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## Clinical and radiological results after Austin bunionectomy for treatment of hallux valgus

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**Abstract** The results of the Austin osteotomies for hallux valgus deformity performed at the Orthopedic Hospital Gersthof were reviewed at least 1 year after surgery. Of the 53 consecutive patients (66 operations) with an average follow-up of 24.3 months, 49 patients (62 feet) were interviewed. Of the reviewed patients 86.6% achieved good or excellent clinical results. The complication rate was 8%, including hallux varus *n* (3), superficial *n* (1) and deep *n* (1) wound infections, hypoaesthesia *n* (2), and reflex sympathetic dystrophy *n* (1). There was one case of avascular necrosis of the first metatarsal head and none of non-union. The Austin osteotomy is a safe and effective treatment of mild and moderate hallux valgus deformity.

### Introduction

Hallux valgus is a progressive subluxation of the first metatarsophalangeal joint, manifested by lateral deviation of the great toe and medial deviation of the first metatarsal. As the deformity progresses, pronation of the great toe often occurs. Hallux valgus takes place almost exclusively in shoe-wearing populations. Many procedures for optimum repair of hallux valgus deformity have been described. The aim of hallux valgus repair is correction of the hallux valgus and intermetatarsal angle and repositioning of the sesamoids. The operations may be subdivided into exostectomy with a soft-tissue procedure, such as the McBride and Schede procedures, or those involving osseous corrections. Procedures involving osteotomies may be further subdivided into basal, midshaft osteotomies (Du Vries, Mann) or subcapital osteotomies, such as the Kramer, Wilson, Mitchell and Austin procedures, and arthrodesis of the metatarsocuneiforme joint.

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An optimal procedure would address the pathological mechanism of hallux valgus, correcting the intermetatarsal angle, hallux valgus angle, metatarsophalangeal joint subluxation, hallux pronation and sesamoid subluxation and would re-establish normal MTP joint function. Particularly in patients under the age of 50 years, preservation of the metatarsophalangeal joint function is preferable.

The Austin procedure is transpositional V-osteotomy of the head of the first metatarsal. It is indicated for mild and moderate hallux valgus deformity and meets all of these requirements [10].

Dr. Dale Austin, who first performed this procedure in 1962, did not publish his initial findings until 1981 [1]. The procedure was, however, documented earlier in the literature and attributed to Austin in 1979 by Miller and Croce [14].

The aim of this retrospective study is to evaluate our short-term results with this procedure and to affirm whether or not it can also be used in patients older than 50 years of age.

### Patients and methods

Between April 1991 and September 1992 at the Orthopaedic Hospital Gersthof in Vienna, the Austin osteotomy was performed 66 times in 53 consecutive patients with mild to moderate hallux valgus deformity. The average age of the patients at the time of surgery was 48.35 years (range 17–82 years). There were 49 female and 4 male participants in this study. Thirty-eight of them were younger than 50 years old, and 28 were older. Thirteen of the 53 cases with bilateral, for a total of 66 feet.

According to the recommendations of the American Orthopaedic Foot and Ankle Society [17], clinical and radiological assessment was done with the use of a new questionnaire, based on the Fore Foot Scoring System of the Mayo Clinic published by H. B. Kitaoka et al. [9], which was designed by the senior author (T. H.-J.) (Fig. 1).

### Radiological assessment

Preoperatively, and at the time of the final follow-up, dorsoplantar weight-bearing and non-weight-bearing and lateral radiographs

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**FORE FOOT - QUESTIONNAIRE**  
 .. MONTHS FOLLOW UP

PATIENT: \_\_\_\_\_ AGE: \_\_\_\_\_  
 DATE OF SURGERY: \_\_\_\_\_

TYPE OF PROCEDURE:

ADDITIONAL PROCEDURES:

POSTOPERATIVE REGIMEN (type and duration):

COMPLICATIONS:

PATIENT'S CONTENTMENT:

Excellent - good - fair - poor

**CLINICAL ASSESSMENT**

<b>1. PAIN LOCATION</b>		<b>2. PAIN:</b>	
Exostosis:	J/N	None	30
1 st MTP Joint	J/N	Mild: occasional but minimal	20
Metatarsal heads	J/N	Moderate: significant, daily	10
		Severe: almost always present	0
<b>3. FUNCTIONAL RESTRICTION:</b>		<b>4. FOOTWEAR RESTRICTION:</b>	
None	15	None, mild: some stylish shoes	10
Mild: some limitations	10	Moderate: no stylish shoes	5
Moderate: no sport activities	5	Severe: modified shoes	0
Severe: major limitation	0		
<b>5. TENDER, PAINFUL CALLUS:</b>		<b>6. ALIGNMENT, OBJECTIONABLE:</b>	
None	10	None or noticeable but acceptable	5
Present	0	Objectionable alignment	0
<b>7. STIFFNESS:</b>			
None	5		
Present	0		

SPREADFOOT: J / N

HAMMER- CLAWTOE: \_\_\_\_\_

HALLUX VALGUS ANGLE (clinical):

LOCALISATION OF CLAVUS FORMATION:

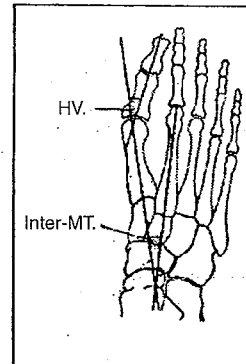
ROM MTP-JOINT :

EXTENSION/FLEXION: \_\_\_\_\_ ACTIVE(norm.:75/0/45)  
 EXTENSION/FLEXION: \_\_\_\_\_ PASSIVE(norm.:75/0/45)

COSMETICS: excellent good fair poor

COMMENTS:

**RADIOLOGICAL ASSESSMENT**



	NON STANDING	STANDING
1. HALLUX VALGUS ANGLE		
2. INTERMETATARSAL ANGLE		
3. JOINT: CONGRUENT/INCONGRUENT		
4. SESAMOID POSITION (0-3)		
5. D.M.A.A.		
6. METATARSAL INDEX (P / I / N)		

1 st METATARSOPHALANGEAL-JOINT:

METATARSO-CUNEIFORME-JOINT:

SIZE OF PSEUDOEXOSTOSIS:

ARTHROSIS 1 st. MTP-JOINT

RESECTION:

OSTEOTOMIE:

POSTOPERATIVE RADIOLOGICAL RESULT:

excellent good fair poor

RADIOLOGICAL PARTICULARITIES:

GENERAL COMMENTS:

**Fig. 1** Forefoot follow-up questionnaire, clinical and radiological parts

were obtained. The hallux-valgus angle (HV, the first intermetatarsal angle (IM), the congruency of the first metatarsophalangeal joint and the metatarsal index were evaluated as described [16]. The sesamoid position (SP) was evaluated by measuring the position of the medial sesamoid relative to a longitudinal line bisecting the first metatarsal shaft and was classified as: grade 0, no displacement of sesamoid relative to the reference line; grade 1, overlap of less than 50% of sesamoid relative to the reference line; grade 2, overlap of greater than 50% of sesamoid relative to the reference line; and grade 3, sesamoid completely displaced beyond the reference line. Furthermore, radiographs were graded according to Mann (grade I: HV ≤ 15, IM ≤ 10; grade II: HV ≤ 30, IM ≤ 15; grade III: HV ≤ 40, IM ≤ 20; and grade IV: HV > 40, IM > 20). Grades I and II were summarized as moderate and grades II and IV as severe deformity [12].

**Clinical assessment**

At the time of the final follow-up, patients were interviewed by a standardized score based on the Fore Foot Scoring System (FFSS) [9]. This score of 75 points includes clinical parameters like pain (30 points), functional restriction (15 points), footwear restriction (10 points), tender and painful callus (10 points), alignment (5 points) and stiffness of the metatarsophalangeal joint (5 points).

The result was rated excellent if it was between 70 and 75 points, good between 60 and 65 points, fair between 50 and 55 and poor with less than 50 points (Fig. 1).

Additionally, patients were asked to rate their feet for overall satisfaction and cosmesis. Furthermore, the range of motion of the metatarsophalangeal joint was measured, and patients were asked if they used any shoe-inlay or arch support. The range of plantar flexion and dorsiflexion was graded from 1 to 4. Plantar flexion of more than 30 deg was graded as excellent, from 20 to 30 as good, from 10 to 20 as fair and less than 10 as poor. Dorsiflexion of more than 60 deg was graded excellent, from 45 to 60 as good, from 30 to 45 as fair and less than 30 as poor. Patients over 50 years of age as a group were compared to those under 50.

**Surgical technique**

The Austin osteotomy surgical technique was performed as described by Miller and Croce [14] and Austin [1]. All procedures were performed under peripheral nerve blockade and Esmarch tourniquet.

A dorsomedial incision was made over the first metatarsophalangeal joint from midshaft of the proximal phalanx to approximately midshaft of the metatarsal. Later (from February 1992) a midside skin incision was utilized.

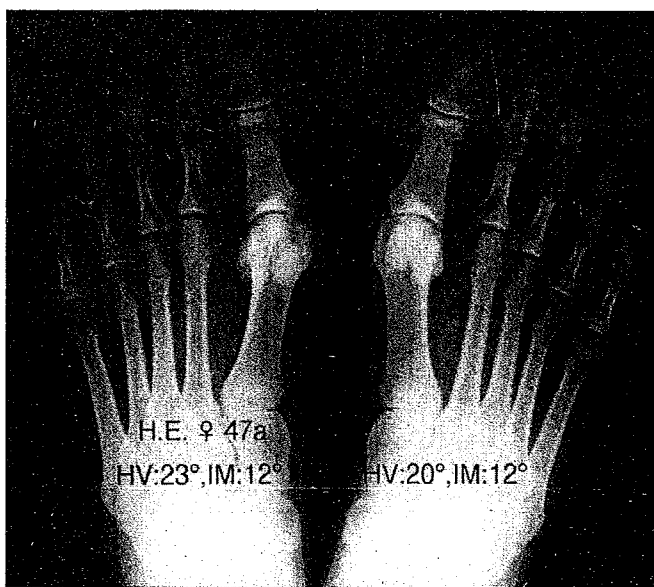
An inverted L or lenticular medial capsulotomy was utilized to expose the medial eminence. The medial eminence was then excised with the use of an osteotome or power saw. The excision of

the medial eminence begins 1 mm medial to the sagittal sulcus and is carried out in line with the medial aspect of the metatarsal shaft. The conjoint tendon of the adductor hallucis can be released either directly down to the lateral side of the joint only, passing the blade horizontally through the joint space, or by going over the shaft of the metatarsal.

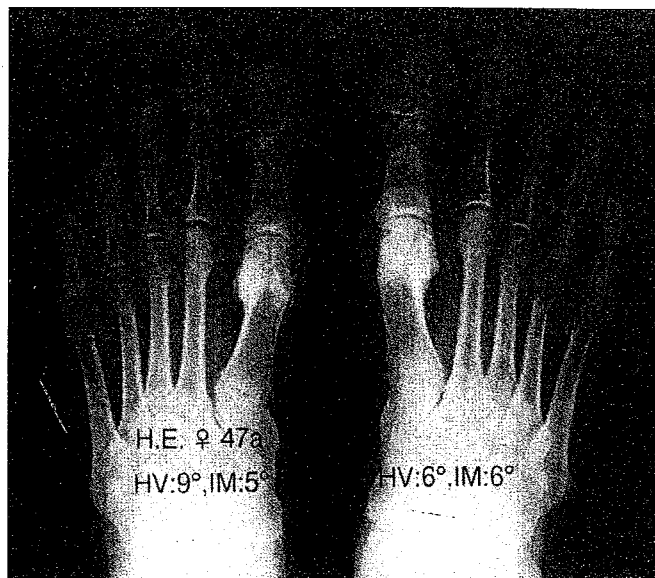
At this point the V-osteotomy is planned and performed, care being taken to ensure that each cut is made precisely to give stability, which is the essence of the procedure. A K-wire is drilled exactly medial to lateral through the first metatarsal head, aiming at the head of the fifth metatarsal. Two cuts are then made with an oscillating power saw, such that they form an angle of 60 deg proximal to the drill hole. Once the capital fragment is freely mobile, it is transposed laterally 3–5 mm. When the joint surfaces are in correct alignment and the metatarsal head is in place, the capital fragment is firmly impacted onto the metatarsal shaft. Unless instability of the head of the metatarsal is evident, no internal fixation is required. The remaining medial 'step defect' is removed. A pressure dressing was used to secure the hallux and control post-operative bleeding and edema. The first dressing change took place on the second postoperative day. For the first 5 days patients remained in a wheelchair and did not bear weight. After 5 days, dorsoplantar and lateral X-rays were done. If any evidence of instability was noted, patients were placed in a short-leg walking cast; otherwise, a bunion shoe with a wooden sole was fitted. The great toe was kept in the proper position with cloth tape, and the dressing was changed once a week for 6 weeks. Three months after the operation, patients were fitted with a custom-made arch support.

## Results

With an average follow-up of 24.3 months, 49 patients with 62 feet were evaluated (Figs. 2, 3). Four patients were lost to follow-up. As expected, moderate to severe pain prompted most patients to undergo surgery initially. Cosmetic concerns and difficulty with footwear were also



**Fig. 2** HE, 47-year-old woman. Preoperative roentgenogram showing angle of 23° left and 20° right between the phalanx and the metatarsal bone of the great toe and an angle of 12° left and 12° right between the first and second metatarsal



**Fig. 3** HE, 14 months postoperation. After osteotomy, hallux valgus angle reduced to 9° left and 6° right and intermetatarsal angle reduced to 5° left and 6° right

major factors in the decision for surgery. No patient underwent surgery for cosmesis alone.

Patients subjectively rated the outcome of the operation in 57.4% as excellent, in 22.9% good, in 8.2% fair and in 11.5% poor. The average FFSS was 64.87 points. According to this score 86.6% of the feet could be rated as excellent or good, 6.7% fair and 6.7% poor (Table 1). In 71.0% the cosmetic results were rated excellent, in 17.7% good, in 6.5% fair and in 4.8% poor.

At the time of follow-up, the average dorsiflexion was 18.0°, the average plantar flexion was 42.2°. Plantar flexion was graded excellent in 15.5%, good in 24.5%, fair in 30% and poor in 30%. Dorsal flexion was graded excellent in 17.5%, good in 33%, fair 32.5% and poor in 17%.

**Table 1** Clinical results of all patients (grade in %)

Grade	Clinical results				
	FFSS	PS	C	Plantar	Dorsal
1	76.6	57.4	71.0	15.5	18.5
2	10.0	22.9	17.7	24.5	33.0
3	6.7	8.2	6.5	30.0	32.5
4	6.7	11.5	4.8	30.0	17.0

**Table 2** Radiological results of all patients (mean ± STD) Joint congruency in %

	Radiological results			
	HV	IM	SP	JC <sup>a</sup>
Pre OP	30.0 ± 8.1	13.7 ± 3.9	1.8 ± 0.8	50.0
Post OP	17.8 ± 9.1	8.1 ± 3.4	0.8 ± 0.9	80.0

**Table 3** Clinical results of patients younger and older than 50 years of age (FFSS Fore Foot Scoring System, PS patient satisfaction, C cosmesis; rates in %)

	Clinical									
	FFSS		PS		C		Plantar flexion		Dorsalex.	
Age	< 50	> 50	< 50	> 50	< 50	> 50	< 50	> 50	< 50	> 50
1 (excellent)	66	79	50	67	68	75	25	0	12	19
2 (good)	10	15	21	15	24	11	27	22	43	26
3 (fair)	15	3	9	7	0	7	27	33	36	29
4 (poor)	9	3	20	11	8	7	21	45	9	26

**Table 4** Radiological results of patients younger and older than 50 years of age (JC joint congruency; HV hallux valgus angle, IM intermetatarsal angle, SP sesamoid position, IMI intermetatarsal index)

	Radiological									
	JC <sup>a</sup>		HV <sup>b</sup>		IM <sup>b</sup>		SP <sup>b</sup>		IMI <sup>c</sup>	
Age	< 50	> 50	< 50	> 50	< 50	> 50	< 50	> 50	< 50	> 50
Pre OP	62	30	29 ± 8.1	31 ± 8.0	14 ± 4.3	14 ± 2.4	1.4 ± 0.9	2 ± 0.8	—	—
Post OP	86	68	17 ± 9.8	20 ± 8.7	9 ± 3.4	9 ± 3.5	0.8 ± 0.8	1 ± 1.0	45	45

<sup>a</sup> Congruent joints in %<sup>b</sup> MW ± STABW<sup>c</sup> Shortening in %

The radiological results (Table 2) revealed that the average preoperative metatarsophalangeal angle was 30.0° with a range from 20° to 48°. Postoperatively, this angle measured 17.8° on average, for a correction of 12.2°. The average first intermetatarsal angle was 13.7° prior to surgery and 8.1° afterward for an average correction of 5.6°. The sesamoid position was corrected from an average grade of 1.8 prior to surgery to 0.8 postoperatively.

Preoperatively, 50% of the first metatarsophalangeal joints was congruent, this was improved to 80% with the operation. A shortening of the first metatarsal was measured in 45%. Using the deformity classification of Mann, no patients had a preoperative grade I, 59.6% were grade II, 32.7% grade III and 7.7% grade IV. Postoperatively this improved to 44.4% grade I, 50% grade II, 3.6% grade III and only 1.8% grade IV.

Because of instability of the metatarsal head, three osteotomies required fixation with a Kirschner wire, and three patients were put into a walking cast for 4 weeks instead of a postoperative shoe.

Associated procedures included single telescoping osteotomy (Helal) of the metatarsal neck of metatarsals (MT) II–IV ( $n = 4$  feet), resection of the first phalangeal head for hammertoe deformity ( $n = 18$ ), distal metatarsal osteotomy of the fifth metatarsal for bunions ( $n = 1$ ) and in one case a extensor tendon lengthening, osteotomy of the second metatarsal neck and capsulotomy of the metatarsophalangeal joint for a crossover second toe.

Comparison of the groups of patients younger and older than 50 years (Table 3) revealed no significant statistically difference regarding patient's satisfaction, cosmesis of FFSS. The range of motion of the metatarsophalangeal joint in the younger group with an average

dorsiflexion of 43.1° and an average plantar flexion of 16.1° was better than in the older group, who achieved an average dorsiflexion of 37.1° and an average plantar flexion of 10.2°.

Comparison of the radiological results of the groups of patients younger and older than 50 years revealed that the amount of correction of both groups was similar, though preoperatively the older group presented more deformity (Table 4).

The overall complication rate was 8%. There was one superficial and one deep wound infection. One patient developed RSD, which resolved with physiotherapy. There were two hypoesthesias of the great toe and three cases of hallux varus. Avascular necrosis of the first metatarsal head was seen in one case and was thought to have been caused by an intraoperative fracture of the metatarsal head. Though all patients were advised to use arch support 3 months postoperatively to prevent further splay-foot problems, only 50% of the patients was using one at the final follow-up.

## Discussion

Although we present our early experience with this technique, our average correction of the hallux valgus angle from 30.0° to 17.8°, the intermetatarsal angle from 13.7° to 8.1°, and the sesamoid position from 1.8 to 0.8 corresponds well with the results described in the literature (Table 5).

The Austin osteotomy as described by Miller and Croce [14] in 1979 and by Austin [1] himself in 1981 is an effective procedure to correct mild to moderate hallux

**Table 5** Radiological results presented in the literature

Reference	HV pre-OP	HV post-OP	IM pre-OP	IM post-OP
Meier [13]	28.5°	21.9°	12.6°	7.8°
Klosok [10]	30°	21°		
Hirvensalo [6]	31°	19°	14°	9°
Johnson [8]	30°	18°	16°	9°
Velkes [18]	32.1°	16°	13.6°	9.3°
Johnson [7]	21°	11°	11°	6.5°
Average	28.8°	17.8°	13.4°	8.3°
Ours	30.0°	17.8°	13.7°	8.1°

valgus. It is associated with numerous complications [3]. An unstable osteotomy site, intraoperative fracture of the capital fragment, hallux varus, osteotomy displacement in the postsurgical period, recurrent hallux valgus and aseptic necrosis of the metatarsal head [4, 5, 13, 15, 19, 20] have all been reported.

As described by Austin, usually no internal fixation is required for this technique [1, 4]. Other authors have presented various techniques for fixation [6–8]. With the exception of the six cases in which instability was noted, we observed no instability of the osteotomy site or osteotomy displacement on intraoperative or postoperative radiographs.

In the three cases of hallux varus, excessive bone resection was performed when removing the bunion on the medial side of the first metatarsal head. This may be prevented if the cut of the exostosis is done medial to the sagittal groove.

Avascular necrosis of the metatarsal head was reported by Meier and Kenzora [13] in 20% of cases after chevron osteotomy and in 40% (4 of 10) after chevron osteotomy with lateral release. Wilkinson et al. [19] reported avascular necrosis like magnetic resonance imaging (MRI) changes in 50% (10 of 20). Only 10% of these patients had a corresponding radiographic lesion, and 40% described joint pain. However, in the group of patients without MRI change 40% of the patients complained of joint pain. Reviewing the papers of Austin and Leventen [1], Corless [2] and Johnson et al. [8], only one case of avascular necrosis in 1465 osteotomies is described. The single case of avascular necrosis we observed in our patients was due to intraoperative fracture of the capital fragment and is therefore related to a technical failure and not the procedure itself.

Several authors suggest the Austin osteotomy for patients younger than 50 years of age [7, 11]. We evaluated our patients accordingly. Similar correction of HV, IM and SP, and shortening of MT I in 45% was found in the two patient groups. Surprisingly, patients older than 50 years attained better results in FFSS and patients satisfaction. This may be due to the lower expectation of older patients.

Limited dorsiflexion is generally observed after the Austin procedure and is presumed to be related to the soft-tissue procedure and the opening of the joint capsule and subsequent scar formation.

In conclusion, the Austin osteotomy is an effective procedure to correct mild and moderate hallux valgus deformities. If the correct technique is used, this procedure may also be used for patients older than 50 years. Subsequent limited range of motion of the metatarsophalangeal joint is partly due to the soft-tissue procedure, but early mobilization and passive range of motion exercises for the great toe may help overcome this problem. Careful surgical exposure with limited soft-tissue stripping and gentle handling of tissues are important to diminish the risk of avascular necrosis of the metatarsal head.

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