

Implant Arthroplasty

Selection of Exposure and Implant



Michiro Yamamoto, MD, PhD^{a,b,*}, Kevin C. Chung, MD, MS^c

KEYWORDS

• Proximal interphalangeal joint • Arthroplasty • Implant • Approach • Exposure

KEY POINTS

- Outcomes after implant arthroplasty for osteoarthritis of the proximal interphalangeal joint are different according to the selection of surgical exposure and implant design.
- Silicone implants with the volar approach show the best arc of motion and fewer complications after surgery among all combinations of exposure and implant design.
- Reconstruction of appropriate soft tissue balance and alignment of the finger are essential to success with surface replacement arthroplasty.
- Future directions for implants should focus on osteointegration and durability.

INTRODUCTION

The prevalence of symptomatic proximal interphalangeal (PIP) joint osteoarthritis (OA) ranged from 0.7% to 2.0% in the Framingham Offspring and Community cohort study,¹ which is the equivalent of 2.3 million people in the United States in 2000. Current treatment options for PIP OA include silicone, metal, pyrocarbon, and ceramic arthroplasties using a volar, lateral, or dorsal approach. Many hand surgeons have been putting substantial effort into the development of these small joint prostheses. However, there is not yet a standard for PIP implant arthroplasties and various types of implants and approaches have been reported (**Fig. 1**). For this article, we reviewed studies on PIP implant arthroplasties that used different exposures and implants. We compared the reported arc of motion (AOM), extension lag, and complication rates among different type of implants and exposures because,

unlike PIP arthrodesis, the goal of PIP implant arthroplasty is to maintain or improve joint motion.

METAL HINGED IMPLANT ARTHROPLASTY

In 1959, Brannon and Klein² reported on the use of a metal, hinge-joint, finger prosthesis in 14 patients with posttraumatic conditions; the longest follow-up period was 3 years. The prostheses were originally made of stainless steel, but were later changed to titanium. This design consists of 2 parts along with an intramedullary stem that are locked by a screw. All cases were operated on using a lateral approach. Although pain relief was achieved in all 14 patients, complications involving bone resorption around the stems, sinking in of the prosthesis with rotation, and loosening of the screw were found more often in the earlier version made with stainless steel. These complications result in shortening of the finger and loss of motion.²

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^a Section of Plastic Surgery, Department of Surgery, University of Michigan, 2130 Taubman Center, 1500 E. Medical Center Drive, Ann Arbor, MI 48109, USA; ^b Department of Hand Surgery, Nagoya University Graduate School of Medicine, 65 Tsurumai-cho, Showa-ku, Nagoya, Aichi 466-8550, Japan; ^c Section of Plastic Surgery, Department of Surgery, University of Michigan, 2130 Taubman Center, SPC 5340, 1500 E. Medical Center Drive, Ann Arbor, MI 48109, USA

* Corresponding author. Department of Hand Surgery, Nagoya University Graduate School of Medicine, 65 Tsurumai-cho, Showa-ku, Nagoya, Aichi 466-8550, Japan.

E-mail address: michi-ya@med.nagoya-u.ac.jp

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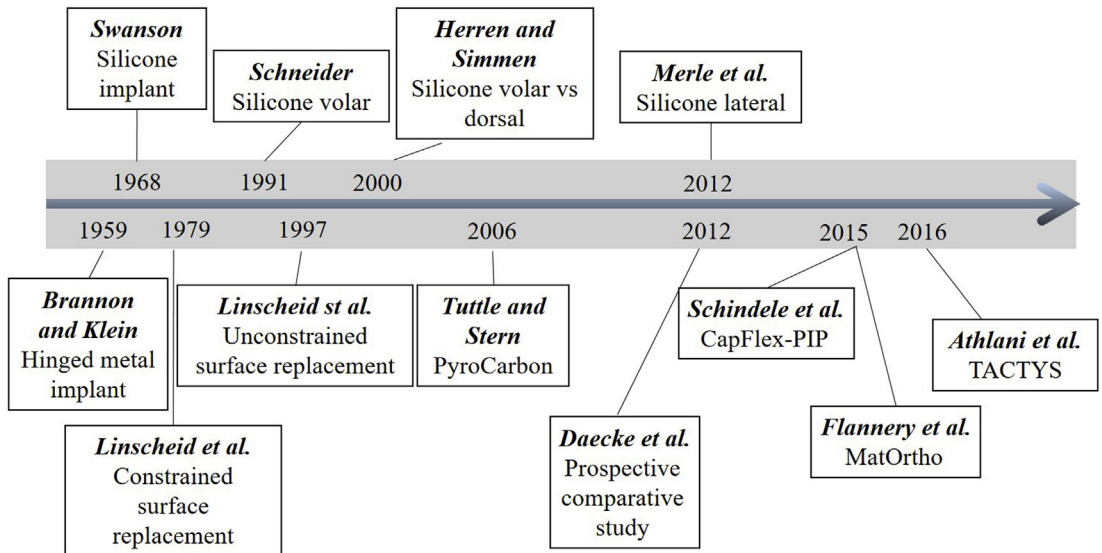


Fig. 1. Chronology of outstanding reports for proximal interphalangeal joint implant arthroplasty.

To prevent the rotational instability seen in the prosthesis of Brannon and Klein,² Flatt³ developed another hinged, metal prosthesis with 2-pronged stems and implanted them into 20 patients with rheumatoid arthritis. The study had a mean follow-up time of 6.2 years, during which 11 implants (15%) were removed because of infection, implant failure, or soft tissue problems. Extraction of the prosthesis was difficult because of bone absorption around the prosthesis, scarring, and heterotopic bone formation surrounding the hinge.⁴

Recently, results from a 17-year longitudinal study were published, reporting the effects of hinged, piston-based DIGITOS (Osteo AG, Selzach, Switzerland) PIP prostheses inserted using a lateral approach. The DIGITOS prosthesis exhibited radiolucent lines at the bone-cement junction and peri-prosthetic osteophytes stemming from instability in the first 7 years. However, radiolucent lines around the implants had not increased in the longer follow-up, and all 12 patients showed good pain relief and expressed high satisfaction.⁵ Some motion between the metal hinge and a polyethylene cuff might be effective in preventing implants from loosening, because the pistonlike motion between the hinge and cuff absorbs stress to the bone. However, DIGITOS prosthesis was taken off the market because of the early osteolysis and the formation of large osteophytes.

Although several types of metal, hinged implants have been developed, they all share common problems of bone absorption, implant loosening, and osteophyte formation. Metal, hinged implants are used much less often than silicone implants and surface replacement arthroplasties.

SILICONE ARTHROPLASTY

After Swanson and colleagues⁶ introduced the silicone implant to treat PIP joint arthritis in 1968, they reported rewarding results for dorsal approach arthroplasty with good pain relief in 98% of patients. Except in cases of swan-neck deformities, average AOM improved after surgery. Swanson and colleagues⁶ also reported 88 (11%) surgical revisions with a minimum 1-year follow-up. Of these revision surgeries, 41 cases were because of stiffness or deformity.⁶ Most surgeons favored a dorsal approach for silicone implants because of easier joint exposure,⁷⁻⁹ but the revision surgery rate after silicone arthroplasties using a dorsal approach is higher compared with that of using a volar approach. In our search, more than a few patients required secondary tenolysis or revision surgeries for stiffness after undergoing a dorsal approach arthroplasty, but none were reported after a volar approach arthroplasty.^{6,8,10}

Beneficial outcomes have been reported since Schneider¹¹ first published his method for silicone arthroplasty with a volar approach for PIP joint OA in 1991. An 8-year follow-up study of volar approach PIP joint silicone arthroplasty demonstrated their lasting effects with only 1 revision surgery (3%) performed.¹² Secondary tenolyses or arthrolyses were quite rare using this approach as well. The volar approach has the advantage of preserving the extensor mechanism. It enables early and aggressive postoperative exercise to avoid extensor tendon adhesion and joint contracture. It also results in a better restoration of extension in the AOM without extension lag (Fig. 2). The

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