Case Report

A Painful, Squeaking Pyrolytic Carbon Metacarpophalangeal Joint Replacement

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Metacarpophalangeal (MCP) joint arthroplasty with pyrolytic carbon implants is a common procedure that is performed to alleviate pain from arthritis. The material properties of pyrolytic carbon are discussed with regard to their efficacy in MCP joint arthroplasty. We report a case of a painful, squeaking MCP joint arthroplasty treated with revision arthroplasty. Squeaking is a rare complication of MCP joint arthroplasty and is usually asymptomatic with spontaneous resolution. However, in this case, the squeaking was persistent and likely related to intraoperative findings of implant subsidence, debris, wear, and an incongruent joint. We also see in this case that the revision pyrolytic carbon MCP arthroplasty underwent subsidence within 2 years of revision surgery and ultimately was revised to a silicone MCP arthroplasty.

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not cause the breakdown of the material, and it is able to experience large amounts of elastic strain without deformation.6 These are all favorable material characteristics for joint arthroplasty. Although there are many obvious advantages of pyrolytic carbon for MCP joint arthroplasty, there are drawbacks. The complications include implant subsidence, bone erosion, dislocation, and intraoperative fracture. Squeaking is well documented with proximal interphalangeal pyrolytic carbon arthroplasty; however, it is a rare complication for MCP joint arthroplasty.7 In 1999, Cook et al8 reported on the long-term follow-up of pyrolytic carbon MCP arthroplasties. Of the 151 cases, there were no reported outcomes of squeaking. In 2017, Aujla et al9 performed a systematic review of the literature regarding the outcomes of unconstrained MCP joint arthroplasty; however, it is a rare operative fracture. Squeaking is well documented with proximal interphalangeal pyrolytic carbon arthroplasty; however, it is a rare complication for MCP joint arthroplasty.10

In 2017, Aujla et al9 performed a systematic review of the literature regarding the outcomes of unconstrained MCP joint arthroplasty; however, it is a rare complication for MCP joint arthroplasty. Of the 237 arthroplasties reviewed, only 2 cases of nonpainful squeaking were reported.9

We describe a case of a 74-year-old man who presented to the clinic with a symptom of a painful, squeaking hand after undergoing a right index finger MCP arthroplasty with pyrolytic carbon. He subsequently underwent revision MCP arthroplasty, and the operative findings are discussed. Unfortunately, his revision MCP arthroplasty developed painful swelling and ultimately required a second revision surgery, which is discussed.

**Case Report**

A 74-year-old right-handed man presented to our clinic with an uncommon symptom: hand squeaking. In 2011, he had undergone a right middle finger MCP joint replacement performed at an outside institution. Approximately 5 years after the surgery he began to experience pain and swelling in his right middle finger. This progressively worsened until audible squeaking with active flexion of the MCP joint could be heard. Because of worsening pain and dissatisfaction with the squeaking, he presented to our clinic for evaluation. Prior to retirement, he assembled parts for an automotive company and did extensive work with his hands. After retiring, he continued to be active with his hands, including working on machinery and playing the guitar. The patient especially noticed the squeaking when performing certain actions, such as twisting bolts or shaking hands. The pain and squeaking were severe enough that they were affecting his quality of life. For treatment, he had previously received a corticosteroid injection by another orthopedic surgeon with no relief. Nonsteroidal anti-inflammatory drugs provided no significant relief either. He denied a personal history or family history of rheumatoid or inflammatory arthritis.

Radiographs of the right hand were obtained in the clinic (Fig. 1), demonstrating the MCP joint replacement in the middle finger with signs of loosening of the proximal phalangeal portion of the implant. The metacarpal component appeared stable, and there was a slight incongruency of the right middle finger MCP joint.

On physical examination, the incision over the dorsal aspect of the right middle finger was well-healed (Fig. 2). There was mild swelling and tenderness to palpation over the MCP joint of the middle finger. There was audible squeaking with active flexion of the MCP joint, but no squeaking with passive flexion or extension (Videos 1 and 2, available on the journal’s website at www.jhsgo.org). The patient could actively flex the right middle finger MCP joint at approximately 70° compared with the normal contralateral side that achieved 90° of flexion.

Because of the patient’s continued pain with active MCP motion and swelling, the decision was made to perform a revision right index finger MCP joint arthroplasty (Fig. 3). The previous incision was incised, and dissection was carried down with an ulnar-sided capsulotomy. There was a significant amount of black staining and debris, presumably from the graphite coating of the implant. The metacarpal portion of the implant was well seated but removed with no difficulties. The distal portion of the implant in the proximal phalanx had subsided, and bone loss was noted. The intraoperative findings were consistent with preoperative radiographic findings with loose proximal phalanx. Using a small rongeur and a tenaculum, the distal implant was easily removed and broke into multiple pieces when set on the back table (Fig. 4). The medullary canal of the proximal phalanx was coated with black staining and filled with debris resembling a tarry substance. The debris was removed, and the wound was copiously irrigated. After broaching, appropriately sized pyrolytic Integra implants made by Smith & Nephew were inserted and taken through a series of satisfactory ranges of motion with 90° of flexion and 10° of hyperextension. There was no instability with varus or valgus stress.

Next, the capsule and extensor mechanism were closed with #4-0 PDS figure-of-eight sutures. The skin was closed with 5-0 Nylon horizontal mattress sutures. After the surgery, the patient was

**Figure 1.** Radiographs: X-rays of the right hand with evidence of the middle finger MCP joint arthroplasty.
placed into a radial gutter orthosis in intrinsic plus incorporating the index and middle fingers and taken to the recovery room for routine postoperative monitoring.

At the patient’s routine 2-week follow-up visit, he reported a resolution of the pain and squeaking. He was able to flex the middle finger MCP joint to 80° and achieve 0° of extension.

At his routine 8-week follow-up, the patient reported he was happy with the results of surgery with pain and squeak-free active range of motion at the middle finger MCP joint. At his 3-month follow-up, he reported pain and clicking at the right middle finger. He was diagnosed with a trigger finger and given a corticosteroid injection. The MCP arthroplasty was well
functioning at that time, and radiographs showed no concerning findings (Fig. 5). He did not follow up after this for nearly 2 years.

The patient represented in June 2021 with symptoms of 6 months duration clicking, swelling, and pain in his right middle finger. He was recommended for MCP joint replacement revision using a silicon prosthesis. He subsequently underwent removal of the failed pyrolytic carbon prosthesis revision implants and was revised to a Silastic, #5 Swanson implant. The previous surgical incision was used for the approach through the ulnar-sided capsule. Scarring and the extensor mechanism were gently teased from the scar tissue. Intraoperatively, the proximal phalanx portion of the revision pyrolytic carbon implant was noted to have subsided. The

Figure 4. Implant Removal: Implants and the debris removed during the procedure demonstrate fracture of the implant and the removed debris.

Figure 5. Radiographs: X-rays of the right hand following initial revision surgery.
Implant was noted to have volar subluxation of the distal portion on the proximal portion. The implant was removed, and a #5 Silastic implant from Swanson was placed using a no-touch technique. The wounds were irrigated, and capsule closure was performed with a 4-0 PDS suture in a figure-of-8 fashion. The skin was closed in a horizontal mattress fashion with a 5-0 nylon suture. The wounds were dressed, and an anterior and posterior orthosis was placed, keeping the wrist slightly extended and the MCP and proximal interphalangeal joints in neutral.

At 1 week postrepeat revision MCP arthroplasty follow-up appointment, he was doing well, underwent suture removal, and was given home exercises for range of motion.

Six weeks after surgery, he was seen again for a routine follow-up. At this visit, he demonstrated full active extension of the MCP joint and could flex to 60°, with complete resolution of his symptoms of pain, swelling, and clicking. Radiographs obtained at that time were unremarkable for any complicating process (Fig. 6).

Discussion

Metacarpophalangeal joint arthritis can be a painful and debilitating condition for individuals. For many, the pain is relieved with conservative treatments, such as nonsteroidal anti-inflammatory medications, disease-modifying antirheumatic drugs, orthosis fabrication, and corticosteroid injections. Those who do not receive relief from their symptoms may elect to proceed with MCP joint arthroplasty. Most often, patients are satisfied with their results. However, in the case of our patient, he was very dissatisfied with his right middle finger MCP arthroplasty because of pain, swelling, and squeaking. As previously mentioned, squeaking is more common in proximal interphalangeal arthroplasty and is usually not associated with pain or swelling. We describe a unique case, as most cases of squeaking MCP arthroplasty have not been associated with pain and swelling. We describe a unique case, as most cases of squeaking MCP arthroplasty have not been associated with pain and swelling. Ceruso et al reported that squeaking usually spontaneously resolves and does not require revision arthroplasty. In 2007, Meier et al hypothesized that squeaking is related to the malalignment of the components. In this case, there did appear to be malalignment of the components with the incongruity of the middle finger MCP joint noted on the preoperative x-rays, as well as intraoperative findings of subsidence of the proximal phalanx implant. This subsidence and incongruity are a likely source of this patient’s pain and squeaking. It is also interesting to note that the patient only experienced squeaking with active but not passive flexion of the MCP joint. It is
hypothesized that as he actively flexed the MCP joints, joint reaction forces across the implant combined with the implant subsidence created joint incongruency and audible squeaking.

The revision pyrolytic carbon implant ultimately showed subsidence on the proximal phalanx side and was responsible for the recurrence of pain, swelling, and clicking of the right index finger. We hypothesize that this was again because of the subsidence of the implant combined with scar tissue formation creating the symptoms when the patient went through active MCP motion at the middle finger.

Ultimately the revision pyrolytic carbon implant also failed. This was initially diagnosed and treated as a trigger finger. However, the symptoms did not resolve. At repeat revision, the implant was found to be subluxing and clicking, which was consistent with the continued symptom. We feel that the clicking and pain present on follow-up after the first revision were because of the implant beginning to fail.

Metacarpophalangeal joint arthroplasty is typically a very reliable and satisfactory operation for patients. However, there are known complications, including implant subsidence, fracture, and occasionally squeaking. If the squeaking is asymptomatic, there is no need for intervention because it usually resolves spontaneously. As presented in this case report, if there is associated pain and swelling, we recommend revision MCP joint arthroplasty to identify and correct the underlying cause of the squeaking, such as implant subsidence or an incongruous joint. The original implant, in this case, failed because of subsidence and loosening of the proximal phalangeal component, causing the implant material to break down. This was evident by the debris found during surgery and the loosening described. The second pyrolytic carbon implant showed subsidence that we feel was because of limited soft tissue constraint and implant subsidence following the revision. This patient ultimately underwent revision to a silicone implant because of the failure of 2 pyrolytic carbon implants. This provided improved stability of the MCP arthroplasty. At his most recent follow-up, the patient was satisfied with his results.

Written informed consent was obtained from the patient for publication of this case report and accompanying images/videos.

References