

KOENIG TOTAL TOE IMPLANT ARTHROPLASTY

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For two decades silastic implant arthroplasty was the procedure of choice for degenerative arthritis of the first metatarsal phalangeal joint. Preliminary anecdotal reports revealed mechanical as well as material failure, which were later confirmed by retrospective reporting. In 1989, Koenig first reported on a bi-polar implant of his design.¹ Initial results were encouraging and two component implants seemed to be the wave of the future (Figs. 1, 2).

BIOMECHANICAL REVIEW

Hallux limitus/rigidus has a multifactorial etiology. Although trauma, iatrogenic injury and metabolic abnormalities may lead to 1st metatarsal phalangeal joint dysfunction, the majority are secondary to structural deformity and long term biomechanical imbalances.

Normal first ray function in the stance/propulsive phase of the gait cycle begins with the peroneus longus plantar flexing the first ray. As the transfer of weight moves from lateral to medial across the forefoot, the first metatarsal is able to

plantarflex while weight is still on the adjacent rays. This downward movement is inhibited by either a first metatarsal which is longer than the second or, in the presence of a pronated rearfoot in which the center of gravity travels the medial column from proximal to distal resisting metatarsal plantarflexion.

Once the first ray is plantarflexed, the sesamoids slide distally and the hallux dorsiflexes on the metatarsal head. As weight is applied fully to the first metatarsophalangeal joint, the retrograde force of the hallux, intrinsic musculature and long flexor maintain the plantarflexed attitude of the metatarsal. Any weakening of the intrinsic musculature or immobilization of the sesamoids will indirectly result in first metatarsal dorsiflexion.

IMPLANT OVERVIEW

Implant arthroplasty procedures were initially designed as joint spacers to prevent digital retraction following osseous resection. Newer two-component systems attempt to restore joint function and maintain weight bearing to the first ray.

Unfortunately, replacing arthritic joints with implants of low bio-reactivity and normal anatomic contours only partially address the pathology of the joint and totally ignores the pathomechanics of the ray. Other potential problems of two component implants are a potential lack of inherent transverse



Figure 1. Excellent postoperative alignment of Koenig implant.



Figure 2. Lateral view of Koenig implant.

plane stability, foreign body reaction (metallosis), and bone-implant interface reactions. These factors combined with the complications inherent in any joint-destructive procedure, (lack of toe purchase, loss of intrinsic strength, sesamoiditis, weight transference) emphasize the importance of careful evaluation of the available options before proceeding with implant arthroplasty of any design.

Koenig's initial report on 35 patients in 1989, was encouraging, but the podiatric literature is replete with successful initial reports of new procedures and materials. Long-term follow-up should be performed by independent practitioners with no personal or financial stake in the findings before recommendations can be given regarding the safety and efficacy of these procedures.

METHODS AND RESULTS

The Koenig Total Toe System is a two-component implant. The metatarsal component is made of a titanium alloy which is intramedullary and stemmed. It features a plantar condyle. The phalangeal component is made of ultra-high molecular weight polyethylene, which is also stemmed and intramedullary. Both components are press-fit.

The author was able to review the charts and patients of Richard Koenig, DPM who performed all the surgeries. Forty-nine patients involving fifty-eight feet were reviewed (21 left feet, 37 right feet). Seventeen patients were examined by the author. The average follow-up was 23.2 months, with a range of 2 to 72 months. The patient age ranged from 23 to 79 years, with an average of 57 years.

Thirty-two patient charts were reviewed by the author. Chart notes were vague, difficult to interpret and contained few if any specific findings. For example, charts did not contain specific findings on joint range of motion. Ten patients were noted as having excellent radiographic and subjective results. Four patients required revisional surgery due to pain and/or joint malposition.

Follow-up examinations were performed on seventeen patients. Five were judged as doing very well. Seven patients required revisional surgeries, some multiple times. One patient had a symptomatic stress fracture, and two patients had lesser metatarsal pain. Recorded measurements demonstrated that 10 patients had a range of motion less than 30 degrees, and three patients had a range of motion greater than 60 degrees (Figs. 3A-3D).

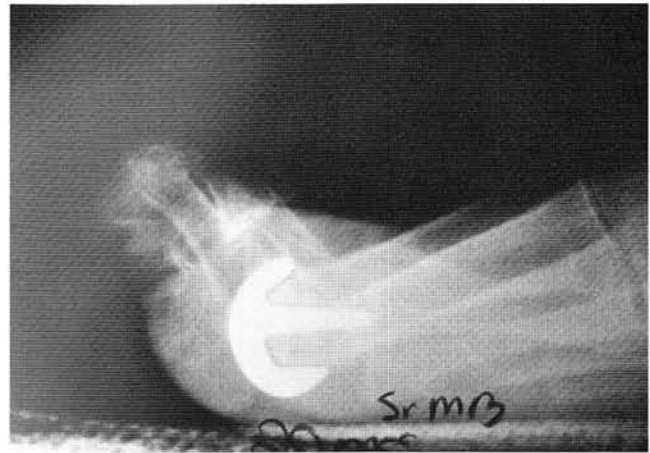


Figure 3A. Intrinsic loss leading to sagittal plane instability.



Figure 3B. Transverse plane subluxation was frequently encountered.

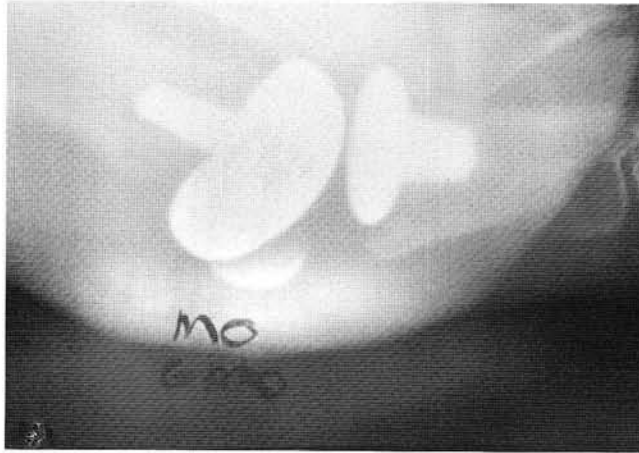


Figure 3C. Articulation of the sesamoids with the implant lead to sesamoid complications.



Figure 3D. Although the implant did seem to have some capacity to bear weight, transfer lesions occurred. This patient required further metatarsal surgery.

CONCLUSION

The Koenig total toe system does not seem to be an improvement over traditional Keller procedures or joint arthrodesis. Both sagittal and transverse stability was significant. A lack of toe purchase and intrinsic failure was common. Sesamoiditis was prevalent as well.

There were, however, a number of patients who did extremely well. They demonstrated normal pain-free range of motion, good toe strength, and full weight bearing over the metatarsal joint. Until further independent research defines the parameters for successful outcomes, the implant should be used with caution.

These problems are ubiquitous to other two component implant designs. Resection of the phalangeal base detaches the intrinsic musculature resulting in lack of purchase, instability and loss of retrograde pressure. Suturing the long flexor restores some sagittal plane stability, but little else. Minimal bone resection may help maintain weight bearing but will not restore joint mobility. The sagittal plane alterations are not addressed by these procedures.

Finally, revisional surgery is difficult after implant arthroplasty. Until further evidence is published, strong consideration should be given initially to joint preserving procedures followed by the Keller arthroplasty as a procedure of last choice.

REFERENCE

1. Koenig RD: Koenig total great toe implant. A preliminary report. *J Am Podiatr Med Assoc* 80:462-468, 1990.