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Chevron osteotomy of the first metatarsal for hallux valgus

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Summary

A retrospective study of 50 chevron osteotomies evaluated subjective and objective functional and cosmetic results, which were in keeping with other reported studies — i.e. satisfactory subjective cosmesis in 98%; excellent or good pain relief in 84%; and satisfactory objective cosmesis in 84%. The correction of the 1st intermetatarsal angle averaged 3,3°, and that of the metatarsophalangeal valgus averaged 15°. Average active range of motion of the 1st metatarsophalangeal joint was 60°. Complications were generally mild and asymptomatic, and were usually iatrogenic. The findings of this study, together with information gained from a concomitant stress analysis, led to recommendations regarding operative technique.

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Any discussion on bunion surgery results in a lively debate. Although over 130 operations have been described, only a few are now in common use. Despite recent criticism based on mathematical arguments,[1] technically the chevron osteotomy remains a fairly simple procedure. It enables early full weight bearing, needs no removal of fixation and results in high patient satisfaction. It is recognised that the chevron osteotomy does not correct all the possible problems associated with hallux valgus. Incorporating a biomechanical stress analysis,[2] a study was undertaken to define problems in order to improve operative results.

Patients and methods

From July 1982 to December 1985 130 chevron osteotomies for hallux valgus were performed on 91 patients, 33 (3 men, 30 women) of whom returned for follow-up 5-46 months post-operatively (average 16 months). They had undergone a total of 50 osteotomies, 16 unilateral and 17 bilateral procedures. The average age was 43 years (range 19 - 74 years).

All patients presented initially with painful and cosmetically unacceptable bunions. Other pre-operative complaints included metatarsalgia, claw toes and bunionettes. In 35 cases initial weight-bearing radiographs showed first intermetatarsal angles (IMAs) varying from 7° to 20° (average 12,9°) (Fig. 1). The

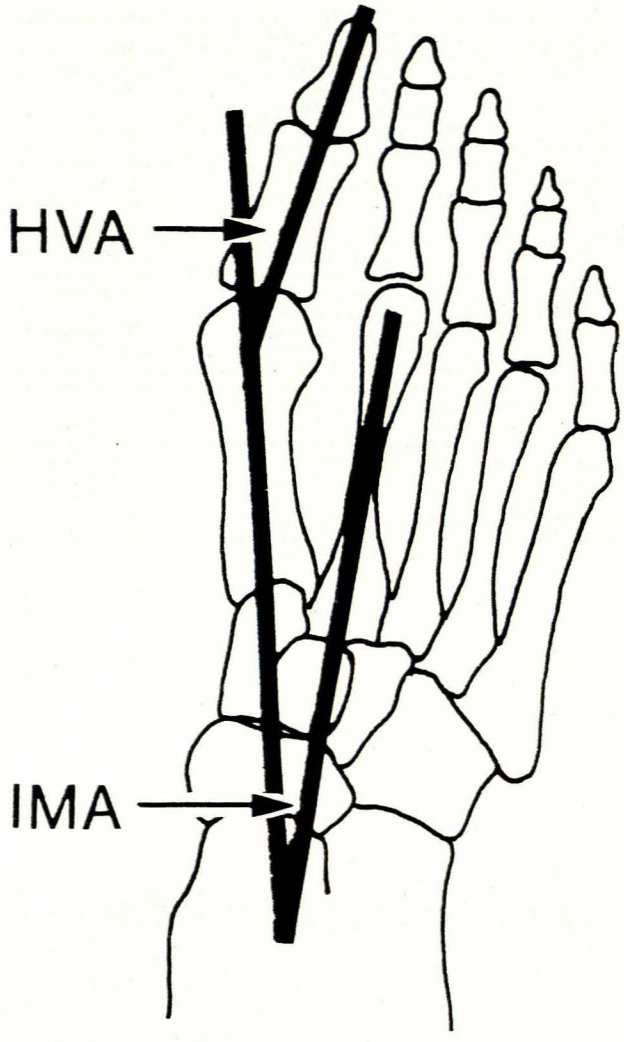

Fig. 1. Diagram of radiograph showing angles measured (HVA = hallux valgus angle; IMA = intermetatarsal angle).

hallux valgus angle (HVA) ranged from 20° to 56° (average 34°). Treatment consisted of a chevron osteotomy similar to that described by Johnson *et al.*[3] (Fig. 2). A dorsomedial incision was used to expose the metatarsal bunion, taking care to protect the underlying cutaneous nerve. A distally based Y-shaped capsulotomy was made and medial exostectomy performed followed by horizontal V-osteotomy of the metatarsal head and neck. The apex was at the centre of the circle formed by the articular surface, the base being just proximal to the capsular attachment of the metatarsal head. A vertical drill hole was made proximal to the osteotomy and the head was then displaced laterally by a pre-operatively determined amount[4] and impacted. The medial bony protuberance was removed and the hallux held in a slightly over-reduced position. The capsular flap was advanced and sutured to the drill hole. The skin was closed and the foot immobilised in a plaster-of-Paris shoe for 6 weeks. Weight-bearing commenced on the third postoperative day.

Results

Patients' assessment

Patients were asked to grade overall operation results as excellent, good, fair or poor. These were excellent or good in 30 feet, fair in 18 and poor in 2 (patient satisfaction 96%). Subjectively, cosmesis was excellent or good in 30 cases, fair in 19, poor in 1 (98% patient satisfaction).

Pain relief and objective cosmetic results were rated by the method of Meier and Kenzora.[5] There was no postoperative bunion pain (opposed to metatarsophalangeal joint pain) in 31 feet, 11 had a good result and 8 had a fair result (84% good or excellent pain relief). There were no poor results.

Other complaints offered by the patients were: metatarsalgia (9); scar pain (4); shoe problems (3); and recurring valgus (3).

Objective assessment

Objective cosmetic results were assessed while weight-bearing. This was excellent in 15 cases, good in 10, fair in 17,

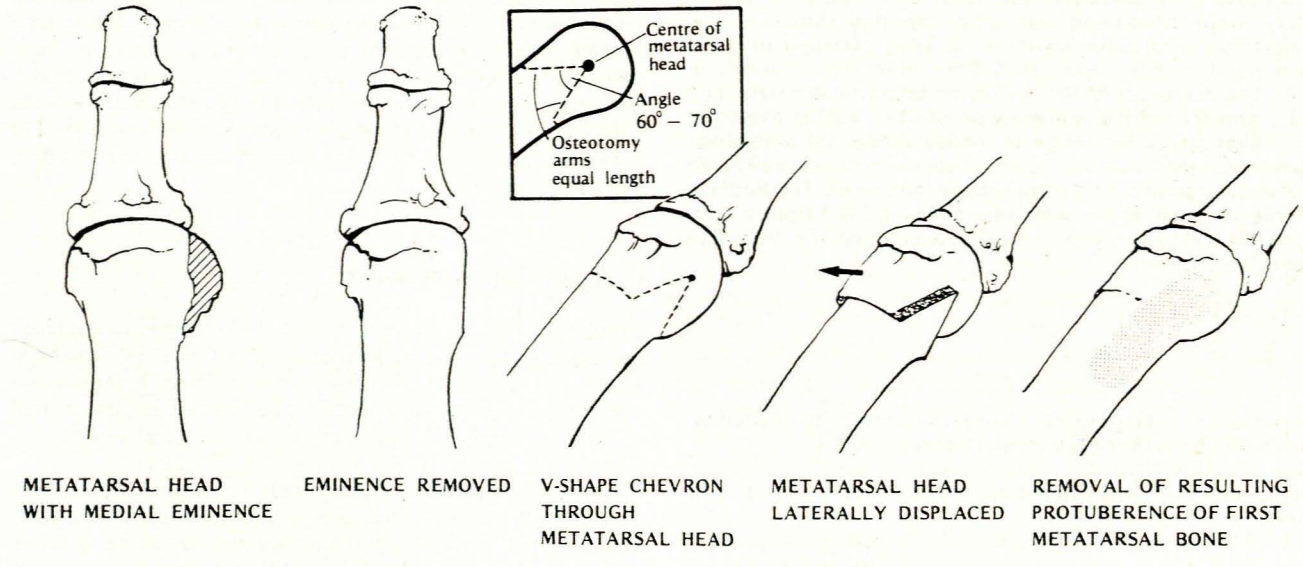

Fig. 2. The chevron osteotomy.

poor in 8 (84% satisfactory results). Note the discrepancy between subjective and objective results.

Displacement, as measured by early postoperative antero-posterior radiography, ranged from 2 mm medial (incorrect) to 7 mm lateral displacement (average 2,7 mm lateral). Six weeks later, weight-bearing radiography evaluated the change in the first IMA. This varied from a 3,5° increase (incorrect) to a 12° decrease (average decrease 3,3°). The decrease in the HVA varied from 1° to 37° (average 15°). Active range of motion at the first MP joint varied from 5° to 95° (average 60°). The change in the metatarsal length varied from a 3 mm lengthening to a 12 mm shortening (average 4,2 mm shorter).

Kirschner wire fixation was used in 17 cases. Two were associated with sepsis, 2 wires migrated out of the bone and 1 patient complained of severe pain caused by the wire.

Table I lists clinically elicited complications, and Table II those demonstrated on early postoperative radiography.

TABLE I. CLINICAL COMPLICATIONS

Metatarsalgia	9
Hallucal pronation	7
Scar problems	3
Hallux erectus	3
Osteitis	1
Superficial sepsis	2
Pressure sore from POP shoe	1
MP pain (pre-op OA)	1
Remaining HVA > 25°	8

POP = plaster of Paris; OA = osteo-arthritis.

TABLE II. RADIOGRAPHIC COMPLICATIONS

Plantar tilt MT head	3
Lateral tilt MT head	2
Loss of lateral displacement	1
Lateral displacement ++	1
Medial tilt MT head	2
Medial displacement	1
Medial resection ++	3
Osteotomy too proximal	1
Apex osteotomy too distal	1
Inadequate exostectomy	1
K-wire migration	2

MT = metatarsal; K = Kirschner.

Meier and Kenzora's[5] classification was used to assess avascular necrosis (AVN) of the metatarsal head. Four patients had grade I changes, 3 had grade II changes and 1 had grade III changes. The incidence of AVN was 16%.

Discussion

Patients in whom chevron osteotomies were performed were very satisfied with the results on the whole, particularly with the cosmesis and pain relief. This is in keeping with previous studies.[3,5–7]

Contrary to Hattrup and Johnson's[8] finding, there was no definite association between increased age and the incidence of poor correction in this series — even when a large HVA had been present pre-operatively. Also a large pre-operative HVA did not necessarily presuppose poor cosmetic results. Some patients may have had lower expectations of the operation cosmetically and this could explain the difference between clinical and subjective cosmetic adequacy.

One patient had pain on MP joint motion from pre-existing osteo-arthritis. The presence of osteo-arthritis is a contra-indication for chevron osteotomy.

Dividing patients into groups based on the amount of metatarsal head displacement (Fig. 3), the expected linear relationship between displacement and first IMA correction was found. Correction of the metatarsus primus varus was good in all groups (Fig. 4), except the third. The latter was ascribed to inadequate lateral displacement. The relatively large change in IMA in comparison to the displacement in the fourth group was not due to the radiographs being an oblique view.

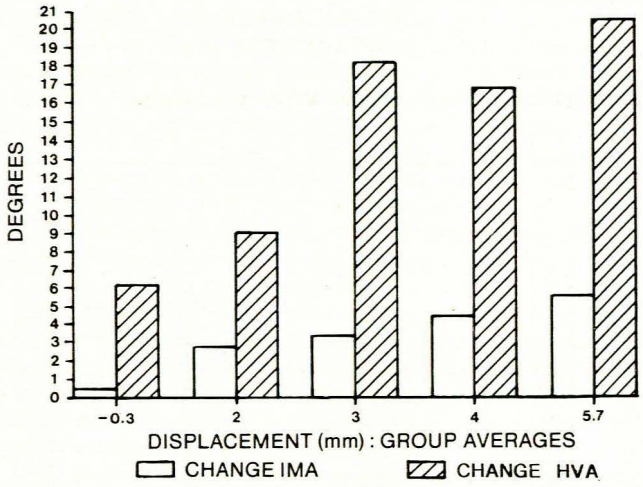

Fig. 3. Effect of displacement on first intermetatarsal angles (IMA) and hallux valgus angles (HVA).

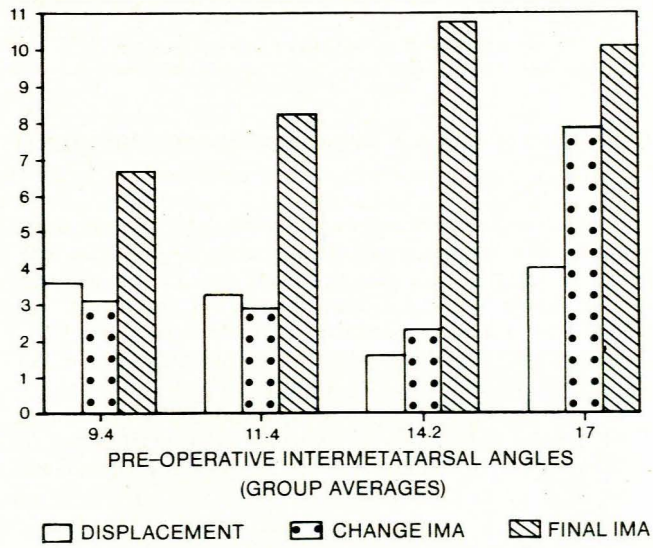

Fig. 4. Comparison of intermetatarsal angles (IMA).

Unlike Scranton's[9] findings, active MP joint range of motion was good in most feet in this series, in which 85% of cases had more than 50° range of motion. There was no correlation between MP joint function and either the amount of displacement of the metatarsal head (Fig. 5) or the degree of MP valgus correction (Fig. 6).

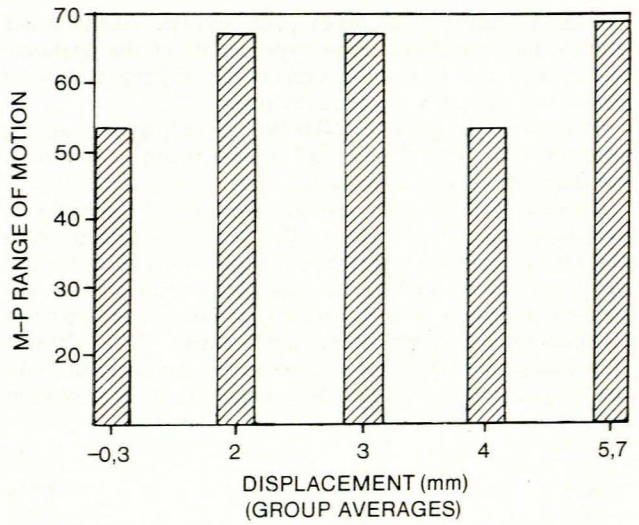

Fig. 5. Effect of displacement on MP range of motion.

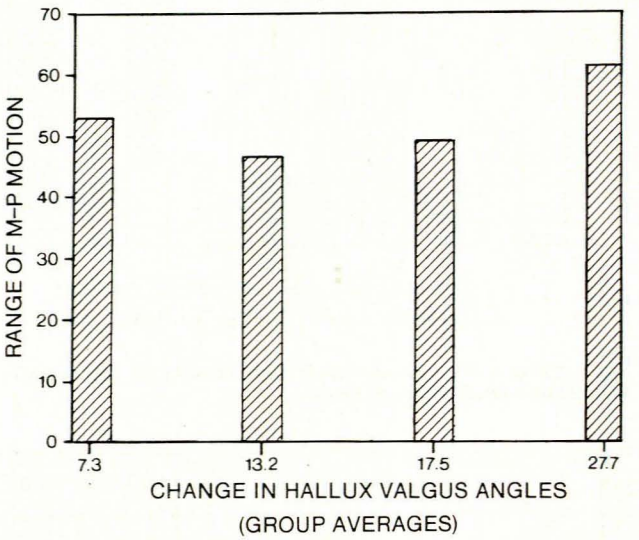

Fig. 6. Effect of change in hallux valgus angles in MP range of motion.

No cases of postoperative onset or worsening of metatarsalgia occurred. The average metatarsal shortening in those feet with persistent metatarsalgia postoperatively was 3,7 mm (average for the whole series 4,2 mm). Metatarsal shortening was therefore not a cause of metatarsalgia in this series.

A need for Kirschner wire fixation is indicative of an improperly cut and unstable osteotomy.

The only symptomatic case of AVN had grade II changes. There was no correlation between the radiological degree of AVN and symptomatology. Since the follow-up period was short, it is possible that some cases of AVN may lead to later symptomatic osteo-arthritis.

There were no cases of non-union or neurological complications.

The operations under review were done in a teaching hospital by various, often junior, surgeons. This may explain the many iatrogenic complications. Careful attention to surgical technique is essential. This is especially important when cutting the osteotomy. An oscillating microsaw with a thin, sharp 5 mm wide blade should be used. Both the arms of the osteotomy must be sawn with a steady hand, taking care not to alter the angle of the blade. This leads to smooth surfaces and results in the least bone loss.

Conclusion

The chevron osteotomy is a technically simple operation, which provides excellent pain relief and cosmetic improvement. Complications can be avoided by improved operative technique.

This clinical study, together with the results of the stress analysis undertaken by the authors,[2] has resulted in the following recommendations regarding the size of the angle of the V-osteotomy: (*i*) careful pre-operative planning and attention to surgical technique are essential; (*ii*) the apex of the osteotomy must be at the centre of the circle of the metatarsal head; (*iii*) the osteotomy arms must be equal; (*iv*) the osteotomy angle must be 60° - 70°; and (*v*) osteo-arthritis of the MP joint and hallucal pronation are contra-indications for this operation.

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