

Motec Wrist Arthroplasty: 4 Years of Promising Results

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Background: The Motec cementless modular metal-on-metal ball-and-socket wrist arthroplasty is an implant with promising intermediate results. An alternative to primary wrist fusion, total wrist arthroplasty is an option for active patients, who wish to retain their wrist function. It is indicated in cases of degenerative osteoarthritis, post-traumatic arthritis and rheumatoid (inflammatory) arthritis.

Methods: A prospective review of patient demographics, pre and post-operative Disabilities of the Arm Shoulder and Hand (DASH), MAYO scores, range of movements and grip strengths. All complications in follow up were recorded across the 4 year period.

Results: 25 implants on 23 patients over 5.5 years, mean age 61; 8 females and 15 male. 10 patients with SLAC, 3 SNAC, 5 inflammatory and 7 patients with generalized osteoarthritis. The patients showed significant improvements of MAYO and DASH scores post-operatively, as well as the flexion/extension arc and grip strengths. There was just one case of implant loosening- the radial screw after a wound infection, which was revised with a longer screw. Two implants were converted to Motec fusion due to pain. One implant was dislocated and relocated. The remaining patients have had good wrist function. Only 6 patients were unable to return to work.

Conclusions: Similar to published studies, this series shows the Motec implant to be a good motion preserving alternative to total wrist fusion.

Keywords: *Wrist, Arthritis, Arthroplasty, Prosthetic*

INTRODUCTION

Wrist arthrodesis has been shown to relieve pain and correct deformity, although it results in impaired function. Total wrist arthroplasty provides the vital movement for performance of daily activities. Wrist replacement has potential for greater short term and long term risks as compared to arthrodesis, so indications should be carefully considered. Recent developments in design and techniques have brought renewed interest in total wrist arthroplasty. Although reductions in the range of motion in the wrist can be compensated for by the

shoulder, elbow and forearm, primary wrist arthrodesis is generally unpopular amongst patients.^{1,2)} It has been reported as a treatment that can cause significant functional impairment due to limited movement, as well as being painful.^{2,3)} Previously reserved for older, low demand patients with inflammatory arthritis, total wrist arthroplasty is now becoming more of a motion preserving alternative to primary wrist fusion for younger, active patients, who wish to retain their wrist function.

Swanson designed the first wrist implant made of silicone, which was a larger version of the finger joint implant. The first prosthesis with an articulating bearing for joint motion was introduced by Meuli and Volz in early 1970s.

The Motec cementless modular metal-on-coated metal ball-and-socket wrist arthroplasty is an implant with promising intermediate results.¹⁰⁾

This implant is indicated in cases of degenerative osteoarthritis, rheumatoid (inflammatory) arthritis and

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post-traumatic arthritis as a result of scapholunate dissociation, Kienböck's disease of the lunate, fracture dislocation of the wrist, intra-articular fractures of the distal radius, intercarpal fusions and proximal row carpectomy.

Following on from Reigstad et al.⁴⁾ study showing good results in 6 years of follow-up, this paper aims to review the outcomes of up to 5.5 years' worth of Motec wrist arthroplasties implanted by a single surgeon at a single institution.

METHODS

The inclusion criteria were any Motec wrist arthroplasty implanted on a patient within the time period by the senior author. We included patients operated in both the private sector and NHS practice. All ages and genders were included. The patients excluded from the study were those who were followed-up at another institution or lost to follow up with no post-operative data.

A total of 26 arthroplasties were implanted on 24 patients (2 bilateral wrists), but one was excluded due to a lack of any data; they were followed up in another institution. There were 8 women and 15 men with a mean age of 61 years (range 44–83 years).

All patients operated on by the senior author between June 2010 and March 2015 were included in the study. The patients were presented with the options of arthrodesis versus arthroplasty in clinic and opted for arthroplasty in order to maintain maximal wrist function. All patients had exhausted conservative management including steroid injections and splinting. In addition to this, they all underwent wrist arthroscopy, which frequently showed significant degenerative changes in the mid-car-

pal joint (in addition to the radio-carpal changes) which were not always seen on radiographs. All patients were presented with the Motec arthroplasty and the supporting evidence from the literature.¹⁰⁾

The patients had pre and post-operative measurements of range of movement and grip strength, alongside functional scoring using quick DASH¹²⁾ and Modified Mayo Wrist Score.¹³⁾ The hand function measurements were taken by hand therapists with no involvement in this study. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) standards for reporting were followed in reporting this case series.¹¹⁾ The data was analyzed with calculation of means and standard deviations and Paired sample t-test used to identify significance of results.

RESULTS

Patients

In the series, 9 patients had previously undergone other surgical procedures with 3 patients having had partial fusion and one patient had undergone a primary fusion of the contralateral wrist. Other procedures included denervation, radial styloidectomy and Darrach's procedure. Indications ranged from Scapho-lunate advanced collapse (SLAC) (Fig. 1) to rheumatoid arthritis as summarized in Table 1.

Implant

The operative technique as described by our senior author is via a dorsal incision and a proximally based capsular flap. A full proximal row carpectomy is performed, a sliver of capitate is excised and a closing

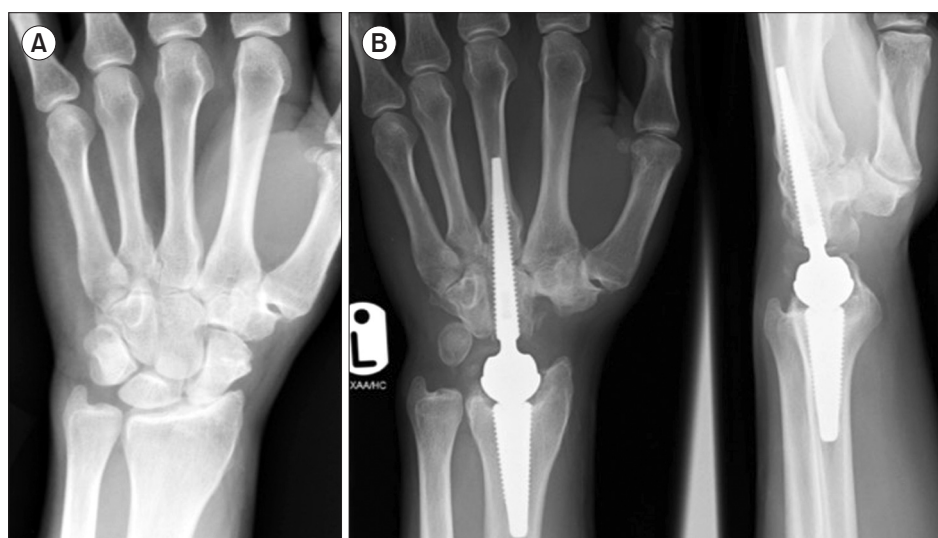


Fig. 1. (A) Pre-operative AP radiograph of a wrist with Grade 4 SLAC, (B) Post-operative AP and lateral radiographs of a wrist with the implanted Motec arthroplasty.

wedge osteotomy of the 3rd CMC is performed to permit a longer metacarpal screw. The implant is screwed into the 3rd metacarpal to the level of the isthmus, after a guide wire is inserted under image intensifier guidance and use of a cannulated metacarpal drill. The radius is prepared in a similar manner and the radius screw inserted after insertion of the guide wire and reaming.

There were no intraoperative complications. The mean surgery duration was 61 minutes. There were a total of 4 (16.7%) implant related problems in the follow-up period; one screw loosening, two conversions to fusion and one dislocation, the details are as follows:

Patient 1. In one patient, there was a problem of proximal screw loosening (Fig. 2). This was revised with a longer screw after which, save for a superficial wound infection, there were no further complications.

Patient 2. This patient had post-traumatic lunotriquetral instability, which was fused and later revised due to non-union with plate fixation. Subsequent plate failure led to insertion of the Motec implant for pain and stiffness. Following this, the patient underwent an MUA and removal of heterotrophic bone formation for persistent

pain and stiffness. Due to the persistent symptoms, the decision was made to convert to a Motec fusion, but due to later disconnection of the components, this was converted to a Medartis fusion a total of 3 years later.

Patient 3. This was a case of Juvenile RA, which was previously treated with excision of the ulna head. After a failed arthroplasty, the patient underwent a 2-stage conversion from a Universal to a Motec wrist arthroplasty. Due to persistent pain and stiffness, this was then converted to a Motec Fusion and the patient was able to return to work as a receptionist.

Patient 4. There was a dislocation of the implant but relocation was achieved successfully and follow-up continues to be favorable and the patient chose to have the same implant on the other wrist with good results.

There was one incidence of ectopic bone formation around the implant, but no function effects were observed.

As the original technique involved retention of the distal scaphoid and triquetrum, one patient underwent a distal scaphoid and triquetrum resection at a later date, followed by a radial styloidectomy for impingement symptoms. Due to these symptoms experienced by the patient, the senior author has opted to always carry out a proximal row carpectomy in order to avoid this.

Table 1. Distribution of Indications for Arthroplasty

Indication	No.
Scaphoid Lunate Advance Collapse	9
Lunotriquetral instability	1
Rheumatoid Arthritis	4
Carpal Osteoarthritis	7
Psoriatic	1
Scaphoid Nonunion Advance Collapse	3

Follow-up

The patients in the study had a follow up of 50 months (mean), a range of 26–66 months. The mean flexion extension arc of motion improved from 78.4 to 112 degrees, an improvement of 43.1%. The radial and ulnar mean arc of motion made an improvement from 35 to 40 degrees (14.7%). The grip strength (mean) had



Fig. 2. (A) AP and lateral radiograph showing proximal screw loosening. (B) AP radiograph showing revised, longer proximal screw.

Table 2. Results Summary

	Pre-op	Post-op	SD	%Difference	<i>p</i> value
Q-Dash	57.60	21.05	24.96	63.46	0.001
MAYO	34.44	66.47	21.65	92.98	0.001
Flexion/Extension	78.47	112.29	29.49	43.10	0.001
Ulnar/Radial deviation	35.19	40.38	22.67	14.74	0.500
Supination/Pronation	136.70	137.20	26.01	0.37	0.200
Grip strength (kg)	12.26	27.76	19.61	126.38	0.010

improvement from 12 to 27.6 kg, an improvement of 126%. A statistically significant increase was seen in the flexion extension arc and grip strength in the series ($p < 0.001$ and $p < 0.01$ respectively). There was a significant improvement in patient functional status, measured by the Quick DASH, where mean decreased from 57.6 to 21.0 and MAYO scores improved from 34.4 to 66.5 ($p < 0.001$). All results are shown in Table 2.

Of the ($n = 14$) patients in employment, 9 (64.3%) were able to return to work, with one retired patient regaining his ability to play golf. Four patients (28.6%) patients were unable to return to work, and one retired after his operation. Two patients also opted to have the prosthesis implanted into the contralateral wrist suggesting a high level of satisfaction with their outcomes.

During the follow-up period, one patient developed Chronic Regional Pain Syndrome (CRPS), which is currently being treated and the patient has been able to return to clerical work.

DISCUSSION

Wrist arthroplasty can preserve motion for patients with painful wrist arthritis while arthrodesis removes wrist motion but provides a more predictable result and relief from pain. Takwale et al⁵⁾ have demonstrated that a majority of patients with RA treated with wrist arthroplasty on one side and arthrodesis on the other would have preferred bilateral arthroplasties. Nydick et al⁶⁾ reported a similar consensus in their study of patients treated for posttraumatic wrist arthritis. These studies suggest a trend toward treating a wider range of patients with painful arthritis of the wrist with arthroplasty. Gaspar et al,⁷⁾ have reported a review of forty-seven TWAs, 52 distal radius hemiarthroplasties, and 6 proximal carpal hemiarthroplasties with complication and revision rates of 51% (53 of 105) and 39% (41 of 105).

In a 4-year follow-up, the Motec wrist implant has been shown to have favorable functional outcomes in patients with significant improvements in the functional

scores DASH and MAYO and a trend towards increased range of movement. These outcomes agree with the results from the systematic review by Yeoh et al showing the implant to have the best post-operative DASH outcomes.⁸⁾

Nelson et al showed that as little as 25 degrees of motion permits significantly more activities of daily living than arthrodesis.⁹⁾ The Motec arthroplasty has been shown in this series to increase the flexion/extension arc by mean 33 degrees. Though reported to allow ROM 136–160 degrees, mean flexion extension arc was 112 degrees. Despite this, patients still had improved functional outcomes.

In our series, both patients who were converted to a Motec fusion, had complex histories with wrists that had previously been operated on. This may indicate that the wrist arthroplasty should be considered prior to other procedures such as partial fusion.

In the initial 8 operated patients over 7–9 years, there were no reported subluxations, metacarpal fractures, cut outs or mechanical failures.¹⁰⁾ There were, however, some problems with implant loosening. Following on from these results, the diameter of the screws were reduced, threads lowered and the distal tip was rounded. CMCJ arthrodesis with bone chips also produced a ‘one bone’ unit into which the distal implant would be inserted to again reduce the incidence of implant loosening.

In the case of persistent symptoms in patients, or implant loosening, the wrist arthroplasty can easily be converted to the Motec fusion at various angles. This can also be used for primary arthrodesis.

With survival rates of this prosthesis reported as 93.3% (at 6 years),⁴⁾ 77% (at 4 years)¹¹⁾ and 80% (at 4 years from our series), the Motec fares well compared to other arthroplasties such as the Universal 1 (75%)¹²⁾ which was implanted for inflammatory arthritis and Bi-axial at 85%, which are no longer available. Improved results have only been reported by the Universal 2 prosthesis with 74–100% survival at 3–5 years^{13,14)} for both degenerative and rheumatoid arthritis and the Maestro

arthroplasty with early results of 95.7% survival at 2.3 years.⁶⁾

Previously generally reserved for low demand patients, this series adds to evidence supporting the use of total wrist arthroplasty in younger, higher demand patients. With the patient being younger, longer follow-up studies are also needed to ensure these good outcomes persist. The results from this series build on the promising results from Reigstad et al.⁴⁾ This series by Reigstad, however, does not exclude revisions from the data analysis, making our results more robust.

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