

# Open wedge metatarsal osteotomy versus crescentic osteotomy to correct severe hallux valgus deformity – A prospective comparative study



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## ABSTRACT

**Background:** Different techniques of proximal osteotomies have been introduced to correct severe hallux valgus. The open wedge osteotomy is a newly introduced method for proximal osteotomy. The aim of this prospective randomized study was to compare the radiological and clinical results after operation for severe hallux valgus, comparing the open wedge osteotomy to the crescentic osteotomy which is our traditional treatment.

**Methods:** Forty-five patients with severe hallux valgus (hallux valgus angle  $>35^\circ$ , and intermetatarsal angle  $>15^\circ$ ) were included in this study. The treatment was proximal open wedge osteotomy and fixation with plate (Hemax), group 1, or operation with proximal crescentic osteotomy and fixation with a 3 mm cannulated screw, group 2. The mean age was 52 years (19–71). Forty-one females and four males were included. Clinical and radiological follow-ups were performed 4 and 12 months after the operation.

**Results:** In group 1 the hallux valgus angle decreased from  $39.0^\circ$  to  $24.1^\circ$  after 4 months and  $27.9^\circ$  after 12 months. In group 2 the angle decreased from  $38.3^\circ$  to  $21.4^\circ$  after 4 months and  $27.0^\circ$  after 12 months. The intermetatarsal angle in group 1 was  $19.0^\circ$  preoperatively,  $11.6^\circ$  after 4 months and  $12.6^\circ$  after 12 months. In group 2 the mean intermetatarsal angle was  $18.9^\circ$  preoperatively,  $12.0^\circ$  after 4 months and  $12.6^\circ$  after 12 months. The AOFAS score improved from 59.3 to 81.5 in group 1 and from 61.8 to 84.8 in group 2 respectively measured 12 months postoperatively. The relative length of the 1 metatarsal compared to 2 metatarsal bone was 0.88 and 0.87 preoperatively and 0.88 and 0.86 for group 1 and 2 respectively measured after 12 months.

**Conclusion:** Crescentic osteotomy and open wedge osteotomy improve AOFAS score and VAS scores on patients operated with severe hallux valgus. No significant difference was found in the two groups looking at the postoperative improvement of HVA and IMA measured 4 and 12 months postoperatively. The postoperative VAS score and AOFAS score were comparable for the two groups with no significant difference. An expected tendency to gain better length of the first metatarsal using the open wedge osteotomy compared to the crescentic osteotomy was not found. Even though the IMA and HVA reduction was only suboptimal the improvement in AOFAS score was comparable to other similar clinical trials.

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## 1. Introduction

Hallux valgus surgery is a very common forefoot operation, and several techniques have been introduced to correct the deformity

[1–11]. Hallux valgus often leads to pain, deformity of the big toe and secondary complications such as abnormal gait and ulcers on the foot. Numerous techniques have been introduced and published regarding correcting hallux valgus. The operation techniques can be divided into distal metatarsal osteotomy (DMO), mid-shaft osteotomies or proximal metatarsal osteotomy (PMO) [1,12–16]. The Akin procedure is used to correct the pronation deviation of the proximal phalanx and to correct hallux valgus interphalangealis, when this is still persisting after

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correcting the hallux valgus (HVA) and inter-metatarsal (IMA) angle [17]. Only very few prospective randomized investigations comparing different operation methods for hallux valgus have been published [8,12,13]. In our department the distal chevron procedure is used for patients with a HVA less than 35 degrees and an IMA less than 15 degrees [8]. For patients with HVA larger than 35 degrees or IMA larger than 15 degrees, we use the PMO to correct the hallux valgus deformity [1], the PMO is in general considered technically more demanding and is more likely to give complications. The DMO is considered mainly to be advisable in operations correcting hallux valgus with a limited HVA and IMA. The aim of the operation for hallux valgus is to diminish pain and to correct the IMA and HVA with a very low incidence of complications.

The hypothesis of this study was that the open wedge osteotomy procedure was equivalent or superior to the crescentic osteotomy, measured by the parameters: postoperative HVA, IMA, AOFAS score, VAS score and relative length of 1 compared to 2 metatarsal, measured preoperative, 4 and 12 months postoperatively.

## 2. Materials and methods

During the period 1st January 2009 to 1st January 2011, 45 consecutive patients were included in the prospective study, which was approved by the Danish Ethical Committee. The inclusion criteria were aged 15–70 years, hallux valgus angle >35 degrees and inter-metatarsal angle >15 degrees, the measurement was evaluated on anterior–posterior (AP) weight bearing radiographs. Patients with rheumatoid arthritis, osteoarthritis of the MTP joint, spasticity of any kind, vascular diseases or pregnancy (elective surgery was not performed on pregnant women) were excluded from the study. All patients had a body mass index of less than 30. None of the patients were diagnosed with osteoporosis, and no patients had a history of any forefoot surgery prior to joining the study. All patients were operated using a popliteal block or general anaesthesia as an outpatient procedure according to the protocol. After informed consent, the patients were randomized to one of two groups by drawing of lots. The allocation was done double blinded.

The mean age was 52 years (19–70). The cohort consisted of 41 women and 4 men. Twenty-three patients were randomized to group 1 (crescentic osteotomy) and 22 patients were randomized to group 2 (open wedge osteotomy). Demographic data suggested no difference between the two groups (mean age and sex ratio).

## 3. Surgical technique

Both the open wedge osteotomy and the crescentic osteotomy consist of a distal lateral release and bunionectomy prior to the proximal osteotomy. Firstly, a dorsal incision was made in the inter-metatarsal space between 1st and 2nd ray. Release of the adductor hallucis tendon, the deep transverse inter-metatarsal ligament and lateral capsule were executed.

The second incision was made midline medial over the medial eminence to remove the medial eminence and perform a capsulorrhaphy. The third incision was made dorsally over the proximal end of the first metatarsal and extended a few millimetres over the medial cuneiforme. The proximal osteotomy for each group was made through this incision.

### 3.1. Group 1

A proximal crescentic osteotomy about 15 mm distal to the TMT-joint, with the concavity pointing proximal was made.

The osteotomy was done in a plane perpendicular to the first metatarsal bone. A 3 mm cannulated AO titanium screw was used for stabilization, directed from proximal–medial–dorsal to distal–lateral. Capsule tightening was performed (Fig. 1). Before skin closure the tourniquet was removed and haemostasis was secured. The HVA and IMA corrections were verified by fluoroscopy intra-operatively.

### 3.2. Group 2

A transverse proximal osteotomy of the metatarsal bone 1.5 cm distal to the TMT joint performed made with a small saw blade, leaving the lateral cortex and periosteum intact. The distal part of the first metatarsal was pushed laterally towards the second metatarsal, until the desired correction had been achieved resulting in an opening of the medial cortex (3–5 mm). The L shaped non-locking Hemax plate was used for fixing the osteotomy. It was inserted on the medial side of the metatarsal to assure best possible mechanical stability of the osteotomy and least possible hardware irritation. The Hemax plate was placed with the “L” in a proximal position, pointing dorsally. Four non-locking screws, 2.3 mm self-tapping, were inserted bicortically in the drill holes, two screws proximally and 2 distally. Cancellous bone from the medial eminence was packed into the osteotomy site (Fig. 2). The correction was verified by fluoroscopy intra-operatively. (Fig. 3)

If there was a tendency to collision between the first and second toe after the osteotomy procedure, the operations in both groups were complemented with Akin procedure at the proximal phalanx.

#### 3.2.1. Postoperative treatment

Both groups followed the same postoperative procedure, which was 1 week with partial weight bearing and 5 weeks in static walker, gradually allowing full weight bearing. Sutures were removed 14 days postoperatively and a toe alignment splint was used permanently for 6 weeks after removal of the stitches. All patients returned to postoperative evaluation after 6 weeks, 4 months and 12 months, respectively. MTP joint mobility exercises were initiated 3 to 4 weeks after surgery. No physiotherapy rehabilitation programme was initiated for any of the groups.

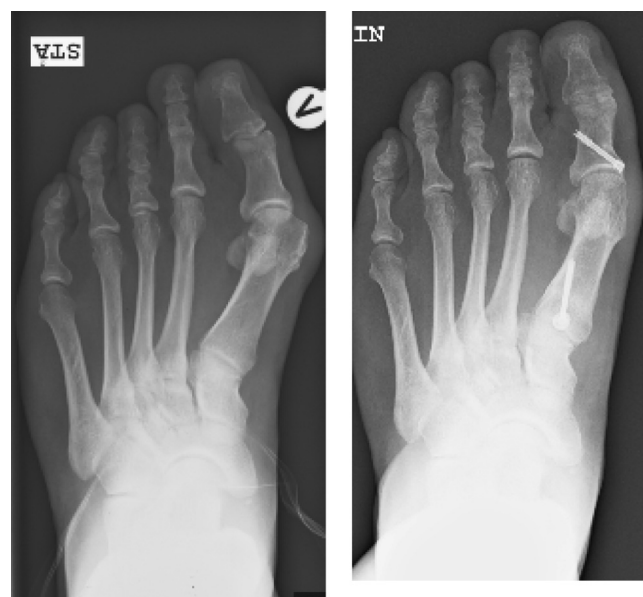


Fig. 1. Pre- and postoperative weight bearing X-rays after crescentic osteotomy.

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