

A literature review comparing the results of wrist arthroplasty and wrist fusion in rheumatoid patients

Abstract

Rheumatoid arthritis is a chronic inflammatory disease affecting the synovium leading to joint damage and bone destruction. Within two years of diagnosis more than half of patients will have wrist pain and more than 90% will have wrist disease by 10 years. The surgical management of the advanced rheumatoid wrist is controversial. A Medline search was performed using the key words 'rheumatoid arthritis and wrist arthroplasty' 'rheumatoid arthritis and wrist arthrodesis' 'rheumatoid arthritis and wrist fusion'. Total wrist arthroplasty is a motion preserving alternative which is slowly increasing in popularity. It is however a complex, technically demanding procedure with a high rate of complications. Wrist arthrodesis is currently the most widely used operative management for end stage rheumatoid arthritis. It provides pain relief and stability but there is a compromise of a loss of movement. We conclude that patients with end stage rheumatoid arthritis with good bone stock may have total wrist arthroplasty or wrist arthrodesis. Total wrist arthroplasty should be with the latest generation implants. Those patients with poor bone stock or soft tissues should have wrist arthrodesis.

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Introduction

Rheumatoid arthritis is a chronic inflammatory disease affecting the synovium leading to joint damage and bone destruction. It is common with a worldwide prevalence of 1% in men and 3% in women. The peak age of disease onset is in the fifth decade. It is multifactorial in nature and it is thought to result from an interaction between genetic and environmental factors.¹

Within two years of diagnosis more than half of patients will have wrist pain and more than 90% will have wrist disease by 10 years.²

The wrist is a complex anatomical structure composed of 3 joints: radiocarpal, midcarpal and distal radioulnar joints these joints provide relatively little bony stability. The stability of the wrist is provided by the soft tissues. Rheumatoid arthritis is a disease of the soft tissues. It affects the synovium and therefore most of these stabilizing structures of the wrist causing pain, deformity and therefore a reduction in quality of life. This hand dysfunction can cause substantial morbidity. A quality of life study demonstrated that rheumatoid arthritis patients feel that living with a painful poorly functioning rheumatoid arthritis wrist for 12 years is equivalent to living for 30 years with a normal wrist.³

To perform normal activities of daily living the minimum range of movement of the wrist required is 30 degrees of flexion and extension and 5-10 degrees of radial and ulnar deviation. Decision making regarding the rheumatoid wrist requires an understanding of the functional demands and occupational needs of your patient as well as an appreciation of rheumatoid arthritis disease progression. Only once these have been addressed can we look at the wrist in isolation.

To understand disease progression we can use the Larsen classification (Table 1), the Wrightington classification (Table 2), or the Simmen classification (Table 3).

A thorough history and physical examination will ensure that patient evaluation identifies the needs of your patient. Persistent disease despite medical therapy is an indication for operative management.

Table 1 Larsen's classification for Rheumatoid Arthritis of the Wrist

Larsen's classification for Rheumatoid Arthritis of the Wrist	
0-No changes	
1-Soft tissue swelling, demineralization	
2-Marginal erosions, initial deviation	
3-Articular erosions, joint line narrowing, mild instability	
4a-Midcarpal ankylosis, major radiocarpal instability	
4b-Radiocarpal ankylosis, stable	
5a-Destruction of carpus, radiocarpal dislocation	
5b-Destruction of carpus, complete ankylosis	

Table 2 Wrightington's classification for Rheumatoid Arthritis of the Wrist

Wrightington's classification for Rheumatoid Arthritis of the Wrist	
Grade 1	Wrist architecture preserved, mild RSS, periarthritis osteoporosis, early cyst formation
Grade 2	Ulnar translocation, lunate volar flexed, flexed scaphoid, radiolunate destruction
Grade 3	Intercarpal joints arthritic, radioscapoid eroded, volar subluxation of carpus
Grade 4	Loss of large amount of bone stock from distal radius, gross erosion of ulnar side of radius

Table 3 Simmen's classification for Rheumatoid Arthritis of the Wrist.

Simmen's classification for Rheumatoid Arthritis of the Wrist	
Type 1 (ankylosis)	Spontaneous tendency to fuse, stable pattern
Type 2 (arthrosis)	Articular loss progresses at equilibrium with arthrosis, stable
Type 3 (disintegration)	Progressive destruction, loss of alignment, unstable

The purpose of the operative treatments is to limit the negative effects of the rheumatoid arthritis disease process: pain, loss of function and deformity. The surgical management of the advanced rheumatoid wrist remains controversial. In current practice the two main options are total wrist arthroplasty and wrist arthrodesis. Total wrist arthroplasty is a motion preserving alternative which is slowly increasing in popularity. It is however a complex, technically demanding procedure with substantial complications. Wrist arthrodesis is currently the most widely used operative management for end stage

rheumatoid arthritis. It provides pain relief and stability but there is a compromise of a loss of movement. It is a straightforward procedure with predictable results. Successfully fused wrists are unlikely to need further operative intervention

There are currently no Randomised Controlled Trials to compare the outcomes of wrist fusion and total wrist arthroplasty for patients with rheumatoid arthritis. In 2008 a systematic review of the literature performed by Murphy et al.⁴ concluded that there was insufficient data to support the preference of total wrist arthroplasty over wrist fusion in severely destroyed rheumatoid wrist. The purpose of this article is to review the literature for and against fusion and arthroplasty of the rheumatoid wrist.

Material and methods

A Medline search was performed using the key words 'rheumatoid arthritis and wrist arthroplasty' 'rheumatoid arthritis and wrist arthrodesis' 'rheumatoid arthritis and wrist fusion'.

Results

Wrist arthrodesis

Wrist arthrodesis is performed to achieve bony ankylosis of the wrist joint. The aim is to produce a wrist that is strong, stable and pain free but this comes with a compromise, loss of movement. In current practice wrist arthrodesis is the procedure performed most often for end stage rheumatoid arthritis of the wrist. Multiple techniques are described in the literature, all with fairly predictable results and rates of fusion. The options are fusion with a pin/rod or plate or without implants.

Pin/rods are generally preferred since it is difficult to secure plate fixation on rheumatoid arthritis bone. Clayton was the first author to describe an operative technique for wrist arthrodesis by means of an intramedullary Steinman pin. Mannerfelt popularized this technique by using a rush pin and additional fixation with staple. Results have been mixed. Elherik et al.⁵ used the Mannerfelt arthrodesis procedure and reported a 65.4% improvement in overall pain outcome. In a retrospective study of 115 patients Rauhaniemi⁶ evaluated the outcome of total wrist fusion using the Mannerfelt technique. Results were disappointing with only 40% of patients being satisfied with the results.

In the 1960s, AO plate fixation was introduced by Muller et al and refined later in the 1980s with the advent of the dynamic compression plate. Toma et al.⁷ retrospectively compared wrist arthrodesis using the Mannerfelt technique and AO plate. They found methods to improve pain and function however there were no statistical difference between the two techniques in terms of activities of daily living (ADL) scores, patient subjective outcomes or complications.

Total wrist arthroplasty

Total wrist arthroplasty has been in use for 40 years however it hasn't gained widespread acceptability in the same manner that arthroplasty has for other joints. This is due to a number of factors namely higher complication and failure rates, and expense. They were first used in the 1970s; the total wrist arthroplasty has undergone several refinements over the generations.

This first implant used was flexible silicone spacers that are not strictly total wrist arthroplasty. Short term results were favourable however later reports were somewhat disappointing. Long term results highlighted several problems such as implant breakage, and osteolysis caused by a foreign body reaction to particulate manner. It manifests

clinically as the re-occurrence of pain, stiffness and swelling after the initial relief of symptoms. Kistler et al.⁸ report a revision rate of up to 50%. They recommend the use of total wrist arthroplasty as an alternative to wrist fusion only for low demand patients with good bone stock and restricted motion.

The next generation of total wrist arthroplasty combined metal and polyethylene and they were distally fixed into the metacarpals. Results were not great. Dennis et al.⁹ reviewed 30 of these arthroplasties performed in patients with stage 3 or 4 rheumatoid arthritis. 60% rated good or excellent, 27% rated fair, 13% rated poor. Newer devices are better than their predecessors but continue to have high revision and failure rates compared to large joint arthroplasties. Third generation designs require less bone resection and avoid the need for metacarpal fixation. The results are modest with limited numbers and short follow ups. Two devices are described below.

Remotion total wrist: Herzberg.¹⁰ reported a 41% improvement in clinical score post-operatively. Longer term follow up is needed. Divelbiss et al.¹¹ reported on 22 prostheses implanted for severe rheumatoid arthritis noting significant improvement in the total arcs of motion post arthroplasty along with improvement in Disability of Arm, Shoulder and Hand (DASH) scores; 14 points at one year and 24 points at two years. Three prosthesis in patients with highly active disease and severe laxity required revision surgery.

Universal total wrist: Winterswijk.¹² demonstrated promising clinical results of this prosthesis in rheumatoid arthritis. All range of motion values improved after surgery with the average post-operative motion noted to be 29° of dorsiflexion, 38° volar flexion, 7° radial deviation and 17° ulnar deviation. There were improvements in DASH score by 29% along with improved pain score in all 15 patients. There was however one component loosening of the carpal plate requiring revision and one early prosthetic dislocation successfully treated conservatively. Ward et al.¹³ at a minimum of 5 years follow up reported a high rate of failure most often because of carpal component loosening resulting in revision of 50% of wrists.

Discussion

There is a gap in the literature comparing the wrist fusion and total wrist arthroplasty. In some studies there have been patients with total wrist arthroplasty on one side and fusion on the other almost all preferred the total wrist arthroplasty. In a study by Goodman et al.¹⁴ ten patients had wrist fusion on one side and arthroplasty on the other. They felt that the arthroplasty wrist was more functional due to a greater range of movement.

Utility and decision analysis studies by Cavaliere et al.³ demonstrate that arthroplasty is associated with higher quality adjusted life year than arthrodesis in patients with rheumatoid arthritis. They also performed cost analysis which demonstrated that both total wrist arthroplasty and arthrodesis are cost effective. Using a validated outcome survey and review of reported surgical complications, Murphy et al.⁴ compared 503 total wrist arthroplasties and 860 wrist fusions. There was no statistical difference between the two groups. Of note the patients who underwent total wrist arthroplasty has older general metal-polyethylene implants which require the distal component to be fixed into the metacarpals.

We conclude that patients with end stage rheumatoid arthritis with good bone stock may have total wrist arthroplasty or arthrodesis. Total wrist arthroplasty should be with the latest generation implants. Those patients with poor bone stock or soft tissues should have wrist arthrodesis. It remains an area of great debate with surgeon and patient preference playing a key role.

Acknowledgments

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Conflicts of interest

None.

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