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A New Intramedulary Locking Plate for the Osteotomy of the V. Metatarsal in the Correction of the Tailors Bunion. Midterm Results of 21 Patients

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Abstract

Background: Since we are very successful in the operation of hallux valgus using a transverse subcapital osteotomy fixated with an intramedullary angle-stable locking plate, and a tailors bunion is understood as a reversed hallux valgus, we have applied the operation also for such indication. Method: The osteotomy was carried out at a straight V. metatarsal subcapitally, and in case of an outwardly curved V. metatarsal at the bending location. The intramedullary plates are available in different designs and the plate and screws disappear completely in the bone, so the soft tissues are not disturbed. The head of the plate is either straight or curved in order to shift the distal fragment sufficiently. Results: 26 patients were operated within a period of 5 years (2008-2012). 21 patients were followed up after an average of 34.4 months. The IM angle IV/V could be improved by an average of 11.76 to an average of 4.10. This is a highliy significant pre- to postoperative difference of 7.66 ($t = 15.07$, $p < 0.001$). The AOFAS score was improved by an average of 42.24 points from 55.76 points preoperatively to 98.00 points postoperative. There was no pseudoarthrosis and no wound healing impairment. All patients were either satisfied or very satisfied with the surgery. Conclusion: This method does not have the disadvantages of the other common operations of the Tailors bunion and is applied now as a standard method in this deformity.

Keywords

Forefoot Disorders, Tailors Bunion, Subcapital Ostetomy, Small Toes Problems, Intramedullary Locking Plate, Angle Stable Locking Plate, Forefoot Correction

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1. Introduction

Tailors bunion is used to describe a widening of the foot on the outside by prominence of the fifth metatarsal head and usually also of the soft tissues above [1]-[3]. Patients sometimes experience shoe pressure problems and occasional pain caused by bursitis or activated osteoarthritis of the MPJ V.

The prominence (pseudo exostosis) of the fifth metatarsal is caused by a spreading of the metatarsals IV and V, which widens the foot and often forms a significant bump at the lateral side of the forefoot. Other causes are a hindfoot varus with or without pes adductus, the plantarflexion of the V. metatarsal, the outwardly curved V. metatarsal, the splayed V. metatarsal with and without ligamentous laxity. Increasingly, exterior factors such as shortened calf muscles or bad, and very tight footwear, as well as very high heels have an influence [1] [2] [4].

An important parameter of the spread of the metatarsals is the intermetatarsal angle between the fourth and fifth metatarsal, which is specified as normal up to 6.5 [5] or 8 [5] [6]. At over 9 the intermetatarsal IV/V angle (IM angle) is certainly pathological and can lead to the occurrence of tailors bunion. This angle is measured from the shaft center line of the fourth metatarsal with a straight line from the center of the fifth metatarsal head to the joint center cuboid/fifth metatarsal in the loaded dp X-ray of the foot. The patient should be standing straight and should load both feet equally, because each pro- or supination of the subtalar joint leads to a change in the IM angle.

Conservative treatment options are rather limited and consist of insoles and customization of footwear in order to intercept the pressure. In its early phase, foot exercises may also slow down the formation of the splayfoot. The calf muscles should be stretched. However, the conservative measures usually help only at the beginning of the deformity and a surgical procedure is often necessary [4].

Standard operation procedures are mentioned as follows. The comments quote the opinion and experience of the authors of the individual operations, and published experiences from the literature are cited: The mere removal of the pseudo exostosis has modest possibilities according to the authors' experience, as this is only a few millimeters wide and the symptoms usually persist after surgery.

The Austin/Chevron Ostetomie [7] and the Hohmann osteotomy [3] are quite good at not too large IM angles without significant outward bending of the metatarsal shaft [3] [7]. However, head shifts with a maximum of 70% of the shaft width [3], or 70% of the head width (Austin) are possible, as a wire or screw fixation will not work and an osteosynthesis would be unstable in case of even greater shifts. Accordingly, Pontious *et al.* only found an average improvement of 2.5 of the IM angle IV/V in 40 cases [8].

The long, oblique, diaphyseal osteotomy of the fifth metatarsal can effectively correct the IM angle [2]. However, a long bone cut is necessary, which makes relief necessary and leads to deterioration of the PASA or DMAA angle due to physical reasons.

The Scarf Osteotomy [9] is technically complex and thus error-prone [9]. In case of a shaft width of ±7 mm, displacements of a maximum of 4 mm are possible, which is sufficient for minor deviations, but is not suitable for severe cases. Accordingly, Seide and Petersen [10] state a correction from averagely 10.3 to averagely 6.8, which is only an improvement of only 3.5 in 10 cases [10].

The base osteotomy with a closing wedge can correct the IM angle very well and is also suitable for curved outward metatarsals. Problems arise due to fixation, which requires relief in case wires or oblique screws are used. In addition, higher rates of nonunion were described [11]. If plates are used for fixation, then these are attached to the lateral side. They therefore lie directly under the skin and have to be removed later.

A modification of this osteotomy is a displacement-ostetomy, where step-plates are used. The distal fragment is not only shifted towards varus but also shifted to the middle of the foot. The fixation is rigid, so that the patient does not need relief for a long period. This osteotomy appears to be particularly suitable for outward curved metatarsals. The plate is again located directly under the skin and as all the shoes here have direct contact with the foot, metal removals can be expected.

2. Materials and Methods

The aim of this work was to find a method which fulfills all the criteria of improvement or normalization of the IM angle IV/V, the normalization of the joint angle (DMAA) and the repositioning of the V. metatarsal head from a possible pressure zone in the shoe. The osteosynthesis should be loaded immediately and the plate should preferably not need to be removed.

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Bunion. Midterm results of 21 patients.

As the tailors bunion can be understood as a reversed hallux valgus [11], and we could collect very good experience in the treatment of hallux valgus [12] using an intramedullary fixation of a transverse, displacement osteotomy, it was obvious to treat the tailor's bunion with such a cross osteotomy [11] [12]. The osteotomy scale can be varied and it is performed exactly at the point of deviation, iesubcapitally or in case of outward bent metatarsals in the shaft area as a transverse displacement osteotomy.

The fixation was performed with the existing 30 mm long V-tek plate with 3 holes and with a specielly designed extra slim 30 mm plate with or without a 2 mm offset. This plate is inserted into the medullary space of the proximal portion of the metatarsal fragment. The insertion is usually very easy. Then, using a target device, the lateral and medial cortex is drilled from lateral, drilling through holes in the plate. There are two threaded holes in the proximal part of each plate. The drill diameter is 2 mm and the screws diameter is 2.7 mm. The screws fixate the plate angle-stable, due to the corresponding threads in the plates.

Screw lengths are in most cases 8 mm. Thereafter, the distal fragment is dorsoplantar aligned and the PASA angle may also be corrected. The plate has a thread hole for a 2.7 mm screw head. After the distal fragment is drilled with a 2 mm drill, the head of the fifth metatarsal is now screwed angle stable to the plate head. The screw length here is usually 12 mm. In case of pathological PASA angles, the head fragment can also be derotated, since in this type of fixation no full contact of the fragments is required. Due to the extremly rigid fixation only a point contact is sufficient. Therefore, a shift of 100% is possible, so you can place the distal bone fragment literally "next to" the proximal.

The osteosythesis can be fully loaded immediately after surgery and patients can resume activites immediately using postoperative shoes or a sandal. After suture removal, patients wore normal comfort shoes. **Figures 1-8** show the result of a failed previous surgery after the correction displacing the distal fragment and fusing with the new intramedullary locking plate. **Figures 9-14** show a patient with tailors bunion and the correction displacing the distal fragment about 100%, which is possible due to the extremly rigid internal fixation with the intramedullary locking plate. **Figure 15** and **Figure 16** show the correction of a widely splayed Vth metatarsal, which was osteotomised at the proximal shaft area and fused with a proximal located intramedullary locking plate.

The study was a retrospective clinical study and the t-test was used for the statistical analysis.

Figure 1. Patient Nr. 1: 78 years old man, previous resection of the prominence V. metatarsal head. Persisting pain and deformity, tibially deviated (varus) 5th toe.

Figure 2. Patient Nr. 1: result after 15 month. No prominence, straight 5th toe, no pain, full function of the MP Joint V.

Figure 3. Patient Nr. 1: preoperative X-rays: Previous resection of the pseudoexostosis. Outward and plantarward bended 5th metatarsal in the distal shaft area. Subluxed 5th MPJ.

Figure 4. Pat. Nr 1 oblique view praeoperatively.

Figure 5. Patient Nr. 1: postoperative X-rays, displacement ostetomy, fixated with the intramedullary angle stable locking plate (V-tek System). The ostetomy was carried out at the place of the bending at the distal shaft area. The distal fragment was displaced about 80% of the shaft width.

Figure 6. Loaded side X-ray of patient Nr 1 post operation.

Figure 7. Patient Nr. 1: result after 15 month. The osteotomy is bridged by solid bone, the 5th metatarsal is straight, the out- and downward bending is corrected completely. The titanium ostesynthesis material is proximal completely covered by bone and distal continuing the lateral cortex. No subluxation of the V. MPJ.

Figure 8. Oblique view of patient Nr 1 after 15 month.

Figure 9. Patient Nr. 2: 17 years old female, shoe problems due to tailors bunion since 5 years.

Figure 10. Patient Nr. 2: 2 years result, painfree and full function of the MPJ V.

Figure 11. Patient Nr. 2: out and downward bended 5th metatarsal.

Figure 12. Patient Nr. 2. Subcapitalostetomy with displacement of 100%, fixated with new design V-tek intramedullary plate. This plate shows a 2 mm offset, and is slimmer.

Figure 13. Patient Nr. 2. X-ray after 2 years. A solid bone bridge and no soft tissue impairment of the osteosynthesis material.

Figure 14. Patient Nr. 2. Side view X-ray after 2 years.

Figure 15. Patient 3. Large splaying of the 5th metatarsal. Hallux limitus.

Figure 16. Patient Nr. 3. After shortening, lateralising and plantarising ostetomy of the Ist metatarsal and cheilektomy, fixated with an intramedullary locking plate and a medialising proximal shaft ostetomy of the 5th metatarsal fixated with a intramedullary locking plate.

3. Results

Between January 2008 and December 2012, 26 patients with tailors bunion underwent operation in our two units. For straight metatarsals a subcapital osteotomy was carried out, for curved metatarsals the osteotomy was respectively done at the proximal beginning point of the outward bend of the V. Metatarsal. 6 patients were operated on both sides but not in one stage. In addition to the Tailors bunion, further interventions were performed for 18 patients at the forefoot, such as the correction of hallux valgus, hammer toes, or splay foot with metatarsalgia.

Except postoperative hematomas (20%) and the standard swelling (85%), which disappeared after a short time, no post-operative complications occured. All osteotomies healed within 6 to 8 weeks. This was verified radiographically.

21 patients were followed up clinically and radiologically after an average of 34.4 months (15 - 72 months). Out of 21 patients, the plate had to be removed in 4 cases (19.04%).

The IM angle IV/V could be improved from an average of 11.76 (between 8 and 16) to an average of 4.10 (between 2 and 8) (**Figure 17**). This is a highliy significant pre- to postoperative difference of 7.66 ($t = 15.07$, $p < 0.001$) (**Figure 18**). As analysis method we used the t-test.

The AOFAS score was averagely 55.76 points preoperatively between 29 - 80 points. Postoperatively, the AOFAS score was on average 98.0 points-between 90 and 100 points, which is a significant improvement ($t = 13.17$, $p < 0.001$) (**Table 1** and **Table 2**).

Patients were also asked about their satisfaction with the surgery. They could choose between: very satisfied, satisfied, adequate or not satisfied.

18 patients reported being very satisfied and 3 patients were satisfied with the surgical result.

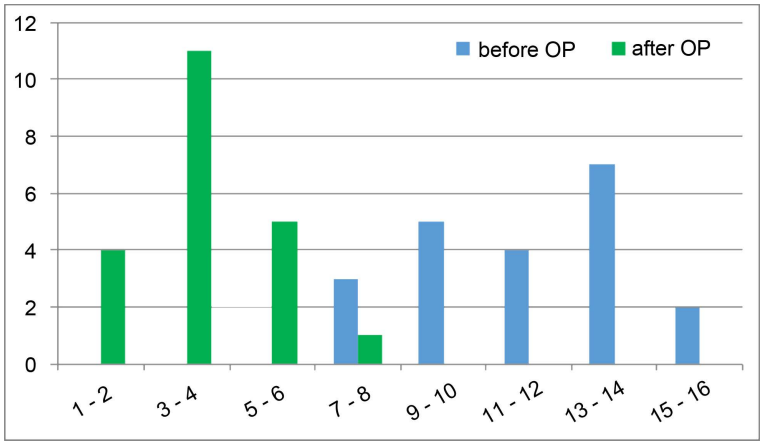

Figure 17. IM angles before and after operation.

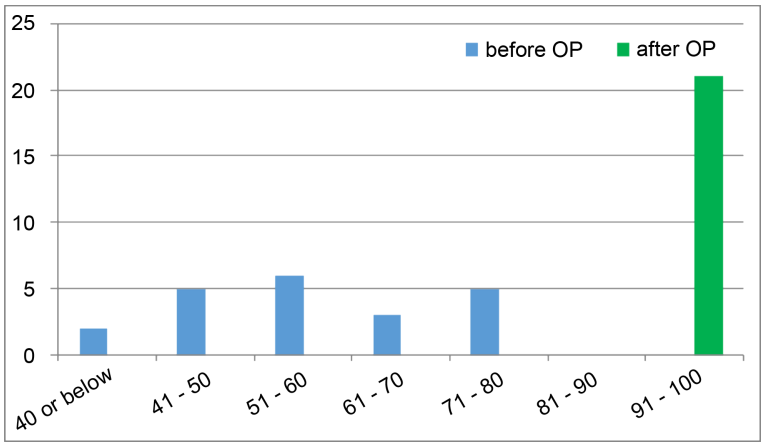

Figure 18. AOFAS-scores before and after OP.

Table 1. IM-angle before and after OP.

	Before OP (n = 21)		After OP (n = 21)		Difference	
Variable	Mean	s.d	Mean	s.d	Mean	s.d
IM angle	11.76	2.54	4.10	1.63	−7.66	2.27

The IM angle IV/V could be improved from an average of 11.76 (between 8 and 16) to an average of 4.10 (between 2 and 8). This is a highliy significant pre- to postoperative difference of 7.66 ($t = 15.07$, $p < 0.001$).

Table 2. AOFAS-scores before and after OP.

	Before OP (n = 21)		After OP (n = 21)		Difference	
Variable	Mean	s.d	Mean	s.d	Mean	s.d
AOFAS score	55.76	13.57	98.00	3.16	42.24	14.34

The AOFAS score was averagely 55.76 points preoperatively between 29 - 80 points. Postoperatively, the AOFAS score was on average 98.0 points—between 90 and 100 points, which is a significant improvement ($t = 13.17$, $p < 0.001$).

4. Discussion

The simple transverse osteotomy of the V. Metatarsal, fixed with the intramedullary, angle stable locked plate has proven to be a safe surgery in the treatment of Tailors bunion. It addresses the pathology of the deformity, because the osteotomy can be performed depending on the deviation of the Fifth Metatarsal, so either subcapitally, or in case of outwardly bent metatarsals at the location of the bend, *i.e.* the shaft or even the base area.

Due to the great strength of the osteosynthesis implants, a displacement of up to 100% of the distal fragment can be carried out, which offers this procedure a great range of correction. In addition to the correction of the IM angle, a pathological PASA or DMAA can be corrected by a distal fragment rotation, because in this method, only a point of contact with the osteotomy-partner is needed. Additionally, the correction of a supinated or pronated V. toe is possible by axial derotation. Disadvantages of other operations could be avoided, as the low correction options in the case of pure pseudo-exostosis resection, or of the Chevron osteotomy, or the operational difficulty of Scarf osteotomy or the subcutaneous layer of the plate in the outside mounted osteosynthesis at a base displacement osteotomy.

Due to the very stable osteosynthesis, no pseudoarthrosis and no wound healing impairment cases occurred among our patients.

The surgery is technically very simple and the learning curve is quick. The patients reported very little or even no pain after surgery; most were treated on an outpatient or day surgery basis. The mobilization was performed immediately after surgery with special shoes or comfortable sandals, which allowed immediate normal ambulation. All patients were allowed to resume activity and full loading of the foot immediately in accordance with the pain. All implant parts in the proximal osteotomy partner are fully incorporated in the bone, so that the soft tissues are not disturbed in the shoe. The plate head is screwed outside the essence of the displacement at the distal fragment. The majority of patients (18 patients) were very satisfied with the operation; the remaining 3 patients were satisfied.

Ethical Clearance

The authors declare no conflict of interests. The informed consent was obtained from all patients before the operation.

References

[1] Bertrand, T. and Parekh, S.G. (2011) Bunionette Deformity: Etiology, Nonsurgical Management, and Lateral Exostectomy. *Foot and Ankle Clinics*, **16**, 679-688. http://dx.doi.org/10.1016/j.fcl.2011.08.003

[2] Coughlin, M.J. (1991) Treatment of Bunionette Deformity with Longitudinal Diaphyseal Osteotomy with Distal Soft Tissue Repair. *Foot & Ankle International*, **11**, 195-203. http://dx.doi.org/10.1177/107110079101100402

[3] Hohmann, G. (1934) Fuß und Bein. JF Bergmann. http://dx.doi.org/10.1007/978-3-662-29987-6

[4] Roukis, T.S. (2005) The Tailor's Bunionette Deformity: A Field Guide to Surgical Correction. *Clinics in Podiatric Medicine and Surgery*, **22**, 223-245. http://dx.doi.org/10.1016/j.cpm.2004.10.004

[5] Fallat, L. and Buckholz, J. (1980) An Analysis of the Tailor's Bunion by Radiographic and Anatomical Display. *Journal of the American Podiatry Association*, **70**, 597-603. http://dx.doi.org/10.7547/87507315-70-12-597

[6] Schoenhaus, H., Rotman, S. and Meshon, A. (1973) A Review of Normal Inter-Metatarsal Angles. *Journal of the American Podiatry Association*, **63**, 88-95. http://dx.doi.org/10.7547/87507315-63-3-88

[7] Austin, D.W. and Leventen, E. (1981) A New Osteotomy for Hallux Valgus, a Horizontally Directed "V" Displacement Osteotomy of the Metatarsal Head for Hallux Valgus and Primus Varus. *Clinical Orthopaedics and Related Research*, **157**, 25-30.

[8] Pontious, J., Lane, G., Moritz, J. and Martin, W. (1998) Lesser Metatarsal V-Osteotomy for Chronic Intractable Plantar Keratosis. Retrospective Analysis of 40 Procedures. *Journal of the American Podiatric Medical Association*, **88**, 323-331. http://dx.doi.org/10.7547/87507315-88-7-323

[9] Gudas, C., Laros, G. and Zygmunt, K. (1989) Z-Bunionektomy with Internal Screw Fixation. *Journal of the American Podiatric Medical Association*, **79**, 322-329. http://dx.doi.org/10.7547/87507315-79-7-322

[10] Seide, H.W. and Petersen, W. (2001) Tailor's Bunion: Results of a Scarf Osteotomy for the Correction of an Increased Intermetatarsal IV/V Angle. A Report on Ten Cases with a 1-Year Follow-Up. *Archives of Orthopaedic and Trauma Surgery*, **121**, 166-169. http://dx.doi.org/10.1007/s004020000210

[11] Mann, R.A. and Haskell, A. (2010) Foot and Ankle. Biomechanics. 3rd Edition. *De Lee & Drezs Orthopaedic Sports Medicine*, **2**, 1865-1873.

[12] Vitek, M. (2009) Neue Techniken in der Fußchirurgie-das V-tek-System: Bohrdrahtfreie Vorfußkorrekturen. ABW Wissenschaftsverlag.