Salvage of the Failed Keller Resection Arthroplasty

Felix Machacek, Jr., Mark E. Easley, Florian Gruber, Peter Ritschl and Hans-Jörg Trnka

This information is current as of March 7, 2005

Reprints and Permissions
Click here to order reprints or request permission to use material from this article, or locate the article citation on jbjs.org and click on the [Reprints and Permissions] link.

Publisher Information
The Journal of Bone and Joint Surgery
20 Pickering Street, Needham, MA 02492-3157
www.jbjs.org
Salvage of the Failed Keller Resection Arthroplasty

Surgical Technique

By Felix Machacek Jr., MD, Mark E. Easley, MD, Florian Gruber, MD, Peter Ritschl, MD, and Hans-Jörg Trnka, MD

Investigation performed at the Orthopaedic Hospital Gersthof, Vienna, Austria

The original scientific article in which the surgical technique was presented was published in JBJS Vol. 86-A, pp. 1131-1138, June 2004

INTRODUCTION

Arthrodesis of the first metatarsophalangeal joint is a reliable technique for salvaging a failed Keller procedure\(^1\). It addresses deformity as well as the problem of instability, which is the underlying cause of most complications occurring after resection arthroplasty.

Preparation and fixation techniques evolved at our institution during the study period. The following is a description of the technique that we currently recommend (Figs. 1-A and 1-B).

SURGICAL TECHNIQUE

Preparation

The procedure is performed with use of regional anesthesia (an ankle block with 1% lidocaine and 0.5% bupivacaine). The use of a fluoroscope to monitor alignment and fixation is recommended. The operation should be done without a tourniquet so that bone vitality can be assessed during preparation.

Skin Incision and Approach

A standard dorsal approach is recommended regardless of existing scars. The skin incision starts approximately 4 cm proximal to the metatarsophalangeal joint and extends to the interphalangeal joint.

The tendon of the extensor hallucis longus is usually dissected out and is cut in a z-shaped fashion to facilitate exposure of the metatarsophalangeal joint. In cases of a cock-up great-toe deformity, it will be necessary to lengthen this tendon anyway.

The joint capsule and the soft-tissue coverage...
of the metatarsal and phalanx are incised longitudinally straight down to the bone and then are opened as an envelope. A subperiosteal preparation is mandatory to ensure sufficient release of the lateral soft tissues and adhesions. Only the plantar aspect is left intact, to preserve the blood supply to both bones. After inspection of the articular surfaces, osteophytes and debris

ABSTRACT | continued

RESULTS:
In group A, the average duration of follow-up was thirty-six months and fusion was achieved in twenty-six of the twenty-nine feet. Satisfaction was excellent or good in twenty-three cases, and the postoperative score according to the modified hallux metatarsal-interphalangeal scale averaged 76 points (maximum, 90 points). A repeat arthrodesis was necessary in five feet because of malposition or pseudarthrosis. In group B, the average duration of follow-up was seventy-four months. Satisfaction was excellent or good in only six

continued
Preparation of the metatarsal and the phalangeal joint surfaces with a special power-driven reamer (Hallu-Reamer; Newdeal, Plano, Texas).
are removed with a rongeur. Special attention should be paid to the plantar aspect of the joint to avoid laceration of the flexor hallucis longus tendon.

**Preparation of the Joint Surfaces**

In the next step, any remaining cartilage and sclerotic bone is removed to create bleeding cancellous bone surfaces. Compared with flat cuts or a conical preparation, a ball-and-socket preparation has the advantage of minimizing bone loss, and it creates the ability to alter the position of the toe after the preparation has been performed. This ball-and-socket preparation can be carried out with a small spherical reamer, chisels, or a rongeur. The potential disadvantage of this method, especially when it is done by hand, is the inaccuracy in attaining a spherical surface, resulting in a reduced area of bone contact. Special power-driven reamers (Hallu-

**FIG. 3-A**

The metatarsal inclination angle should be measured preoperatively on a weight-bearing lateral radiograph to adequately position the phalanx relative to the metatarsal.

**FIG. 3-B**

The metatarsal inclination angle should be measured preoperatively on a weight-bearing lateral radiograph to adequately position the phalanx relative to the metatarsal.
Reamer; Newdeal, Plano, Texas) can facilitate this step (Figs. 2-A and 2-B).

To expose the phalangeal joint surface, the toe is brought into maximum plantar flexion. A 1.6-mm Kirschner wire is placed into the center of the phalanx as a guide for the reamer set. An adequately sized convex reamer is then used to remove the sclerotic bone down to cancellous bleeding bone. The preparation of the surface of the metatarsal head follows, performed in the same manner as the concave counterpart.

**Position**
The position of the fusion is crucial. A hallux valgus angle of 15° is recommended, but the correct position has to be determined for the individual patient. Both impingement on the second toe (caused by excessive abduction) and irritation of the medial aspect of the hallux by the shoe (caused by insufficient abduction) must be avoided. Positioning in the sagittal plane can be referenced to the first metatarsal or the plantar plane of the foot (Figs. 3-A through 3-D). The correct position is achieved when the tip of the toe is able to exert pressure on the ground while the patient is standing. Insufficient dorsal extension must be avoided to prevent overloading of the toe and the interphalangeal joint during walking. As it is difficult to simulate the weight-bearing situation in the operating room.

**INDICATIONS:**

- **Revision Surgery**
  - Instability of the metatarsophalangeal joint (cock-up deformity, floppy toe)
  - Recurrent valgus deformity

- **Primary Surgery**
  - Severe arthritis of the metatarsophalangeal joint

**CONTRAINDICATIONS:**

- Infection
- Neurological disease
- Severe vascular disease

*continued*
the use of the metatarsal as an osseous reference point may be helpful. In general, a range of 15° to 20° is recommended for the dorsal angle between the metatarsal and the phalanx, but the metatarsal inclination angle of the individual patient has to be considered. The inclination of the first metatarsal can be measured on a preoperative weight-bearing lateral radiograph to help position the fusion in the sagittal plane. The rotation of the toe should always be neutral.

**CRITICAL CONCEPTS**

**PITFALLS:**

- Despite the presence of other scars, a dorsal approach should be used. This allows one to expose the metatarsophalangeal joint adequately and to avoid injury to the medial dorsal cutaneous nerve, which may be difficult to identify in the scar tissue.

- Positioning is the most important factor. A slight deviation from the correct position in any of the three planes can lead to symptoms requiring additional revision. The anatomical position of the foot during surgery differs from the situation during normal weight-bearing, especially with regard to the intermetatarsal angle and the first metatarsal inclination angle. We
Fixation

The method of fixation depends on the size and quality of the residual phalanx. Usually, two crossed 3.0-mm cancellous screws (Synthes, Paoli, Pennsylvania) are used. The guide-wires for the screws are inserted through medial skin incisions under fluoroscopic control. The first is driven from the medial aspect of the first metatarsal head, with the screw aimed at the lateral cortex of the proximal phalanx. To avoid contact between the screws, neither should be placed exactly in the center of the dorsoplantar diameter of the bone; one should be shifted slightly dorsally and the other, slightly plantarly. The second screw is inserted from the me-
Lateral (Fig. 5-B) and anteroposterior (Fig. 5-C) radiographs after bone-block interposition arthrodesis.
dial aspect of the proximal phalanx and aimed at the lateral aspect of the metatarsal (Figs. 4-A and 4-B).

Mobilization
Depending on the intraoperative stability of the fusion and the anticipated compliance by the patient, the patient either wears a stiff-soled shoe and is allowed weight-bearing to tolerance on the heel or wears a below-the-knee walking cast until there is radiographic evidence of fusion. Normal shoe wear is possible after seven to ten weeks.

Felix Machacek Jr., MD
Florian Gruber, MD
Peter Ritschl, MD
Hans-Jörg Trnka, MD
Orthopaedic Hospital Gersthof, Wielemanngasse 28, 1180 Vienna, Austria. E-mail address for F. Machacek Jr.: f.machacek@chello.at

Mark E. Easley, MD
Division of Orthopaedic Surgery, Duke University Medical Center, Durham, NC 27710

The authors did not receive grants or outside funding in support of their research or preparation of this manuscript. They did not receive payments or other benefits or a commitment or agreement to provide such benefits from a commercial entity. No commercial entity paid or directed, or agreed to pay or direct, any benefits to any research fund, foundation, educational institution, or other charitable or nonprofit organization with which the authors are affiliated or associated.

The line drawings in this article are the work of Joanne Haderer Müller of Haderer & Müller (biomedart@haderermuller.com).

doi:10.2106/JBJS.D.02703

REFERENCES