A Minimal Wrist Arthroplasty for Early Wrist Osteoarthritis

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Abstract

Background The most common forms of salvage surgery for wrist arthritis of any stage are four corner fusion and proximal row carpectomy. Younger, high demand patients with early arthritis may not be candidates for this type of salvage surgery. We describe a technique and preliminary case series of a minimal radiocarpal arthroplasty aimed at patients with initial and isolated wrist arthritis (stage 1). This procedure does not preclude any procedure that may become necessary in the future.

Patients A series of nineteen male heavy laborers with scapholunate advanced collapse (SLAC grade 1–2) wrist osteoarthritis that felt the wrist arthritis was prohibiting their function enough to warrant surgery, but were unwilling to undergo a salvage procedure, were treated with the technique. The average age was 57.2 ($\pm$ 7.7) years. The average follow up period was 40.3 months (9–63 months). All patients returned to heavy labor. No revision surgery was needed within the follow up period. Range of motion (ROM) and grip strength did not significantly improve. Patient satisfaction was high despite imperfect results.

Conclusions Minimal arthroplasty as described may provide a temporary solution for active patients with symptomatic early wrist arthritis who are not candidates for salvage wrist surgery. Longer-term follow up as well as investigation of additional stabilization procedures is necessary.

Keywords

- resurfacing
- wrist
- early arthritis
- laborers

The treatment of early wrist arthritis, especially in younger and more active patients such as heavy laborers, may be challenging. The two most common forms of salvage surgery are four corner fusion and proximal row carpectomy. Four corner fusion results in loss of motion and proximal row carpectomy may not be sufficiently durable, especially in younger, high demand patients.^{1,2} Palliative procedures such as a radial styloidectomy do not address the underlying carpal instability.³ Furthermore this population may not be interested in surgery because of the inability to take time off from work to allow for a fusion to heal, or the reluctance to sacrifice grip strength and/or ROM.

We describe a series of patients that were treated with a minimal resurfacing procedure either using a polylactide-co-glycolide copolymer plug or artelon interposition or both

an artelon and plug procedure aimed at providing pain relief and preserving wrist motion in lieu of performing a definitive procedure.

Case Series

This procedure is indicated in high-demand patients with significant radial sided wrist pain due to early degenerative changes in the radioscaphoid joint that are not candidates for a salvage procedure. Intraoperatively, the indication for the use of the artelon spacer was a limited area of cartilage loss on the radial surface. The indication for use of the bone plug was an isolated area of cartilage loss on the scaphoid surface. Contraindications for the procedure included patients with more advanced degenerative changes (such as scapholunate

advanced collapse pattern (SLAC) grades 3 and 4) where a small spacer or plug could not adequately address the area of cartilage loss, or older and less active patients who would benefit from a definitive salvage procedure.

A total of 19 patients were treated with this procedure. All were classified radiographically as SLAC stage 1–2. The average age was 57.2 (± 7.7) years. All patients in the series were male, heavy laborers. The definition of this (most common) pattern of wrist osteoarthritis is made on posteroanterior (PA) and lateral plain films. Stage I is arthritis limited to the radial styloid-scapoid joint. Radiographs show radial styloid “beaking” and narrowing of the radial aspect of the radioscapoid joint space. Stage II is defined by narrowing of the complete radioscapoid joint space. In stage III there are signs of arthritis in the capitulate joint. Stage IV includes arthritis in the radiocarpal joint and the midcarpal (capitulate) joint.³ All of the patients in this series had chronic scapholunate dissociation with secondary radial styloid osteoarthritis. Five patients were construction workers, five farmers, two heavy equipment operators, one cook, three truck drivers with heavy lifting and two maintenance workers and one landscaper. In 7 of the 19 patients a specific injury could be identified as the initial event leading to wrist pain. In 10 of the 19 patients the dominant wrist was the injured/painful wrist.

Following surgery, patients were evaluated for active ROM specifically wrist flexion and extension, grip strength using a hand held dynamometer (JAMAR), and pain as measured by a visual analogue scale (VAS) where 0 is no pain at all and 10 is equal to maximal pain. Disabilities of the Arm Shoulder and Hand (DASH) scores were used as a functional score and the patients were interviewed at every follow-up visit regarding the type of work they were able to do and their specific limitations.

Surgical Technique

A triangular capsular flap is formed through a dorsal approach to the wrist, with the base of the triangle located over the radial aspect of the radioscapoid joint.⁴ The radioscapoid joint is inspected, including the surfaces of the radius and radial styloid and the proximal and radial scaphoid surfaces.

Limited areas of cartilage loss are addressed. For the flatter radial surface, an artelon spacer is used as an interposition material. The artelon spacer (Artelon® CMC Spacer and Artelon® CMC Spacer Arthro) is not FDA cleared for use in the radiocarpal joint and is used off-label. The implant is a T-shaped device made of a degradable polycaprolactone-based polyurethaneurea that was developed for use in thumb carpometacarpal (CMC) joint arthritis to resurface the distal aspect of the trapezium (**Fig. 1**).^{5,6} The dimensions of the implant are 10 mm for the intraarticular length by 9.5 mm for the width. The phalanges are 9mm in length by 9.5mm width. Only one implant is used. The implant has a relatively stiff 90 degree angle and this is laid on the dorsal edge of the distal radius. The articular surface is not violated so the implant is used solely as an interposition material. No drilling is performed, so no damage is caused to the intact cartilage

Fig. 1 A diagram of the Artelon spacer (Artelon® CMC Spacer and Artelon® CMC Spacer Arthro).

where it exists or to subchondral bone. It is therefore possible that the spacer does not degrade and does not become replaced. Though the implant is held by suture anchors it seems to sit well on the dorsum of the radius during surgery. Though we did not reopen or scope the patients, no instability of the implant has been noted to cause symptoms or require reoperation.

The distal phalange is removed since it is unnecessary and is not attached anywhere to provide stability as it is in the thumb CMC joint. The proximal phalange is attached using a suture anchor to the dorsal surface of the distal radius. **Fig. 2** shows the implant as it looks following removal of the distal phalange. For the “round” areas of cartilage loss, on the scaphoid surface, polylactide-co-glycolide copolymer (TRUFIT™ BGS PLUG-Smith and Nephew) plugs are used.^{7,8} This implant is FDA approved as a bone and void filler. Only one plug with a diameter of 0.5 cm is used. A hole is drilled between 0.5 cm -1cm deep in the scaphoid surface in the area of cartilage loss, and the plug fitted into it. The implant is

Fig. 2 The Artelon spacer without one of the phalanges.

Fig. 3 The Trufit bone plugs (TRUFIT™ BGS PLUG-Smith and Nephew).

inserted flush with the scaphoid surface. This does not always completely resurface the area of articular loss (►**Fig. 3**).

Prior to tightening of the capsular flaps, a “roughening of the dorsal surfaces of the scaphoid and lunate is performed, removing any ridging and allowing a scar to form.”⁴ This is done to stabilize the scapholunate joint. This procedure specifically addresses the chronic scapholunate dissociation by restricting the sagittal plane motion of the scaphoid. Following surgery the patients are encouraged to use their hands without limitation after 5 days. This postoperative protocol was carried out according to the described procedure. It is not clear what happens to the dorsal capsule and if the surgery actually changes the mechanics of the scapholunate joint in a significant manner.

Three patients were treated with a plug only, five patients with an artelon interposition only, and 11 patients were treated with a combination of both types of materials. The average follow-up period was 40.3 months (range 9–63 months). The data was too limited for any statistical analysis to be performed. Pain improved in all groups following surgery (patients with plugs and artelon from 8.3 to 2.0, artelon only from 7.0 to 1.0 and plugs only from 6.5 to 1.7). The DASH scores improved in all groups by an average of 14 points (artelon only from 36.9 to 23.7, artelon and plug from 36.9 to 22.8, plug only from 33.6 to 17.8). Flexion remained about the same pre and postoperatively in all groups and extension improved in some cases despite the tightening of the dorsal structures but perhaps due to the improvement in pain. All patients returned to heavy labor. No revision surgery has been necessary at last follow-up. Follow-up radiographs did not differ from preoperative radiographs in regards to progression of the radiocarpal osteoarthritis. ►**Figs. 4a** and **4b** show a wrist before and 9 months after surgery. No changes can be seen in the articular surfaces. There was one complication – an extensor tendon rupture. Though this was not clear during exploration, a tear due to fraying on the edge of the artelon implant could not be ruled out.

Fig. 4 (a) An oblique radiograph of the left wrist prior to surgery. (b) The same wrist 9 months after surgery.

Discussion

Interposition and resurfacing arthroplasty has been used for the treatment of arthritis of joints other than the wrist.^{3–5} The advantages of this type of arthroplasty are the ability to retain the functioning of the ligamentous structures and preserve normal wrist anatomy. The technique described provides pain relief and allowed our patients to return to heavy labor. The unanswered question is what the contribution of the dorsal capsulodesis to the pain relief is as compared with the resurfacing and/or interposition arthroplasty and whether or not the interposition material is even necessary. From prior experience with only capsulodesis in the face of minimal cartilage loss, the pain relief was not dependable and lasted for ~3 years. At this time the longest follow up period for the described series is 6 years. Future study is necessary to evaluate this question. It is possible that with further investigation and refinement of the technique and interposition materials, a long lasting surgical solution will become available for early wrist osteoarthritis.

Conflict of interest

None

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