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Early results of ceramic/ceramic fist metatarsophalangeal joint replacement

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Abstract

We set out to evaluate the early outcome of ceramic on ceramic (MOJE) prosthesis in the treatment of hallux rigidus. Between March 2000 and November 2003, 13 patients (14 implants), were treated using the ceramic/ceramic prosthesis. These patients have been followed for an average of 24.46 months. The American Orthopaedic Foot Association scoring system (AOFAS) was used to assess the patients before and after surgery. The average AOFAS score significantly increased from 43.07 pre-operatively to 95.28 post-operatively ($P = 0.0001$). At 6 months, 12 patients had no pain. The total range of dorsiflexion and plantarflexion improved to greater than 75° in 10 patients. Audible squeaking of the prosthesis, which improved between 3 and 6 months, was noted in 12 patients.

The early results are encouraging with good functional outcome. Long-term follow-up is required to assess the durability of the ceramic/ceramic press fit prosthesis.

Keywords: Ceramic/ceramic prosthesis; Metatarsophalangeal joint replacement; AOFAS

1. Introduction

Hallux rigidus is characterised by pain and limitation of movement at the first metatarsophalangeal joint. This restriction particularly affects dorsiflexion [1,2]. Arthroplasty of the first metatarsophalangeal joint, aims to eliminate pain and improve the range of movement at the first metatarsophalangeal joint. Various materials have been used in first metatarsophalangeal joint replacement, examples of which include silicone-, silastic- and titanium-based prostheses.

Recently, ceramic-based prostheses have been introduced. A screw fit ceramic prosthesis was withdrawn, due to reports of early loosening and breaking of the screw fit components [3]. A press fit version was introduced in December 1999. We set out to evaluate the early outcome of ceramic/ceramic press fit prosthesis in patients with hallux rigidus.

2. Patients and methods

Between March 2000 and November 2003, 13 patients (14 prostheses) had arthroplasty of the first metatarsophalangeal joint, using the ceramic on ceramic (MOJE) prosthesis. There were eight female and five male patients. The mean age of the patients was 49.79 years (range 29–65). The indication for surgery was severe pain not responding to conservative measures. A hallux metatarsophalangeal–interphalangeal scoring scale, by the American Orthopaedic Foot Association was used to assess the patients, before and after surgery. This scoring scale has a total of 100 points. The scale consists of three main categories: pain, function and alignment. Forty points is the maximum score for a patient with no pain.

Patients with severe pain score zero. The function category has objective and subjective components. Forty-five points is the maximum score for a patient who has no limitation of activity, no restriction of foot wear and a dorsiflexion-plantar flexion range of greater than 75°. Within this category, a patient with a dorsiflexion-plantar flexion range of less than 30° scores zero. Five points is given to a patient with a range of movement between 30° and 74°. A patient with

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a range of movement greater than 75°, scores 10 points. A patient with normal hallux alignment, has a maximum score of 15.

Patients who had secondary osteoarthritis of the first MTP joint, were excluded. Informed consent was obtained from all the patients prior to surgery. At follow-up, in addition to using the hallux metatarsophalangeal scoring scale, record was made of complications related to surgery. Patients were also encouraged to state subjectively, their level of satisfaction with the treatment they received. The Student's paired *t*-test was used to assess the statistical significance of the results obtained.

3. Operative technique

A dorsomedial skin incision is made over the first metatarsophalangeal joint. The capsule of the joint is divided longitudinally. Four millimetre resections of the first metatarsal and the proximal phalanx are made. Mobility of the first MTP joint is assessed and soft tissue released as necessary to facilitate movement at the joint (70° of dorsiflexion is acceptable). The implant is sized using the provided trial prosthesis. A 1.5-mm k-wire is drilled into the cut end of the proximal phalanx at 90° to the cut surface. A 6.5-mm cannulated drill bit is then used to make an impression for the prosthesis to fit in. The prosthesis is then fitted, using a polytetraflouro-ethylene (PTFE) impactor. The process is repeated in the cut end of the first metatarsal. The capsule and the wound are then closed [4]. (Fig. 1)

4. Results

The average follow-up period was 12 months (11–14 months). At 3 months follow-up, nine patients were pain free. This improved to 12 out of 13 patients at 6 months after surgery. Before surgery, all 13 patients using the hallux metatarsophalangeal scoring scale, had severe pain, scoring zero. Post-operatively this improved to a mean of 38.6, out of a maximum score of 40. This was statistically significant ($P = 0.0001$). Five of the patients had a dorsiflexion-plantarflexion range of less than 30°, before surgery. The other eight patients had a range of movement between 30 and 74°. Following surgery, 11 patients had an improvement in their range of movement, to greater than 75°. The range of movement mean score improved from 3.21 before surgery to 8.57 after surgery ($P = 0.001$). This improvement was statistically significant.

Ten of the patients subjectively described the outcome of the procedure as excellent, whilst two patients described it as satisfactory. One patient developed subluxation of the prosthesis at six weeks. At revision, the prosthesis was noted to be loose and a distraction arthrodesis was carried out. Prior to surgery, none of the eight female patients was able to wear

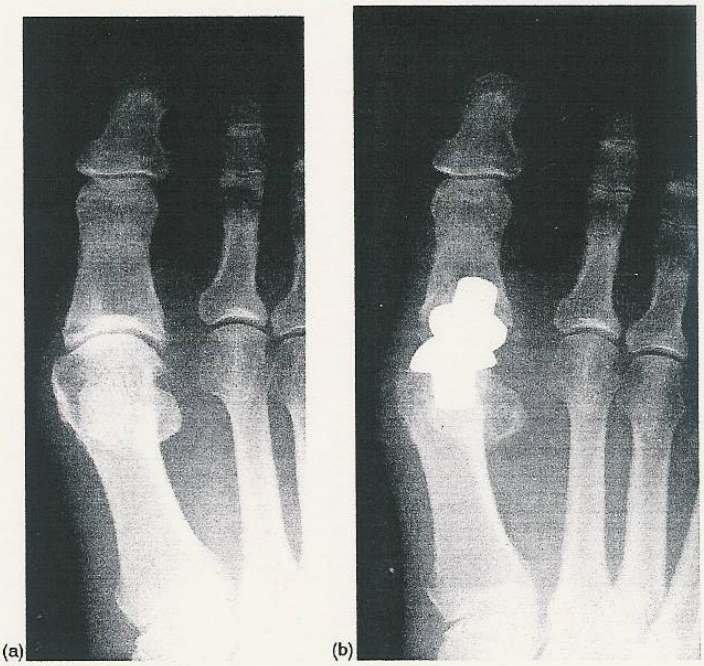

Fig. 1. (a and b) A radiograph showing a patient with hallux rigidus, before and 1 year after ceramic/ceramic first MTP joint replacement.

fashionable (high heeled) shoes. However, seven of the eight female patents were to do so after surgery.

One patient developed superficial wound infection, which was treated successfully. Twelve patients experienced audible squeaking, which improved after six months. The overall AOFAS score for the patients statistically improved from 43.07 before surgery to 95.28 after surgery ($P = 0.0001$).

5. Discussion

Surgical management of hallux rigidus includes excision of osteopyhtes, excision arthroplasty, arthrodesis and recently replacement of the first metatarsophalangeal joint. Excision arthroplasties results in shortening of the hallux. There is also the potential for recurrence of osteophytes when excised. Arthroplasty of the first metatarsophalangeal joint aims to eliminate pain and improve range of movement at the first MTP joint [10,11]. In addition it also prevents shortening of the hallux [5].

Various prosthetic materials, such as silicone and titanium have been used in arthroplasty of the first MTP joint. Although there has been some success with the use of these materials, there has also been some shortcomings relating to biocompatibility. Rahman and Fagg [5] reported cases of silicone granulomatosis and recommended silicone-based prosthesis be abandoned. There has also been a report of inguinal lymphadenopathy secondary to siflex implant [6]. Shankar [7] also reported increasing pain at the first metatarsophalangeal joint as well fragmentation of silastic-single stem implants. Recently, ceramic-based prostheses, have been introduced. Following the withdrawal of a screw fit ceramic prosthesis due to loosening of its components, a press fit version was introduced. The ceramic/ceramic press fit prosthesis is designed to simplify surgical technique and prevent metallosis resulting from loosening of the titanium screws. There is evidence that suggests ceramic materials have good biomechanical and biocompatibility properties [12]. The wear rate and particle formation is less than other materials.

The early clinical outcome, using this press fit ceramic/ceramic prosthesis, appear encouraging. Majority of the patients (77%) subjectively described the outcome of surgery as excellent. There was also a significant improvement in our objective assessment of clinical performance of the prosthesis (AOFAS score of 95.2), after surgery. Although 12 patients initially noticed squeaking of their prosthesis, they noted this disappeared 6 months following surgery. Although our experience with this prosthesis is encouraging, long-term follow-up of these implants is required to evaluate their durability in the management of hallux rigidus.

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Further reading

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