The long-term outcome of silastic implant arthroplasty of the first metatarsophalangeal joint: a retrospective analysis of one hundred and eight feet

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Abstract

Purpose The short-term results of silastic implant of the first metatarsophalangeal joint (MTPJ) have been successful. However, reservations exist regarding long-term results. The aim of this study was to evaluate long-term outcome of silastic implant prosthesis in treatment of hallux rigidus.

Methods This was a retrospective study, with 108 feet in 83 patients, operated upon between 1988 and 2003. Mean age at operation was 55 years (SD 8.1) with a follow-up period of 8.5 years. Outcome measures included the American Orthopaedic Foot and Ankle Scoring system (AOFAS), passive and active arc of motion. Patients' satisfaction was assessed using the visual analogue scale. All the patients had anteroposterior and oblique views and were assessed for loosening and osteolysis. Pedobarographic studies were performed using the Musgrave Footprint. Complications and revisions were recorded.

Results The mean total AOFAS score was 77.5 (SD 13.4). Mean active and passive arc of motions were 36.8 degrees (SD 19.13) and 46.82 degrees (SD 17.19), respectively. Patient satisfaction showed mean VAS of 7.73 (SD 2.41). Prostheses were removed in three feet at three, five and seven years respectively because of persistent pain. Radiologically 25 feet (23 %) had osteolysis but were non progressive and didn't correlate with the functional outcome.

Conclusion We can conclude that silastic implant arthroplasty is an effective procedure in hallux rigidus management with satisfactory functional outcome and high patient satisfaction.

Introduction

Silicon hemi-implants were introduced by Swanson in 1967 [1]. They were meant to create a joint spacer to replace the excised base of the proximal phalanx. Seven years later the double-stemmed hinged silastic implant was introduced [2] to replace the resected proximal phalangeal base and first metatarsal head.

The silastic double-stem implant has been demonstrated to be an acceptable procedure with successful results when used in the arthritic and geriatric population [2, 3]. Cracchiolo et al. used the double-stem implant in 133 cases with rheumatoid arthritis and all patients experienced pain relief [4].

Previous reported complications of silicone implant include detritic synovitis, silicone synovitis, fatigue, lymphatic migration, erosive osteolysis and silicone lymphadenopathy [5]. Most of these complications are associated with hemi-implants [6]. In addition there are iatrogenic factors which are attributed to the implant failure such as trimming or suturing the implant.

Currently there is great concern regarding the complications of silicone implant and its outcome. Among the previous published reports regarding the use of silastic implant, only a few report the long-term results of total silastic implants [7, 8].

The aim of this study is to present the long-term results of total silastic implant prosthesis in treatment of hallux rigidus.

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Methods

A total of 110 patients had total silastic implant arthroplasty between 1988 and 2003, and 12 patients died. After obtaining ethical approval the remaining 98 patients were called for review, of which 83 (90 %) patients attended for review.

All the patients were assessed clinically using the American Orthopaedic Foot and Ankle Scoring system (AOFAS) [9].

The AOFAS comprises three domains including pain, function and alignment. The function domain includes activity limitation, footwear requirements, MTP joint motion, IP joint motion, metatarsophalangeal (MTP) and interphalangeal joint (IP) stability, and callus related to hallux MTP-IP. Maximum score is 100 and minimum score is 0. The higher the score, the better the outcome. Passive and active range of motion (ROM) were recorded. The range of motion was measured using a small hand goniometer.

Patients were asked to reflect their satisfaction with the operation on a visual analogue scale between 0 and 10. Zero was the worst and ten was the best and also if they would repeat the procedure.

Patients were assessed radiologically (Figs. 1, 2 and 3) through standardised weight bearing anteroposterior (AP), lateral and oblique radiographs of the involved foot. The plain radiographs were assessed for osteolysis and migration of the implant.

Fig. 1 Anteroposterior (AP) weight bearing radiograph. AP and lateral weight bearing radiograph of a 62-year-old man 12 years postoperatively

Fig. 2 Lateral weight bearing radiograph. Anteroposterior (AP) and lateral weight bearing radiograph of 62-year-old man 12 years postoperatively

The distribution of plantar pressure in the involved foot was recorded with a pedobarography using Musgrave Footprint [10]. It comprises two fixed pressure plates constructed from arrays of load cells, interfaced to a computer. The main advantage is the ability to measure and analyse spatial distributions of contact pressures and their time dynamics, and to do this relatively inexpensively in a clinical setting. The peak pressure on the plantar surface was calculated particularly over the first metatarsal head, the base of the first toe, the second metatarsal head, the lateral three metatarsal heads and the heel. The aim of recording plantar pressure is to evaluate loading of the first MTPJ in the involved foot.

Revisions and complications were recorded.

Statistical analysis

Statistical analysis was performed using the statistical software SPSS version 13.0. First, data were subjected to

Fig. 3 Anteroposterior (AP) and oblique radiograph of 59-year-old woman ten years postoperatively

descriptive statistics. Inferential statistics were then performed using a t-test for quantitative variables and chi-square test for categorical ones. Statistical significance was set at 5 %.

Results

A total of 83 patients (108 feet), 75 females and eight males, were reviewed. Mean follow-up was 8.5 years (minimum 14 months, maximum 17 years). Mean age at operation was 55.1 (SD 8.3). The indication for operation was hallux rigidus.

In three of the 108 feet, the prostheses were removed. One was removed four years postoperatively because of deformity and the joint was arthrodesed. One was removed six years postoperatively because of transfer metatarsalgia. One was removed at three years postoperatively because of pain.

Functional outcome

The mean total AOFAS score was 77.5 (SD 13.4). Only in 16 (15 %) feet patients reported that they had bunion pain. In 82 (78 %) feet patients reported no bunion pain and in five feet (4.8 %) occasional pain.

Scores of all domains of the AOFAS are shown in Table 1.

Range of motion

The mean active arc of motion is 36.8 degrees (SD 19.13) and passive arc of motion 46.82 degrees (SD 17.19).

Satisfaction

Patients' satisfaction was subjectively evaluated using visual analogue scale (VAS). The mean VAS was 7.73 (SD 2.41). When patients were asked if they would repeat the procedure, 83 (80 %) responded "definitely yes", 15 (15 %) reported "yes", seven responded "no", and 22 patients "definitely no".

Plantar pressure

The distribution of plantar pressure in the involved foot was evaluated in 77 feet (71.2 %). In 28 we could not measure the distribution of plantar pressure because patients declined to attend a specific clinic for plantar pressure measurement. In 36 feet the maximum pressure recorded was under the lesser metatarsals (46.7 %). In 41 feet there was more loading of the first MTPJ (53.3 %).

Table 1 AOFAS score

Domain description	AOFAS mean (SD)	Possible maximum score
Pain	33.90 (7.78)	40
Function		
Activity limitation	8.52 (2.38)	10
Footwear requirements	6.95 (2.96)	10
MTP joint motion (dorsiflexion plus plantar flexion)	3.95 (2.26)	10
IP motion (plantar flexion)	4.86 (0.83)	5
MTP-IP stability (all directions)	5 ^a	5
Callus	4.52 (1.47)	5
Alignment	9.77 (4.57)	15
Total	77.5 (13.43)	100

AOFAS American Orthopaedic Foot and Ankle Scoring, *SD* standard deviation, *MTP* metatarsophalangeal, *IP* interphalangeal joint

^a All patients scored 5

Radiological evaluation

In 25 feet (23 %) there was osteolysis which was non progressive. There were no cases of implant migration.

Complications

One patient had rupture of the extensor hallucis longus. Another patient had rupture of the flexor hallucis longus. In 12 (11 %) feet patients reported that they had transfer metatarsalgia.

Discussion

Silastic interposition arthroplasties were originally introduced to improve the stability of the Keller arthroplasty [1]. Both single-stemmed and double-stemmed implants have been used [1, 2]. It is an accepted option for management of hallux rigidus as it provides a long-term pain relief as well as satisfactory range of motion [3, 4].

Our study showed that the silastic implant prosthesis proved to offer a very satisfactory clinical outcome in terms of pain reduction, ease of shoe fitting, wide range of activity level and excellent rate of patient satisfaction at a mean follow up of 8.5 years. This is in keeping with previous studies. In a retrospective study [11] of 27 patients who had silastic implant prostheses, 51.9 % were rated as "completely satisfied", 33.3 % as "good" and 14.8 % as "fair". Similarly, Lemon et al. [12], in a retrospective, subjective analysis of 55 patients, found an overall success of surgery reported to be 91 %, whereby 82 % would have the procedure performed again and 85 % would recommend the

procedure to a family member or friend. Equally, many authors reported high patient satisfaction rate following silastic implant prostheses [2–4, 13–17].

In our study the mean score for pain postoperatively was 33.9 (SD 7.78) out of 40. Similarly, Bonet et al., in their retrospective analysis of 27 patients, found that 78 % of the patients exhibited relief postoperatively. Ris et al. [18] reported on 53 patients who had 68 hinged metatarsophalangeal implants of the Swanson design; after an average follow-up of 48 months, 68 % of the patients had no pain and an additional 26 % had occasional pain. In review of 63 patients [15] who had a flexible hinged prosthesis at an average of three-years follow-up, 66 % reported marked improvement of pain.

Most of our patients reported that they were able to wear cosmetically acceptable shoes. The average score of foot wear section in the AOFAS was 6.95 (SD 2.96) out of 10. This is in parallel with the findings of Granberry et al. [15]. Also, Pontell et al. [17] showed 100 % unlimited shoe tolerance.

Silastic implant arthroplasty has proved to offer a fairly wide range of activity levels. In 70 (66.7 %) feet patients reported that they had no activity limitation. The mean score of the activity limitation section in AOFAS score was 8.52 (SD 2.38). The mean passive arc of motion was 46.82 (SD 17.19) and active was 36.68 (SD 19.13). This is consistent with the findings of Cracchiolo et al. [4] (35 degrees), Pontell and Gudas [17] (49 degrees) and Swanson et al. [2] (52 degrees). First, MTPJ arthroplasty offers an alternative to arthrodesis in treatment of hallux rigidus with satisfactory functional outcome [19].

None of our patients (108 feet) had reactive synovitis. This is in contrary to Worsing et al. [20] who reported three patients with reactive synovitis.

The radiographic findings did not mirror our encouraging results. This is in agreement with the previous studies [11, 12, 15]. Mondul et al. [7] stated that certain radiographic changes will take place. It is important to note that these changes do not necessarily correlate with patients' subjective satisfaction [7, 21]. Satisfactory function continues after radiographic deterioration because the implant acts as a spacer via encapsulation rather than a fixed hinge [22]. The implant itself provides a capsuloligamentous system via encapsulation to provide increased stability [23]. It has been described by Cracchiolo et al. [4] as the body's response to surgical intervention with the implant serving as a template for the proper deposition and alignment of encapsulating collagen tissues.

There are two main limitations to our study. First, we had no preoperative scoring for the patients. This should not invalidate the outcome of this study in terms of pain relief and high patient satisfaction rate. Second, 28 patients declined to return for biomechanical plantar foot measurements. As a

result, the biomechanical measurements showed no significant changes.

To the best of our knowledge, this study is the most recent with a large cohort (108 feet) and a long follow-up (mean of 8.5 years, minimum 14 months and maximum 17 months). Patients have been assessed both subjectively and objectively. We conclude that silastic implant prosthesis of the MTPJ of the big toe has been used successfully. It offers adequate pain relief, a high patients' satisfaction rate, adequate range of motion, a wide variety of activity and allows patients to wear cosmetically acceptable shoes with very few complications, despite possible radiographic deterioration because this implant, as mentioned before, acts as a dynamic spacer via encapsulation [22]. Hanft et al. [24] posed the question, "are we trying to satisfy patients or reconstruct an anatomic first metatarsophalangeal joint?"

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