SCIENTIFIC ARTICLE

Clinical and Radiographic Outcomes of Metacarpophalangeal Joint Pyrolytic Carbon Arthroplasty for Osteoarthritis

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Purpose To determine the effectiveness of pyrolytic carbon arthroplasty for the management of primary osteoarthritis of the metacarpophalangeal joint.

Methods A retrospective review of 11 pyrolytic carbon arthroplasties for osteoarthritis of the metacarpophalangeal joint, performed by a single surgeon, was conducted. All patients returned for clinical assessment at a minimum of 2 years after surgery. Evaluation included range of motion, pain and functional scores, and patient satisfaction. Validated outcome measures included the Michigan Hand Questionnaire and Quick Disabilities of the Arm, Shoulder, and Hand. Radiographs were assessed for implant failure, loosening, migration, and subsidence.

Results The average follow-up was 4 years (minimum 2 y). The arc of motion significantly improved from 62° before surgery to 76° after surgery. Grip strength decreased slightly compared to the contralateral side (average, 3 kg). The average pain score was 1 on a 10-point visual analog scale. All but 1 patient were fully satisfied at final follow-up. All patients who were working before surgery returned to work after surgery. The Michigan Hand Questionnaire average score was 80, and the Quick Disabilities of the Arm, Shoulder, and Hand average score was 22. Two patients experienced persistent, asymptomatic squeaking and clicking, and 1 patient reported extensor tendon subluxation. One joint had conversion to arthrodesis for continued, unexplained pain. All surviving implants had a surrounding lucency on radiographs. The average subsidence was 3 mm; there was no implant migration, fracture, or dislocation.

Conclusions Pyrolytic carbon arthroplasties of the metacarpophalangeal joint resulted in satisfactory outcomes at average 4-year follow-up, with improved joint motion, good pain relief and satisfaction, and few complications. Radiographic outcomes revealed a consistent, asymptomatic surrounding lucency with no evidence of implant failure or migration. *(J Hand Surg 2013;38A:537–543. Copyright © 2013 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic IV.

Key words Arthroplasty, metacarpophalangeal joint, osteoarthritis, pyrolytic carbon.

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Osteoarthritis (OA) of the metacarpophalangeal (MCP) joint is uncommon. Overall hand function is dependent on the MCP joint mobility, and OA can result in stiffness, pain, and deformity. To maintain and optimize hand function, treatment of MCP joint arthritis might be necessary. Initial treatment includes nonsurgical modalities, such as activity modification, anti-inflammatory medication, and corticosteroid injections. If these techniques are ineffective, more invasive treatments such as arthroscopy, arthroplasty, or arthrodesis might be required.[1]

Pyrolytic carbon implants have excellent biomaterial properties and have been used for joint arthroplasty in the small joints of the hand for the past few decades.[1–7] The implant is formed by pyrolysis of a hydrocarbon gas and is chemically stable, making it compatible with biologic media.[8] The implant is stabilized into bone by initial impaction and then fixed by appositional growth.[9] The initial results of pyrolytic carbon arthroplasty of the MCP joints produced satisfactory outcomes in a mixed arthritic population.[2] This was followed up with a long-term study revealing similar encouraging results,[3] with a calculated survivorship of 80% at 5 and 10 years.

To date, there is little evidence specifically investigating the results and clinical outcomes of patients with OA of the MCP joint treated with pyrolytic carbon arthroplasty.[3–5] Previously reported studies present a mixed population with multiple etiologies of arthritis.[3,5] Our study was conducted to investigate the longer-term outcomes of pyrolytic carbon arthroplasties of the MCP joint for osteoarthritis. We hypothesized that patients would have satisfactory results, both clinically and radiographically, at a minimum of 2 years of follow-up.

MATERIALS AND METHODS

All patients who had arthroplasty for OA of the MCP joint with a pyrolytic carbon implant before 2010 by a single surgeon (P.J.S.) were reviewed. The study was approved by the local institutional review board. The indication for the surgery was pain that was unresponsive to conservative treatment, including activity modification, anti-inflammatory medication, and steroid injections. Inclusion criteria were a primary diagnosis of OA of the MCP joint (Fig. 1) and a minimum follow-up of 2 years. Patients with inflammatory arthropathy and posttraumatic arthritis were excluded, as were patients with deficient collateral ligaments. The pyrolytic carbon arthroplasty was performed in 11 MCP joints in the 9 patients who met the inclusion criteria. The follow-up evaluation was carried out by an independent observer (L.B.W.) who was not involved in the care of these patients.

FIGURE 1: Preoperative posteroanterior radiographs of middle finger MCP joint OA in a 59-year-old woman.

The average age of the patient at the time of arthroplasty surgery was 62 years (range, 40–73 y). Four of the 9 patients were women. Two patients had replacements in both middle fingers. Arthroplasties were performed in 3 index fingers and 8 middle fingers.

Surgical technique

All procedures were performed as outpatient procedures, using either regional block or general anesthesia. The joint is approached through a dorsal longitudinal extensor splitting incision followed by division of the joint capsule. The metacarpal head is penetrated just dorsal to the mid-axial line with a starting awl. Next, an alignment awl is inserted down the medullary canal of the metacarpal, using fluoroscopic guidance to ensure that it is centered in the canal in both the coronal and sagittal planes. A sagittal saw is then used to make the osteotomy, 1 to 2 mm distal to the collateral ligaments. The joint is then flexed, and the starter awl is placed into the base of the proximal phalanx slightly dorsal to the mid-axial line. The alignment awl with cutting guide is then placed into the phalanx under fluoroscopic guidance, and an osteotomy to remove a wafer of bone from