

# Interpositional Arthroplasty Using Mammary Capsule for Finger Joints: A Novel Technique

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**Summary:** Degenerative osteoarthritis frequently affects the hands, altering the movements; surgical therapy includes arthrodesis and arthroplasty. We report the case of a female patient who presented arthrosis in the hands, severe on the proximal interphalangeal (PIP) joints, initially in her right index finger, and subsequently in the index and middle left fingers. At first, she received treatment in the PIP joint of the right index finger with a silicone implant; later on, she presented fracture of it and required replacement 8 years later. In the PIP joints of index and middle left fingers, treatment was made with interposition arthroplasty by mammary implant capsule. We present the postoperative progression of the silicone versus mammary capsule interposition arthroplasty. It is remarkable that, over time, articular function of the intervened joints with capsular arthroplasty remained stable with good motion, while range of motion in other fingers was reduced as a consequence of osteoarthritis. The frequency of patients presenting simultaneously with mammary capsule contracture and osteoarthritis is low, but this novel technique is nonetheless worthwhile to take into consideration. (*Plast Reconstr Surg Glob Open* 2019;7:e2556; doi: [10.1097/GOX.0000000000002556](https://doi.org/10.1097/GOX.0000000000002556); Published online 31 December 2019.)

**D**egenerative osteoarthritis frequently affects the hands, altering the function of the carpometacarpal joint of the thumb, as well as of the metacarpophalangeal (MCP), proximal interphalangeal (PIP), and distal interphalangeal joints of the hand.

Surgical therapy include arthrodesis and arthroplasty.<sup>1,2</sup> To perform arthroplasty different techniques and materials are available including silicone implants—frequently used in MCP joints, acting as a hinge to give the joint mobility and decrease pain—and metallic implants used to achieve greater stability and reduce lateral stress. Pyrocarbon implants are the most biocompatible, offering stability and greater grip and pinch strength. While use of autologous tissue in arthroplasty offers biocompatibility and immediate vascularity and chance of growth,<sup>3-5</sup> nevertheless, an ideal surgical technique remains to be described.

## CASE

A 66-year-old female patient, right-handed, consulted in 2007 with osteoarthritis and pain in the right hand. X-rays revealed destruction of the right index PIP joint,

collapsed radial condyle of the proximal phalange, and osteophytes in medial and proximal phalanges.

In 2008, Swanson PIP joint (Wright size No.1) arthroplasty of the right index finger and extensor tendon centralization were performed. The patient improved mobility with less pain and deviation, and was able to resume normal activities, including playing golf. In 2016, she returned with complaints of pain in both hands and Swanson implant fracture. Also, she had previous history of breast augmentation with silicone implants 20 years ago, and was now presenting painful breast capsular contracture, Baker grade IV and III on her right and left breasts, respectively.

The patient underwent surgery for implant exchange on her PIP joint of the right index, which was replaced with a NewFlex No.2 implant (DePuy Mitek), and ligamentorraphy. Because the patient continued with pain and limitation on her left index and middle PIP joints, we proposed in the same procedure an interposition arthroplasty using the mammary capsule, which the patient agreed to have with a prior informed consent.

Bilateral capsulectomy was performed; the smoothest region of the left capsule (Baker III, hyalinized tissue with smooth surface) was used. Two rectangular grafts were taken—one for each finger—the graft was of a length twice the size of the joint surface, so when the graft was

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Received for publication June 1, 2019; accepted October 9, 2019.

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DOI: [10.1097/GOX.0000000000002556](https://doi.org/10.1097/GOX.0000000000002556)

**Disclosure:** We declare that this work was funded by CES University (Medellin, Colombia) for translation. We have no conflicts of interest in relation to this article, our purpose is purely academic, and we seek with this article to contribute to science for the advent of new or better surgical approaches and treatments.



**Fig. 1.** Mammary capsule graft. The capsule is being bent and placed in the articular space of the proximal interphalangeal joint of the third left finger.

bent onto itself, it covered the joint surface increasing the articular space (Fig. 1).

Surgical approach for the left index PIP joint was from the dorsum and lateral ulnar to the extensor tendon without injuring the lateral structures. We bent the capsular graft and once in the joint with the ends of the graft looking volarly, a 5-0 monocryl stitch was made through the volar plate and the capsule (in the radial and ulnar side) suturing the graft to this structure on each side, then we

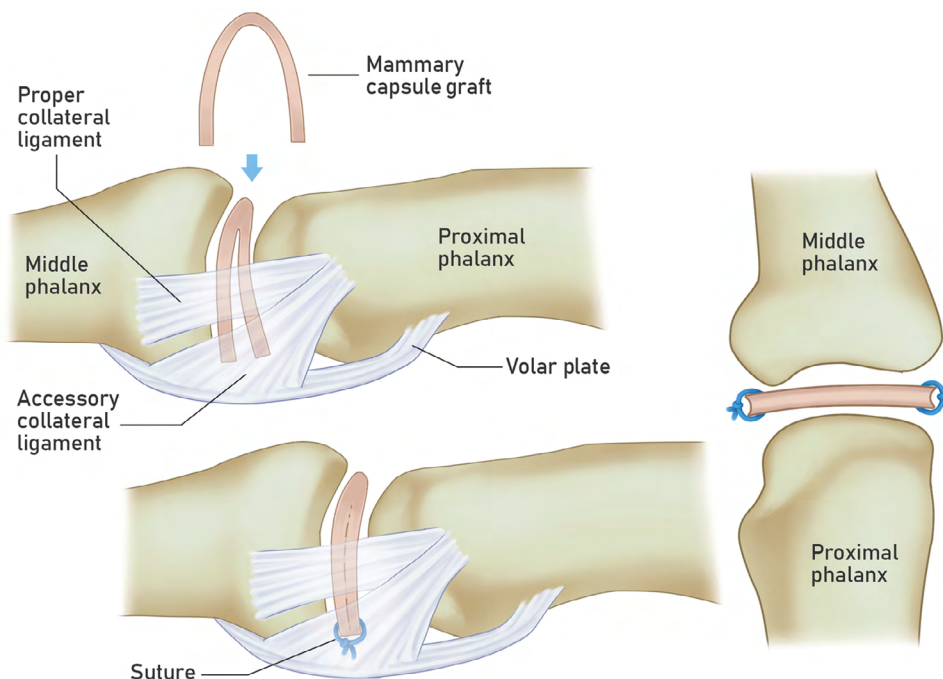
pulled off the suture out of the capsule to cover all the articular surface. After the graft was correctly inserted, movement test was performed to evaluate joint stability, finally the capsule was sutured dorsally without compromising the central slip of the extensor tendon. The approach of the PIP in the middle finger was dorsal, a split in the midpoint of the extensor tendon is performed to expose the joint and then the same procedure in the index finger was made, finally a suture of the extensor tendon is made with prolene 5-0 (Fig. 2).

In the postoperative period, we kept the joint without movement for 10 days and then the patient started passive and active movements of the joint gradually to improve flexion and extension, knowing that she already had limitation of the movements because of osteoarthritis.

Postoperative clinical and radiological follow-up shows satisfactory recovery without pain and a stable range of motion of the PIP joints, which reaffirms the usefulness of this graft in a 31 month follow-up and makes us expect that the durability of this graft and technique can last longer and may be used more frequently in selected patients and joints (Figs. 3 and 4).

## DISCUSSION

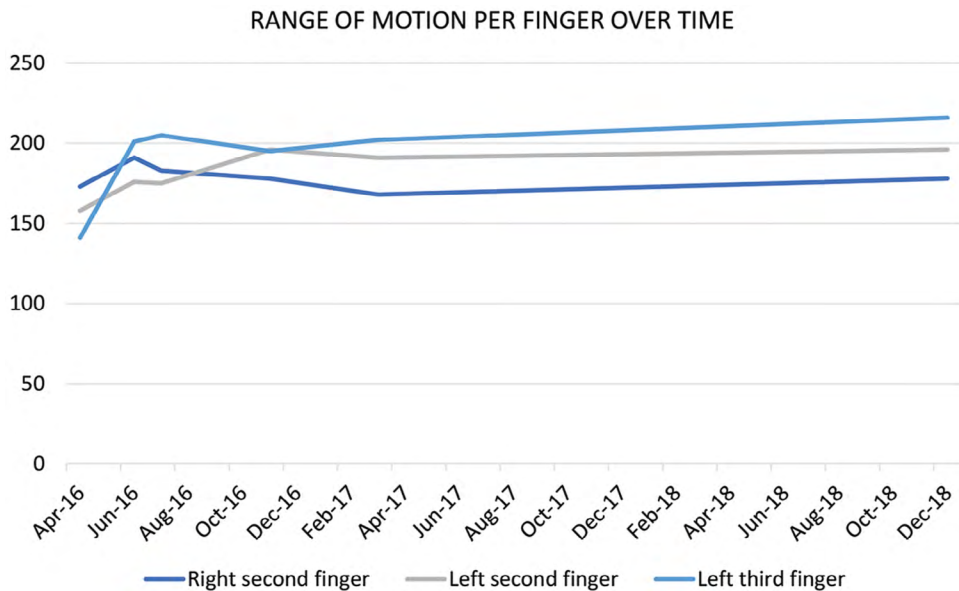
Multiple arthroplasty techniques have been proposed, and patients prefer them over arthrodesis because of preservation of joint motion, lower costs, fewer reoperations, and shorter recovery times<sup>5-9</sup>; arthroplasty of the PIP joint of the second finger has been a matter of controversy as it is more unstable and prone to failure, thus making arthrodesis the better therapeutic choice.<sup>6,10-13</sup> However,



**Fig. 2.** Positioning of the graft. **1.** Mammary capsule is bent onto itself. **2.** Insertion of the graft is performed. **3.** Suture is placed on the volar side of the graft (on both sides) through the graft involving the volar plate.



**Fig. 3.** Comparative x-ray of the left hand. On the left side, preoperative x-ray (2015). On the right side, 31 months postoperative x-ray (2018). After performing arthroplasty with mammary capsule on PIP joint of index and middle left fingers, articular space has been improved on both articular spaces.



**Fig. 4.** Range of motion per finger over time. Arthroplasty with silicone prosthesis in the right hand had a better range of motion at the beginning, but in time, mammary capsule arthroplasty on the left fingers showed better range of motion compared with the right second finger (silicone prosthesis).

under specific circumstances, options can be discussed with the patient, and in this case, the patient chose to have the arthroplasty on her right index finger, since it was not usually subjected to relevant forces.

The type of approach used to operate has also been controversial. A dorsal approach allows a comfortable

access to the joint; however, it requires more revision surgeries. The volar approach has a faster recovery period, preserves the extensor mechanism, and avoids extensor tendon adhesion and joint contracture, the lateral approach preserves the flexor-extensor mechanism and movements, but in the long term it may lead to greater



lateral instability.<sup>5,14,15</sup> We believe that a dorsal approach was appropriate in our procedure with a split of the extensor tendon in the middle finger and in the ulnar side of the extensor tendon to keep the insertion of the tendon in the middle phalange and to avoid any instability in the radial side of the PIP in the index finger, with good results in range of motion and stability.

However, interposition arthroplasties fail to offer some features, in autologous tissues contact with an arthritic bone may wear it down because of its thickness, the use of the volar plate may lead to joint instability; furthermore, the fascia generates scars and discomfort at the donor site, and in addition it is thin. Silicone implants act as a hinge to give the joint mobility and decrease pain but they have a risk of fracture and may require revision surgery. Pyrocarbon implants are the most biocompatible, offering stability and greater grip and pinch strength but range of motion may vary along patients, radiographic lucency, loosening, and subsidence are complications that can be found.<sup>4</sup>

In response to breast implants, a natural wound-healing process generates the mammary capsule. Because of its synovial lining and fibrous connective tissue wall, the generated mammary capsule made us believe that it was an ideal material for small joint arthroplasty. In addition, the capsular contracture can achieve a thickness of 2–3 mm.<sup>16,17</sup> The tissue provided by the breast capsular contracture (Grade III) was thick enough and its histological composition (a fibro-connective tissue with inflammatory infiltrate) made it structurally appropriate (strong to withstand cushion, support the joint stress and last longer) in comparison to other autologous tissues such as fascia or volar plate.

Nonetheless, there are other options available before thinking in breast capsule arthroplasty, such as silicone implants, metallic implants and autologous tissue (volar plate or fascia), each one with some benefits and difficulties as mentioned before.

Joint function follow-up over time (31 months) of the 3 involved joints showed that flexion was improved to a greater extent in the PIP joints where mammary capsule interposition was performed compared with the one with the silicone implant. Furthermore, finger motion due to the tenolysis and release of tissues showed better movement results in MCP and distal interphalangeal in capsule interposition arthroplasty than in silicone interposition technique. Over time, joint function of the fingers that where intervened remained stable, while joint function in the other fingers was reduced because of osteoarthritis. While the frequency of patients simultaneously presenting mammary capsule contracture and osteoarthritis may be

low, this novel technique is nonetheless worthwhile to take into consideration.

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## REFERENCES

- Burton RI, Margles SW, Lunseth PA. Small-joint arthrodesis in the hand. *J Hand Surg Am.* 1986;11:678–682.
- Linscheid RL. Implant arthroplasty of the hand: retrospective and prospective considerations. *J Hand Surg Am.* 2000;25:796–816.
- Adkinson JM, Chung KC. Advances in small joint arthroplasty of the hand. *Plast Reconstr Surg.* 2014;134:1260–1268.
- Zhu AF, Rahgozar P, Chung KC. Advances in proximal interphalangeal joint arthroplasty: biomechanics and biomaterials. *Hand Clin.* 2018;34:185–194.
- Yamamoto M, Malay S, Fujihara Y, et al. A systematic review of different implants and approaches for proximal interphalangeal joint arthroplasty. *Plast Reconstr Surg.* 2017;139:1139e–1151e.
- Forster N, Schindele S, Audigé L, et al. Complications, reoperations and revisions after proximal interphalangeal joint arthroplasty: a systematic review and meta-analysis. *J Hand Surg Eur Vol.* 2018;43:1066–1075.
- Herren DB, Keuchel T, Marks M, et al. Revision arthroplasty for failed silicone proximal interphalangeal joint arthroplasty: indications and 8-year results. *J Hand Surg Am.* 2014;39:462–466.
- Papalia R, Tecame A, Torre G, et al. Small joints replacement for hand osteoarthritis: a systematic review. *Br Med Bull.* 2015;116:55–68.
- Harris CA, Shauver MJ, Yuan F, et al. Understanding patient preferences in proximal interphalangeal joint surgery for osteoarthritis: a conjoint analysis. *J Hand Surg Am.* 2018;43:615–624.e4.
- Wagner ER, Luo TD, Houdek MT, et al. Revision proximal interphalangeal arthroplasty: an outcome analysis of 75 consecutive cases. *J Hand Surg Am.* 2015;40:1949–1955.
- Drake ML, Segalman KA. Complications of small joint arthroplasty. *Hand Clin.* 2010;26:205–212.
- Dryer RF, Blair WF, Shurr DG, et al. Proximal interphalangeal joint arthroplasty. *Clin Orthop Relat Res.* 1984;3:187–194.
- Stern PJ, Ho S. Osteoarthritis of the proximal interphalangeal joint. *Hand Clin.* 1987;3:405–413.
- Inumaru K, Harada M. Proximal interphalangeal joint arthroplasty with silicone implants (NeuFlex) by a lateral approach: a series of 51 cases. *J Hand Surg Eur Vol.* 2012;37:50–55.
- Yamamoto M, Chung KC. Implant arthroplasty: selection of exposure and implant. *Hand Clin.* 2018;34:195–205.
- Adams WP Jr. Capsular contracture: what is it? What causes it? How can it be prevented and managed? *Clin Plast Surg.* 2009;36:119–126, vii.
- Galdiero M, Larocca F, Iovene MR, et al. Microbial evaluation in capsular contracture of breast implants. *Plast Reconstr Surg.* 2018;141:23–30.