Clinical Case Review: ARTHROSCOPIC INDICATIONS & TECHNIQUE FOR ARTELON INTERPOSITION ARTHROPLASTY OF THE THUMB TRAPEZIOMETACARPAL JOINT

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2 authors:

Alejandro Badia
Badia Hand to Shoulder Center, Miami, FL USA
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Clinical Case Review:

Arthroscopic Indications & Technique for Artelon Interposition Arthroplasty of the Thumb Trapeziometacarpal Joint

ALEJANDRO BADIA, MD, FACS.
MIAMI HAND CENTER, FLORIDA, USA.
PRAKASH KHANCHANDANI, MS.
MIAMI HAND CENTER, FLORIDA, USA.

Corresponding author:
Alejandro Badia, MD, FACS.
Hand, Upper Extremity and Microsurgery
Miami Hand Center
8905 SW 87th Avenue
Suite 100
Miami, FL 33176
Phone: 305-661-3000
Fax: 305-661-3054

SBi
Small Bone Innovations

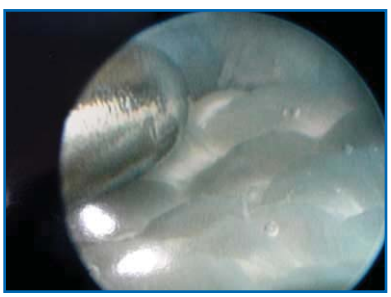
INTRODUCTION

Basal joint osteoarthritis of the thumb has a variety of treatment options ranging from conservative means to the aggressive surgical procedures. Except for the young laborer or much older low-demand patient, arthroscopic evaluation and management may be indicated for the vast majority of arthritic thumb basal joints recalcitrant to conservative treatment.[1] Radiographic changes occasionally correlate with the true articular cartilage loss, but an arthroscopic classification proves to be decisive for selecting the appropriate management protocol for different stages of arthritis. Badia clearly outlined three well defined arthroscopic stages of trapeziometacarpal joint arthritis.[1]

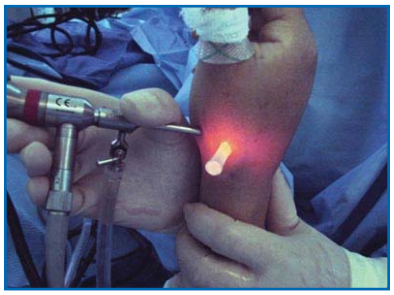
Arthroscopic stage III arthritis (Eaton Stage II or Stage III) characterized by full-thickness cartilage loss on the majority of the trapezium and a portion of the metacarpal, is the best indication for Artelon interposition arthroplasty. The Artelon spacer which has been devised to prevent articular impingement and to provide scaffolding for tissue ingrowths has shown promising results in advanced stages of basal joint arthritis. It is a synthetic material made up of polyurethane urea and can be introduced in the joint arthroscopically or by open surgery depending on the grade of subluxation associated with the arthritis. Basal joint arthritis with minimal subluxation is best suited for arthroscopic Artelon interposition. However, on occasion, younger, active patients may present with advanced arthritic changes coupled with a high degree of trapeziometacarpal subluxation. This grossly lax joint may be best suited for an open Artelon placement as the T-shaped wings of the Artelon implant serve to additionally stabilize the trapeziometacarpal joint. These wings can be fixed with either screws, sutures or bone anchors. However, the arthroscopic indication is superior in that the trapeziometacarpal joint capsule is not violated. Therefore, the joint stability is maintained by performing the interposition arthroplasty via arthroscopic means. This not only allows for a minimally invasive approach, which patients prefer and often demand, but the postoperative recovery is faster and generally less painful due to diminished swelling from the arthroscopic approach. Since the primary problem is painful bone-to-bone contact in the well-aligned but advanced arthritis scenario, the interposition of a material to prevent this process and allow for native tissue ingrowths is an attractive and logical concept. Once the patient is indicated for Artelon arthroscopic interposition arthroplasty, the procedure is scheduled on an outpatient basis.

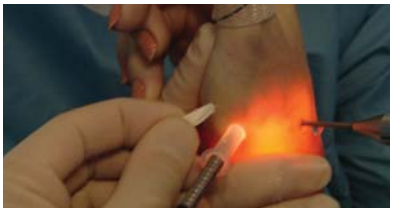
MATERIAL & METHODS

The biomaterial used in the Artelon spacer is polycaprolactone-based polyurethane urea that weighs around 0.3 gms and degrades by hydrolysis in about 6 years time.[2] The spacer can be inserted both by arthroscopic or open technique depending on the grade of subluxation associated with the arthritis. Hence, with greater subluxation an open method is preferred whereas in minimal subluxation an arthroscopic technique should be used. The Artelon spacer was implanted in 13 thumbs in 12 patients from Oct 2005 to Dec 2006 by an arthroscopic technique. The average age of the patients was 58 years (range 44-70). There were 9 Females and 3 males. The dominant hand was involved in 7 patients and non- dominant in 6 patients. One patient had the procedure performed bilaterally, as she did well after the first implant. A second patient is included who had the first side performed with a tendon graft interposition (data not included), but for the other side Artelon was used.

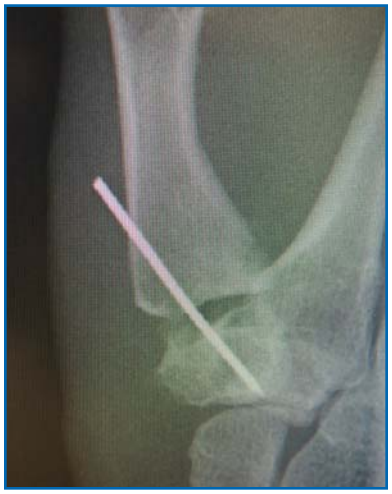


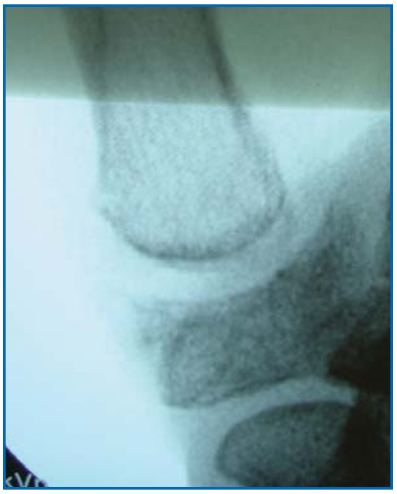
SURGICAL TECHNIQUE





The procedure is generally done under regional block anesthesia, most typically a wrist block along with intravenous sedation in order to minimize tourniquet discomfort. Tourniquet time is approximately 35 minutes. The procedure is usually done with a 1.9 mm arthroscope; however, the 2.7 mm arthroscope typically used in the wrist can often be used since the procedure will entail removal of several millimeters of the eburnated trapezial surface. Therefore, a larger arthroscope can be used which may prove more comfortable and provide superior visualization. The arthroscope is introduced into either the radial or ulnar portal as first described by Berger[3] with any additional portals being localized using an 18-gauge needle to determine the point of entry. The procedure is essentially free of complications, but one must ensure to make small, longitudinal incisions followed by spreading of a small clamp in order to avoid iatrogenic injury to the distal branches of the radial sensory nerve. Once the arthroscope has been placed and saline outflow established, one can then determine the arthroscopic stage. If, indeed, stage III is present, a full radius shaver is inserted through the other portal in order to perform a synovectomy and debride the joint for better viewing. Occasionally loose bodies will be found, and these should be excised with a small joint grabber in order to avoid impingement by these floating bodies despite the interposition material. Once adequate debridement is performed, the remaining cartilage and subchondral bone is removed from the trapezium in a carefully orchestrated manner. It is important to avoid leaving any prominent bone surfaces as this can cause focal impingement and possibly pain in the future.



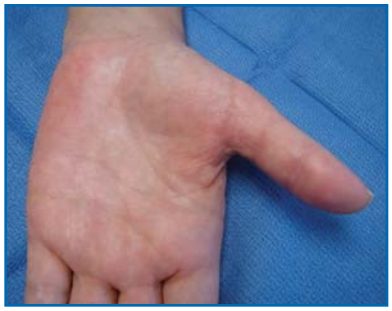


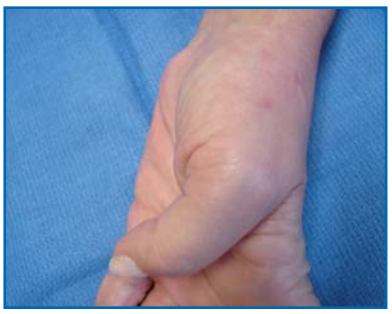
Therefore, the trapezium is divided into four quadrants, being careful to attack each quadrant with the shaving burr in order to remove approximately 2 mm of subchondral bone, leaving bleeding cancellous bone. This is important because the tissue factors that will create fibrous ingrowth encompassing the Artelon material will come from the bleeding subchondral bone once the tourniquet is released in the immediate postoperative period. Once an adequate amount of trapezium is excised, fluoroscopy can then be brought in to ensure that there is no prominent region of the trapezium abutting the metacarpal base. At this point, the arthroscopy is much easier technically since there is a much larger space within which to work. Do not debride the metacarpal, although any interposed capsular tissue or synovitis should be excised. Once adequate trapezial excision has been confirmed, the Artelon material can now be interposed. This can be done through either one of two approaches: The portal can be extended longitudinally, allowing the capsule to be opened with a larger clamp and then the Artelon material can be folded longitudinally into a tube shape and inserted bluntly through the capsule. Or as often seen, the capsule may be rather noncompliant and a technique using an inserted cannula may prove easier. A rigid material serving as a portal is inserted with arthroscopic visualization so that the cannula lies within the joint between the metacarpal base and trapezium. The Artelon material is similarly folded into a longitudinal tube and a trochar-type instrument is used to deliver the material into the joint. Once the Artelon is within the joint, it is laid down flat in order to cover the majority of the surface of the trapezium with the assistance of a hook probe or blunt trochar. While it is noted that the Artelon implant remains rather stable within the joint due to its placement via an occult capsular rent, it may be prudent to fixate the material with the trapeziometacarpal joint in a reduced position, securing it with K-wire fixation. We did use this fixation in all cases in this study. This is done by remov-

ing the arthroscope once the Artelon is in good position and with the thumb still in 5 pounds of traction, the fluoroscopy device is brought in sterilely at a perpendicular angle and a 0.045 K-wire can be driven obliquely across the trapeziometacarpal joint, ensuring that the metacarpal is well centralized on the trapezium and there is no impingement. The K-wire fixation serves to not only ensure that the metacarpal base lies well centered over the trapezium, but this also prevents micro motion, thereby assisting fibrous ingrowth to the Artelon fibers. However, fixation may not be necessary in all the cases as the arthroscopic technique essentially guarantees that the spacer will not migrate since the capsule remains intact. Once fluoroscopy has determined a good position of the joint, the K-wire is cut underneath the skin and the arthroscopy portals are closed simply with benzoin and Steri-Strips. This helps minimize the scarring on the very apparent dorsum of the hand. Occasionally the larger portal used to insert the Artelon material may need closure with a Vicryl Rapide suture which is absorbable. This obviates any need for stitch removal since the patient will be in a cast. Small wings are also present on the implant for optimal fixation to the metacarpal and trapezium in cases of instability after the trapezial burring.

POSTOPERATIVE CARE

Following skin closure, the hand is placed in a well-padded thumb spica plaster splint over generous cast padding, allowing the fingers free to move and encouraging early light pinch maneuvers. The patient is seen within one week in order to remove this bulky dressing and apply a light thumb spica fiberglass cast. The cast is in place for a 5 to 6-week period which would allow the fibrous ingrowths to the Artelon material as the material gets incorporated in the joint. At the time of cast removal, the pin is removed as a simple office procedure with a local anesthesia and fluoroscopic assistance. The patient is then given a removable hand-based CMC-type Elastoplast splint which protects the base of the thumb but allows for increased activity. The patient should only wear it intermittently as they begin their course of hand therapy. It has been our experience that hand therapy typically lasts only a few weeks to a month as the recovery is quite rapid due to the fact that the joint capsule has not been violated and only minimal swelling is present. Pinch strength will recover over time and normal use.





The patient is seen as 1 week, 6 weeks and 3 months. X-rays are taken at 1 week post-op to confirm good pin placement. Follow-up x-rays are taken at the time of pin removal at 5-6 weeks with final x-rays taken at 3 months, at which time the patient is usually discharged from care.

PRELIMINARY RESULTS

The patients are still under active follow up and the preliminary results have been encouraging. All the patients, without exception, had marked pain relief as compared to the preoperative levels. All the patients had slightly improved pinch strength as compared to preoperatively. The Pinch strength has recovered gradually with the activities of daily living over a period of time. Follow-up x-rays demonstrate a narrow space present between the metacarpal base and trapezium that was not present preoperatively on all patients.

No complications were seen using this technique. Specifically, no injuries to sensory nerves, infections or development of a complex regional pain syndrome were observed.

Our experience using this technique has been encouraging and has shown that symptom resolution has maintained itself. In fact, several patients have requested the contralateral hand to undergo the same procedure. This may very well be the best indicator of its success.

DISCUSSION

High demand patients with arthroscopic grade III arthritis are suitable candidates for a degradable spacer with capsular augmentation, since good grip function and pinch strength are not as compromised as in tendon interposition procedure. The complete trapezial resection arthroplasty is an aggressive procedure for this group of patients and should be reserved for patients with associated severe STT arthritis or marked trapezial deformity, as it results in gross alteration in anatomy and subsequent shortening of the thumb that may compromise pinch and grip strength. Once the trapezium has been completely excised, there are little salvage options in case of failure.

Due to the great force demands placed on this small but critical joint, the track record for implant arthroplasties has been mixed. Silicone trapezial implants, which were so frequently used in the past, have the drawbacks of greater wear and implant failure. These were also implicated in severe foreign body reactions associated with silicone. Pelligrini and Burton 4 documented a 25% of failure rate with silicone implants and a much higher rate of revision surgeries owing to higher incidence of subluxation of implants and silicone synovitis. Creighton et al[5] in their evaluation of 151 silastic trapezial arthroplasties observed scaphoid cysts in 56% and intramedullary radiolucency of the first metacarpal in 74% of the patients.

Muermans and Coenen 6 compared Gore-Tex and Marlex (polypropylene) implants with interposition of extensor carpi radialis longus in patients after trapeziectomy. They reported 30% incidence of synovitis characterized by pain and osteolysis in patients with gortex implants as compared with the other study group. Greenberg et al[7] observed that 80% of their patients developed osteolysis around the Gore-Tex implants. Liljesten et al[8] reported encouraging results by using polyurethane for ACL reconstruction in rabbit knee. They concluded that the material had mechanical properties similar to human ligament and from a histological and perhaps functional point of view, has good clinical implications. Sollerman et al[9] showed encouraging initial results with the trapezial replacement using a polyurethane implant with no reactive synovitis due to this implant. However, the implant had similar frequency of implant dislocations as silicone counterparts. Gretzer et al[10] in their in-vitro comparison of titanium, polystyrene and polyurethane urea concluded that polyurethane urea was the material least affected by the cell mediated immunity. Nilsson et al[2] in their landmark study compared the Artelon spacer with tendon arthroplasty using APL. They concluded that the pain relieving effect of Artelon TMC spacer implantation was equivalent to that after a tendon arthroplasty, but the key and tripod pinch strength proved to be considerably better than the APL group. They also affirmed that there was no foreign body reaction in the vicinity of Artelon and the

tissue ingrowths was appreciable without any intervening structures between bone and Artelon fibers.

We used the arthroscopically placed Artelon spacer in arthroscopic stage III arthritis with minimal subluxation. There is a learning curve associated with the procedure and surgeons have to know how to scope the joint and know to look for landmarks because the joint is so small. The technical challenges of this procedure are related more to arthroscopy itself rather than insertion of the Artelon implant. In our series, the immediate postoperative recovery of the patients was excellent, as well as rapid, with later follow-up encouraging. Long term follow-up results with more frequent use of this interposition material may change the scenario in management of advanced basal joint arthritis. The most convincing argument for use of an interposition material with limited trapezial resection may be the rapidity of recovery and return to normal activities. This may have a profound economic impact for many patients undergoing the procedure and could certainly offset the increased cost of this, or other implants. While LRTI often demonstrates good long term results, it is an accepted fact, supported by the literature and surgeon opinion, that pain relief and pinch strength recovery are slow in the majority of cases. The rapid recovery allowing a rapid return to near normal function may justify Artelon's use in more active patients. The possibility of a revision procedure, if deemed necessary, is an added benefit when compared to an aggressive surgery that resects the entire trapezium, the base of the thumb pillar. Moreover, the Artelon material may have implications in the management of advanced arthritis in other small joints as well.

Long term results are necessary to establish its place within the treatment armamentarium of thumb basal joint arthritis.

REFERENCES

1. Badia A. Trapeziometacarpal Arthroscopy: A Classification and Treatment Algorithm. Hand Clin 2006;22:153-163.

2. Nilsson A, Liljensten E, et al. Results from a Degradable TMC Joint Spacer (Artelon) Compared with Tendon Arthroplasty. J Hand Surg [Am]. 2005;30(2):380-389.

3. Berger RA. Technique for arthroscopic evaluation of the first carpometacarpal joint. J Hand Surg [Am] 1997;22:1077-80.

4. , . Surgical management of basal joint arthritis of the

thumb. Part I. Long-term results of siliconee implant arthroplasty. J Hand Surg

[Am]. 1986;11(3):309-24.

5. Creighton JJ Jr, Steichen JB, Strickland JW. Long term evaluation of Silastic trapezial arthroplasty in patients with arthroplasty. J Hand Surg [Am]. 1991;16(3):510-19.

6. Muermans S, Coenen L. Interpositional arthroplasty with Gore-Tex, Marlex or tendon for osteoarthritis of the trapeziometacarpal joint. A retrospective comparative study. J Hand Surg [Br]. 1998;23(1):64-8.

7. Greenberg JA, Mosher JF Jr, Fatti JF. X ray changes after expanded polytetraflouroethylne (Gore-Tex) interpositional arthroplasty. J Hand Surg [Am]. 1997;22(4):658-63.

8. Liljensten E, Gisselfalt K, Edberg B, et al. Studies of polyurethane urea bands for ACL reconstruction. J Mater Sci Mater Med. 2002:13(4):351-9.

9. Sollerman C, Hasselgren G, Westermark J, Herrlin K. Replacement of the os trapezium by polyurethane implants. Scand J Plast Reconstr Surg Hand Surg. 1993;27(3):217-21.

10. Gretzer C, Gisselfalt K, Liljesten E, et al. Adhesion, apoptosis and cytokine release of human mononuclear cells cultured on degradable poly (urethane urea), polystyrene and titanium in vitro. Biomaterials. 2003;24(17):2843-52.