	155 (150-163)	143 (130-155)
12 months	60 (45-70)	25 (10-30)	150 (140-165)	140 (119-151)
24 months	65 (45-75)	30 (20-35)	150 (145-160)	140 (125-155)

*Values are given as the median, with the interquartile range in parentheses.

TABLE VI Complications During the First 2 Years After TWF or TWA

	TWF	No. (%) of Patients	TWA	No. (%) of Patients
Early complications*	Perioperative fracture of the third metacarpal that healed during casting	1 (3.4)	Superficial infection treated with oral antibiotics	2 (11.1)
			Carpal tunnel syndrome the day after surgery due to swelling, treated with carpal tunnel release	1 (5.6)
Late complications*	Plate discomfort†	2 (6.9)	Painful radial impingement, treated by revision with osteotomy of scaphoid remnants	2 (11.1)
	Loosened screw†	2 (6.9)		
	Screw breakage†	1 (3.4)		
	Distal plate loosening†	1 (3.4)	Painful radial impingement; patient declined revision with osteotomy	1 (5.6)
	Extensor tendon adhesions after tendon reconstruction and carpal tunnel syndrome, treated with tenolysis and carpal tunnel release	1 (3.4)	Wrist stiffness and carpal tunnel syndrome, treated with arthrolysis and carpal tunnel release	1 (5.6)

*Early complications occurred within the first month after surgery, and late complications occurred after the first month. †These hardware problems led to plate extraction.

common complication following TWF. However, prosthesis dislocation and loosening, the most commonly reported long-term adverse effects following TWA[4,5], were not observed in the present study, which may be related to the short follow-up period. Instead, the most common cause of reoperation following TWA in our study was radial impingement between the remnants of the scaphoid and the radial implant component.

This study had limitations. The groups were not randomized, which could potentially have introduced selection bias and response bias during the completion of patient-reported outcomes. As part of the pragmatic study design, treatment choice was influenced by patient factors, such as occupation and diagnosis. However, all patients were eligible for both treatment options, and the 2 groups did not differ in terms of demographic characteristics, patient-reported function, pain, grip strength, or the range of wrist motion at baseline. TWF is often a more suitable solution for blue-collar workers who need to load their wrist without restrictions, which was reflected in the greater (albeit not significantly greater) number of blue-collar workers in the TWF group than in the TWA group.

We included patients with inflammatory arthritis and those with noninflammatory arthritis, but we adjusted for the type of diagnosis in the mixed-model analyses. A greater percentage of patients in the TWF group than in the TWA group had inflammatory arthritis, suggesting that poor bone stock or coexisting pathology may have prevented many of these patients from undergoing TWA. In fact, additional surgery was more common among patients who received TWF, especially among those with inflammatory arthritis, indicating that these patients had wrist problems that were more severe. However, the diagnosis was adjusted for in the mixed-model analyses. To control for the effect of additional surgery, we performed sensitivity analyses of the subgroups of patients without additional surgery and found similar results. We also compared the subgroups of patients who underwent TWF with or without additional surgery and found no differences in age, sex, or PRWE score. Finally, this study was performed in a single-center setting and the number of included patients was small, although we were able to control for missing patients.

The strengths of this study include the prospective, longitudinal cohort design and the use of validated outcome measurements. Additionally, all measurements were performed by the same physiotherapist and all patients in the TWA group received the same type of implant. Also, by providing prospective data (including baseline values) regarding patients who underwent TWF, this study contributes to the current knowledge on a patient group for which prospective studies have been scarce.

Conclusions

In this prospective cohort study of patients with surgically treated symptomatic end-stage wrist arthritis, we found no superiority of TWA over TWF in the short term. Persistent pain and activity limitations were common among patients in both the TWA and TWF groups. ■

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