Prosthetic Arthroplasty Versus Arthrodesis for Osteoarthritis and Posttraumatic Arthritis of the Index Finger Proximal Interphalangeal Joint

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Purpose To compare outcomes of prosthetic arthroplasty versus arthrodesis to treat index finger proximal interphalangeal (PIP) joint arthritis.

Methods Patients with osteoarthritis or posttraumatic arthritis of index finger PIP joints were evaluated. Digit range of motion, grip and pinch strength, patient-rated pain and satisfaction scores, Michigan Hand Questionnaire scores, and complications were recorded.

Results A total of 79 finger PIP joints were followed for a median of 67 months overall (72 months for arthroplasty and 8 months for the arthrodesis group). Sixty-five were treated with arthroplasty and 14 with arthrodesis. Patients undergoing arthroplasty experienced no significant postoperative change in PIP joint range of motion whereas all preoperative PIP joint motion was eliminated after arthrodesis. Patients undergoing arthroplasty experienced significant postoperative improvement in opposition pinch. In contrast, patients undergoing arthrodesis experienced significant improvement in both opposition and apposition pinch. There were no differences in pain relief, satisfaction, or Michigan Hand Questionnaire scores between treatment groups. Patients undergoing arthroplasty had a significantly greater mean number of complications per year and mean number of complications in the first year postoperatively. There was a 4.3 times increased risk of complication in patients undergoing arthroplasty versus arthrodesis, and Kaplan-Meier analysis revealed a shorter time to first complication among patients undergoing arthroplasty.

Conclusions The decision for prosthetic arthroplasty versus arthrodesis in the index finger of patients with osteoarthritis or posttraumatic arthritis must be made with patient goals in mind and in light of greater risk of complications associated with arthroplasty. *(J Hand Surg Am. 2015;40(10):1937–1948.*

Type of study/level of evidence Therapeutic III.

Key words Arthrodesis, index finger PIP joint, osteoarthritis, posttraumatic arthritis, prosthetic arthroplasty.

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S.L.M. is a paid consultant for Integra Life Sciences (Plainsboro, NJ), which is the manufacturer of one of the prostheses used in the current study (pyrolytic carbon PIP joint prosthesis).

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Common etiologies of proximal interphalangeal (PIP) joint arthritis include osteoarthritis (OA), inflammatory arthritis, and posttraumatic arthritis (PTA).[1,2] Arthrodesis[3–5] and prosthetic arthroplasty with silicone,[6–9] metal surface replacement,[10–12] or pyrolytic carbon[13–19] implants have been used to treat severe PIP joint arthritis. Although both treatments are effective in relieving pain, arthrodesis affords joint stability at the price of motion compared with arthroplasty,

which preserves motion but may carry greater risk of complications.[6,10,12,19–24]

The index finger is unique compared with other digits because of the large lateral and axial joint forces to which it is subjected during pinch activities, which require a stable joint.[14,16,25,26] Some authors have advocated arthrodesis of the arthritic index finger PIP joint over prosthetic arthroplasty because of increased demands of index finger pinch,[10,14,16,17,23,26,27] although previous studies have not specifically compared the results of these 2 treatments in the index finger.

It remains unclear whether prosthetic arthroplasty is a viable option for active patients with index finger PIP joint OA[8,21,28–30] and PTA.[7,15,30–32] The purpose of this study was to compare the outcomes of index finger PIP joint arthroplasty and arthrodesis in patients with OA or PTA.

MATERIALS AND METHODS

Patient study group

We included patients with primary OA or PTA of the index finger PIP joint treated with either arthrodesis or prosthetic arthroplasty from January 1999 to January 2011. Patients with inflammatory arthritis were excluded because they may have lower demands with regard to pinch activities and also may have ligamentous attenuation, making them unsatisfactory candidates for arthroplasty. Patients with OA and PTA were grouped together on the assumption that they would be relatively active with regard to pinch activities and also would be better candidates for arthroplasty because of collateral ligament integrity. Patients were treated by 10 different surgeons, and the decision to perform arthroplasty versus arthrodesis was based on surgeons' clinical judgment and patient preferences. Tension band, headless compression screw, or plate fixation constructs were used for arthrodesis (Table 1). Two different PIP joint prostheses were used for arthroplasty: a metal and ultra high-molecular-weight polyethylene surface replacement prosthesis (Small Bone Innovations, Morrisville, PA) or a pyrolytic carbon total joint prosthesis (Integra Life Sciences, Plainsboro, NJ). Although these 2 prostheses are similarly designed to resurface joint surfaces and preserve collateral ligaments, they have different material properties and design; nonetheless, prospective randomized analysis has found equivalent results with these 2 implants.[24] Approaches for PIP joint arthroplasty were dorsal extensor splitting (52 cases), Chamay (12 cases), and volar (1 case), as decided by the treating surgeon.

TABLE 1. Arthroplasty Implants and Methods of Arthrodesis Used

	Arthroplasty (N = 65)	Arthrodesis (N = 14)
Arthroplasty implant		
Metal surface replacement*	18 (28%)	NA
Pyrolytic carbon†	47 (72%)	NA
Arthrodesis method		
Tension band	NA	9 (64%)
Plate osteosynthesis	NA	3 (21%)
Headless compression screw	NA	2 (14%)

NA, not applicable.
*Cobalt chromium and ultra high-molecular-weight polyethylene surface replacement prosthesis.
†Pyrolytic carbon total joint prosthesis.

Evaluation and documentation

Clinical end points included active PIP joint range of motion (ROM) measured with a goniometer, grip strength measured with a Jamar dynamometer, and opposition and apposition pinch strength measured with a pinch dynamometer. The mean of 3 attempts was recorded.

An independent survey-center administered the questionnaires by mail. Questionnaires included a visual analog scale for pain, a surgery satisfaction score, and the Michigan Hand Questionnaire. The visual analog scale pain score was on a scale of 0 to 10 (0 represented no pain and 10 represented the most severe pain) in which patients rated current severity of pain in the treated finger. The surgery satisfaction score was a single question asking patients to rate satisfaction with surgery on a Likert scale of 1 to 6 (1 represented "very satisfied" and 6 represented "very dissatisfied"). The Michigan Hand Questionnaire is a hand-specific instrument with established responsiveness, reliability, and validity in assessing hand disorders and outcomes of interventions.[33,34]

Radiographic evaluation included assessment of osteolysis, implant subsidence, or migration of prostheses in patients undergoing arthroplasty and assessment of union in patients undergoing arthrodesis. Osteolysis was determined for both proximal and distal components; in the case of pyrolytic carbon implants, osteolysis was considered present only when there was periprosthetic lucency greater than 0.5 mm (0.5 mm or less is considered normal by the manufacturer because of the radiolucent outer coating).[28] Implant subsidence was assessed by comparing initial postoperative with final postoperative radiographs.[21] Implant migration was graded by a previously published method assessing coronal and sagittal plane deformity.[21]