

Oper Orthop Traumatol  
<https://doi.org/10.1007/s00064-018-0542-z>  
Received: 1 September 2017  
Revised: 26 November 2017  
Accepted: 27 November 2017  
© Springer Medizin Verlag GmbH, ein Teil von  
Springer Nature 2018

**Editor**  
R.A. Fuhrmann, Bad Neustadt  
**Illustrator**  
R. Himmelhan, Mannheim



CrossMark

G. A. Morawe<sup>1</sup> · M. H. T. Schmieschek<sup>2</sup>

<sup>1</sup> Abteilung Fuß- und Sprunggelenkchirurgie, ORTHOPARC Klinik GmbH, Köln, Germany  
<sup>2</sup> Medizinische Fakultät, Universität zu Köln, Köln, Germany

# Minimally invasive bunionette correction

## Introductory remarks and objective

Bunionette or ‘tailor’s bunion’ is a deformity of the fifth ray, which comes along with a metatarsus quintus valgus and a varus deformity of the fifth toe with subluxation of the metatarsophalangeal joint (Fig. 1; [5]). The sitting position of a tailor with crossed legs has led to the term ‘tailor’s bunion’ [22]. Due to



**Fig. 1 ▲** Tailor’s bunion deformity

the friction between the fifth metatarsal head and a close fitting shoe the deformity usually leads to a painful chronic bursitis lateral and plantar of the fifth metatarsal head, localized hyperkeratosis, and increasing difficulties regarding foot wear [8].

Multifactorial etiology is discussed, including anatomical variations of the fifth metatarsal head, i.e., the enlargement of the fifth metatarsal head, metatarsus quintus valgus, and biomechanical causes [9].

Conservative treatment includes use of wide shoes, insoles, metatarsal bars, physiotherapy, nonsteroidal analgesics, shaving of hypertrophic callus [10, 18], and corticosteroid injections [1, 10, 16].

The standard surgical procedure is an osteotomy, which can be performed either at the distal metatarsal, the diaphyseal region, or the proximal metatarsal [4]. After realignment and internal fixation the procedure is finished with an

exostosectomy [19]. Resection arthroplasties have proven to be unrewarding.

In recent years, the use of minimally invasive surgery (MIS) has continued to rise. MIS correction of tailor’s bunion deformity was first described by De Prado and Isham (Table 1; [6]). They performed a percutaneous osteotomy of the fifth metatarsal without internal fixation using burrs [6]. Apart from that some authors denote mini open osteotomies performed with an oscillating saw and retrograde Kirschner-wire fixation as “minimally invasive” [7].

Similar to open surgical procedures, the type of osteotomy complies with the underlying pathology. MIS procedures allow comprehensive treatment of various types of tailor’s bunion deformities.

## Radiographic classification

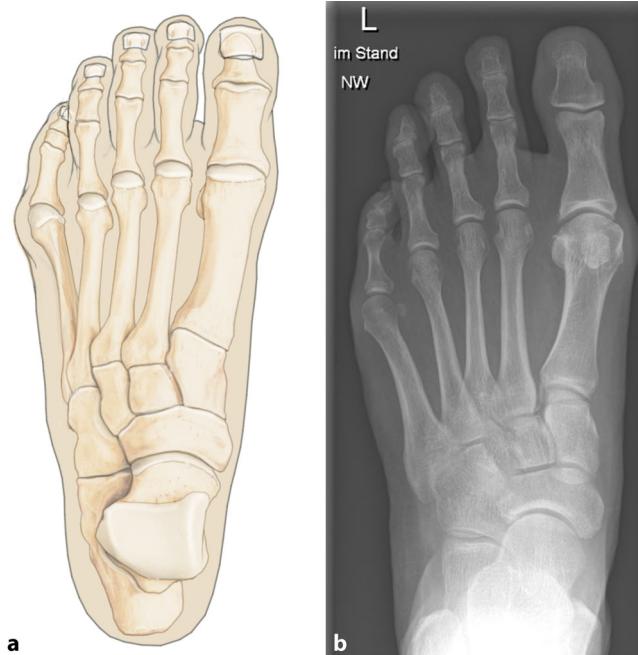
The classification of bunionette is described by Coughlin [3]:

**Table 1** Algorithm of indication [6]

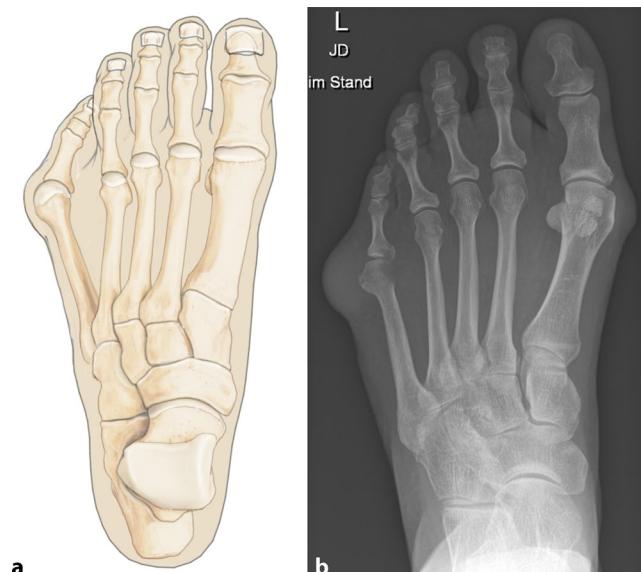
	Exostosectomy + release of soft tissues	Exostosectomy + release of soft tissues + distal osteotomy	Exostosectomy + release of soft tissues + diaphyseal osteotomy	Exostosectomy + release of soft tissues + proximal osteotomy
Intermetatarsal angle	Normal	<12°	>12°	>12°
Metatarsal lateral deviation angle	Normal	7°–10°	7°–10°	>10°
Addition	Congruent metatarsophalangeal angle	–	–	Incongruent metatarsophalangeal joint



**Fig. 2 ▲ a** Type 1: Enlargement of the head of the fifth metatarsal head.  
**b** X-ray of type 1 Tailor's bunion deformity



**Fig. 3 ▲ a** Type 2: Lateral bowing of the distal aspect of the fifth metatarsal shaft.  
**b** X-ray of type 2 Tailor's bunion deformity



**Fig. 4 ▲ a** Type 3:  
Increase in the inter-metatarsal angle of  
the fourth and fifth ray.  
**b** X-ray of type 3  
Tailor's bunion deformity

- Type 1: Enlargement of the head of the fifth metatarsal head (16–33%; **Fig. 2**)
- Type 2: Lateral bowing of the distal aspect of the fifth metatarsal shaft (10%; **Fig. 3**)
- Type 3: Increase in the inter-metatarsal angle of the fourth and fifth ray (57–74%; **Fig. 4**)

### Advantages of MIS fifth ray surgery

- High patient satisfaction
- Superior aesthetic result
- Low cost surgery
- Short operation time
- No material removal

### Disadvantages of MIS fifth ray surgery

- Learning curve
- Reliable patient compliance
- Limited stability of the osteotomy

### Indications

- Symptomatic tailor's bunion deformity
- Failed conservative treatment
- Closed epiphyseal gap

### Contraindication

- Osteoporotic bone
- Non-compliant patient

### Patient information

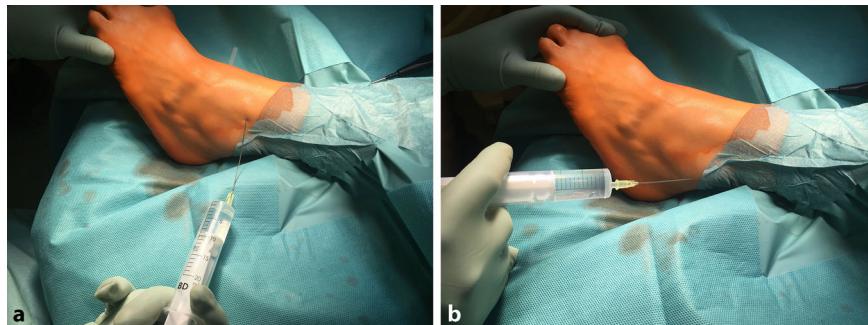
- General surgery-related risk factors
- Revision surgery
- Alternative treatment
  - Conservative treatment
  - Open surgical approach
- Necessity of full compliance
- Outpatient surgery
- Incapacity for work up to 6 weeks
- Clinical and radiological follow-up after 6 weeks

	Abstract · Zusammenfassung
<ul style="list-style-type: none"> <li>— Satisfying results up to 97% [8]</li> </ul> <p><b>Preoperative work-up, anesthesia, and intraoperative positioning</b></p> <ul style="list-style-type: none"> <li>— X-rays anteroposterior and lateral (weight bearing) (► Fig. 5)</li> <li>— General anesthesia, spinal anesthesia, popliteal or complete ankle block (► Fig. 6)</li> <li>— Single shot antibiotic prophylaxis with cefuroxime 1.5 g intravenous, e.g., Zinacef®</li> <li>— Supine positioning on a radiolucent table (► Fig. 7)</li> <li>— Intraoperative patient temperature control with air warming blankets</li> <li>— Dispense with tourniquet, nonobligatory</li> <li>— Portable C-arm image intensifier fluoroscopy</li> <li>— Standard antiseptic preparation</li> </ul> <p><b>Instruments</b></p> <ul style="list-style-type: none"> <li>— Minimally invasive surgery set, e.g., Arthrex (Munich, Germany) (► Fig. 8) <ul style="list-style-type: none"> <li>■ Rasp and blunt elevator, small</li> <li>■ Rasp and blunt elevator, medium</li> <li>■ Combi-elevator, straight and curved ends, sharp</li> </ul> </li> <li>— Straight burr 20 mm length, 2 mm diameter, e.g., Arthrex (► Fig. 9a)</li> <li>— Conical burr 20 mm length, 2.9 mm diameter, e.g., Arthrex (► Fig. 9b)</li> </ul>	<p>Oper Orthop Traumatol <a href="https://doi.org/10.1007/s00064-018-0542-z">https://doi.org/10.1007/s00064-018-0542-z</a>      © Springer Medizin Verlag GmbH, ein Teil von Springer Nature 2018</p> <p>G. A. Morawe · M. H. T. Schmieschek</p> <p><b>Minimally invasive bunionette correction</b></p> <p><b>Abstract</b></p> <p><b>Objective.</b> Bunionette or ‘tailor’s bunion’ is a deformity of the fifth ray, which comes along with a metatarsus quintus valgus and a varus deformity of the fifth toe with subluxation of the metatarsophalangeal joint. A minimally invasive osteotomy of the fifth metatarsal without internal fixation using burrs is an increasingly used alternative for symptomatic tailor’s bunion deformity. Similar to open surgery procedures the type of osteotomy complies with the underlying pathology. Minimally invasive surgical (MIS) procedures allow comprehensive treatment of various types of tailor’s bunion deformities.</p> <p><b>Indications.</b> Symptomatic tailor’s bunion deformity, failed conservative treatment, a closed epiphyseal gap.</p> <p><b>Contraindications.</b> Osteoporotic bone, poor patient compliance.</p> <p><b>Surgical technique.</b> The technique comprises percutaneous resection of the lateral exostosis of the fifth metatarsal head with a straight burr and an osteotomy of the fifth metatarsal,</p> <p>either distally, diaphyseal or proximally with a conical burr due to the shape of the deformity, usually without internal fixation.</p> <p><b>Postoperative management.</b> Redressive wrapping, partial pain-adapted weight bearing. Non-steroidal anti-inflammatory drugs for 3–5 days, lymphatic drainage, intermittent cooling. Radiographic assessment on postoperative day 1; radiographic follow-up 6 weeks postoperatively. Thromboembolic prophylaxis.</p> <p><b>Results.</b> The clinical outcome is comparable to standard surgical procedures with the advantages of MIS. Based on our results and the current literature, the minimally invasive distal metatarsal osteotomy without fixation is becoming a reliable treatment for tailor’s bunion.</p> <p><b>Keywords</b>      Tailor’s bunion · Metatarsophalangeal joint · Minimally invasive surgery · Percutaneous surgery · Metatarsal osteotomy</p> <h3>Minimal-invasive Bunionette-Korrektur</h3> <p><b>Zusammenfassung</b></p> <p><b>Operationsziel.</b> Die Bunionette-Deformität oder „Tailor’s Bunion“ ist eine Deformität des fünften Strahls, welche mit einem Metatarsus quintus valgus und einer Varusdeformität der fünften Zehe mit Subluxation des Metatarsophalangealgelenks einhergeht. Eine minimal-invasive Osteotomie des fünften Strahls ohne Fixierung ist eine immer häufiger angewandte chirurgische Alternative zur Behandlung des symptomatischen Schneiderballens. Ähnlich zu dem offenen chirurgischen Vorgehen entscheidet die vorliegende Pathologie über den Typ der Osteotomie. Das minimal-invasive Vorgehen ermöglicht umfassende Behandlungen von diversen Arten der Bunionette-Deformität.</p> <p><b>Indikationen.</b> Symptomatische Bunionette-Deformität, Versagen der konservativen Behandlung, ein geschlossener epiphysealer Spalt.</p> <p><b>Kontraindikationen.</b> Osteoporotischer Knochen, mangelnde Compliance des Patienten.</p> <p><b>Operationstechnik.</b> Bei dieser Technik wird die laterale Exostose mit einer geraden Fräsereseziert und eine Osteotomie des</p> <p>fünften Mittelfußknochens entweder distal, diaphysär oder proximal – je nach Ausmaß der Deformität – mit einer konischen Fräse perkutan durchgeführt, dies in der Regel ohne Osteosynthese.</p> <p><b>Weiterbehandlung.</b> Redressierende Verbände, schmerzadaptierte Teilbelastung. Nichtsteroidale Antirheumatika für 3–5 Tage, Lymphdrainage, intermittierendes Kühlen. Radiologische Beurteilung am 1. postoperativen Tag, radiologische Nachkontrolle 6 Wochen postoperativ. Thromboembolieprophylaxe.</p> <p><b>Ergebnisse.</b> Die Ergebnisse sind – bei allen Vorteilen der minimal-invasiven Chirurgie – mit der offenen Technik vergleichbar. Basierend auf unseren Ergebnissen und der aktuellen Literatur scheint die minimal-invasive distale metatarsale Osteotomie ohne Fixation eine zuverlässige Behandlung der Bunionette-Deformität darzustellen.</p> <p><b>Schlüsselwörter</b>      Tailor’s Bunion · Metatarsophalangealgelenk · Minimal-invasive Operation · Perkutane Operation · Metatarsale Osteotomie</p>

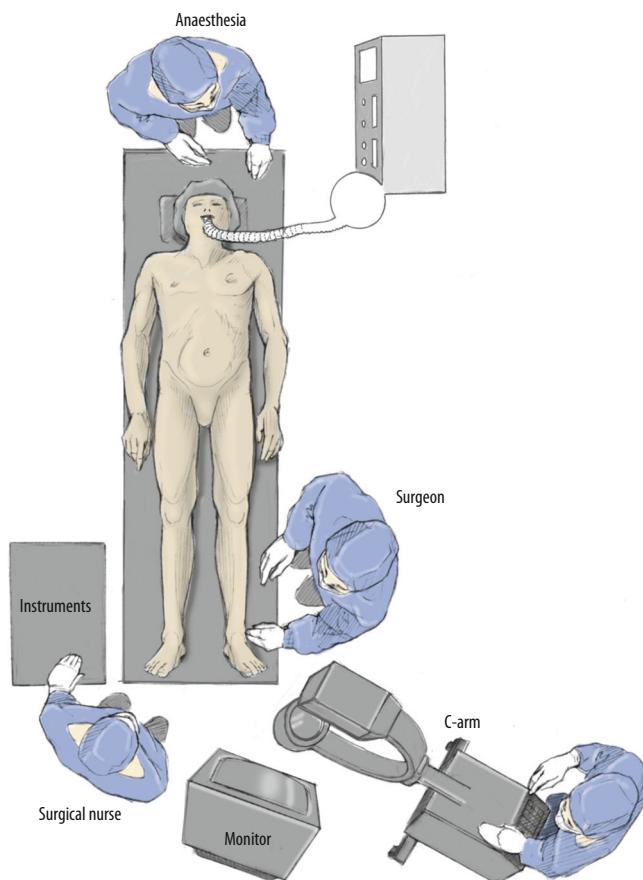
## Surgical Techniques



**Fig. 5 ▲** Weight bearing X-rays anteroposterior and lateral preoperatively



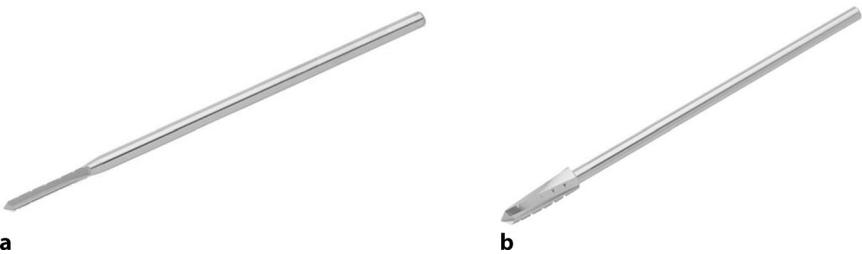
**Fig. 6 ▲** a Ankle block superficial peroneal nerve. b Ankle block sural nerve



**Fig. 7 ▲** Operative setting



**Fig. 8 ▲** Minimally invasive surgery set, Arthrex. (Courtesy of Arthrex GmbH, Munich, Germany)



**Fig. 9 ▲** **a** Straight burr 20 mm length, 2 mm diameter, Arthrex. **b** Conical burr 20 mm length, 2.9 mm diameter, Arthrex. (Courtesy of Arthrex GmbH, Munich, Germany)

## Surgical technique

( Figs. 10, 11, 12, 13, 14, 15, 16, 17, 18)

### Exostectomy

Indication for exostectomy and soft tissue release: enlarged 5th metatarsal head with normal intermetatarsal angle IV/V and congruent metatarsophalangeal joint.



**Fig. 10 ▲** Stab incision on the lateral proximal edge of the fifth metatarsal head. The mini blade has to be aligned parallel to the bone until osseous contact has been reached. Minimally invasive surgery (MIS) rasperatorium is used to create a working space between the exostosis and the surrounding



**Fig. 11 ▲** **a, b** Fluoroscopically guided resection of the exostosis using the straight burr in a mopping movement. The burr should not be placed at one spot permanently to avoid excessive bone resection. **c** Fluoroscopy after resection

## Surgical Techniques

### Distal osteotomy

Indication for distal osteotomy:

- Bulky 5th metatarsal head
- Intermetatarsal angle IV/V <14°



**Fig. 12 ▲** The soft bone mass should be pressed out of the skin incision



**Fig. 13 ▲** Stab incision dorsal and lateral of the extensor digitorum tendon at the top of the arc of deformity. Soft tissue dissection with a minimally invasive surgery (MIS) raspatorium. Insertion of the long burr in contact with the medial side of the metaphysis of the distal fifth metatarsal at the bow of deformity. Osteotomy is performed from distal to proximal plantar in an angle of 45°, although the lateral cortex should not be cut completely to spare a lateral hinge

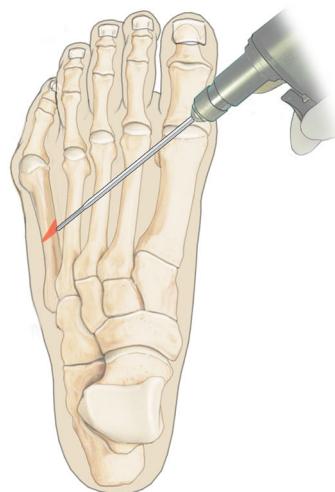


**Fig. 14 ▲** Manual reposition with a “push & pull” maneuver under fluoroscopy. Redressing wraps without skin sutures

### Diaphyseal osteotomy

Indication for diaphyseal osteotomy:

- Bulky 5th metatarsal head
- Intermetatarsal angle IV/V >14°



**Fig. 15 ▲** Same procedure as the distal osteotomy, positioned at the midshaft area at the point of bowing of the fifth metatarsal



**Fig. 16 ▲** Same procedure as the distal osteotomy, but performed at the proximal metaphysis



**Fig. 18 ▲** Varisation of the fifth ray

### Proximal osteotomy

Indication for proximal osteotomy

- Bulky 5th metatarsal head
- Intermetatarsal angle IV/V >14°
- Incongruent MTP 5 joint



**Fig. 19 ▲ a** Postoperative shoe, e.g., MedSurg™ (DARCO Int., Huntington, WV, USA). **b** Insole modification, e.g., Puzzle Insole®, DARCO Int.

a





**Fig. 20 ▲** Wrapping, e.g., Peha-taft® (Paul Hartmann AG, Heidenheim, Germany)



**Fig. 21 ▲** Post-operative X-ray

Some figures have been flipped horizontally and labelled for didactical reasons.

### Add-on minimally invasive surgery of the fifth metatarsal

- Overlapping 5th toe: percutaneous tenotomy of extensor digitorum longus
- Subluxation of the fifth metatarsophalangeal joint: medial capsulotomy
- Flexible hammer toe deformity: percutaneous tenotomy of flexor digitorum longus
- Digitus quintus varus: osteotomy of the base of proximal phalanx

### Postoperative management

- Distal osteotomies: 6 weeks post-operative shoe (Fig. 19a, b) with soft bedding of the 5th ray and pain-adapted full weight bearing. Prox-

imal and diaphyseal osteotomies: 2 weeks partial weight bearing with heel contact in a postoperative shoe or crutches for 2 weeks, then pain adapted weight bearing for further 4 weeks.

- First change of dressing after one week. Consequent redressing bandage (Fig. 20) at daily intervals for 6 weeks day and night, after that additional 4 weeks at night, en passant the patient should be trained regarding this.
- Non-steroidal anti-inflammatory drug (NSAID) for 3–5 days depending on pain and swelling
- Lymphatic drainage
- Intermittent cooling
- Regular elevation of the foot in the initial days and moving exercises of the ankle
- Radiographic assessment at day 1 postoperatively (Fig. 21)

- Radiographic follow-up 6 weeks postoperatively
- In case of increasing pain or swelling immediate radiographic follow-up
- Thromboembolic prophylaxis with low molecular heparin subcutaneously, e.g. enoxaparin, Clexane 40 mg®, usually for 2 weeks. Partial weight bearing 20 kg and 20° ankle motion should be reached in that time. In case of risk factors for thromboembolic incidents, prophylaxis has to be prolonged.

### Complications

- Intraoperatively lack or loss of reduction of deformity: switch to open surgery
- Intraoperatively instable fracture of osteotomy plane: switch to open surgery and internal fixation
- Break of instruments: switch to open surgery
- Superficial wound infection: wound dressing, calculated antibiotic therapy, if symptoms remain: wound revision
- Delayed union: prolonged mobilization in a cast with non-weight bearing, extracorporeal shockwave therapy, ultrasound therapy
- Non-union: surgical revision, open approach, resection of non-union, autologous bone transplantation, osteosynthesis with plate and screw fixation
- Transfer metatarsalgia: soft padding insoles, revision surgery in patients with persistent pain
- Recurrence of deformity: open approach, osteotomy with osteosynthesis

### Results

In reference to the described technique we overview the following unpublished data. A total of 32 feet (24 women, 4 men) with a mean age of 47 years with type 1 bunionette deformities and a mean follow-up time of 14 months were retrospectively reviewed. After percutaneous minimally invasive surgery without fixation one delayed fusion occurred. The mean intermetatarsal angle IV/V was reduced

Table 2 Overview of published results MIS fifth ray. (Adapted from Ceccarini et al. [2])								
Authors	Level of evidence	Year	Procedures	Bunionette classification	Type of osteotomy	Patients/Feet	Follow-up (months)	Clinical outcomes (AOFAS)
Giannini et al. [7]	IV	2008	SERI/Fixation with K-wire	All cases types 2 and 3	Distal, sub-capital, 25° inclined	32/50	56	94
Laffene^tre et al. [11]	IV	2015	Percutaneous/No fixation	Type 1: 34 Type 2: 5 Type 3: 10	From distal dorsal to proximal plantar at 45°	38/49	34	97
Legenstein et al. [12]	IV	2007	Boesch/Fixation with K-wire	All cases types 2 and 3	Subcapital, transversal	65/77	56.6	95.2
Lui [13]	IV	2014	Percutaneous/No fixation	Type 1: 4 Type 2-3: 11	Shaft, proximal	12/15	24	100
Magnan et al. [14]	IV	2011	Percutaneous Distal Osteotomy/Fixation with K-wire	All cases types 2 and 3	Distal, sub-capital	21/30	96	98.4
Martinelli et al. [15]	IV	2007	SERI/Fixation with K-wire	All cases types 2 and 3	Distal, sub-capital	20/25	28	92
Michels et al. [17]	IV	2013	Percutaneous/No fixation	Type 1: 5 Type 2: 3 Type 3: 13	Distal, from dorsal distal to plantar proximal	20/21	29	96.5
Waizy et al. [20]	IV	2012	Minimally invasive/ Fixation with K-wire	Type 1: 1 Type 2: 5 Type 3: 12	Distal, subcapital, from lateral-proximal to medial-distal	20/31	52	80–100 (16 feet): Type 1: 12 Type 3: 4  60–80 (14 feet): Type 1: 2 Type 2: 5 Type 3: 7  56 (1 foot): Type 3
Weitzel et al. [21]	IV	2007	Minimally invasive/ fixation with K-wire	Type 2: 12 Type 3: 18	Distal, transverse	21/30	92	88.2

AOFAS American Orthopaedic Foot and Ankle Society

from 13.1° preoperatively to 4.5° at follow-up. The clinical outcome measured by the American Orthopaedic Foot and Ankle Society (AOFAS) forefoot score increased significantly from preoperative 74 points to postoperative 92 points.

The results are in concordance with recent studies [2, 7, 11–15, 17, 20, 21], illustrated in Table 2, which was adapted from Ceccarini P. et al. [2].

Based on the current literature, the minimally invasive distal metatarsal osteotomy without fixation appears to become a reliable treatment in tailor's bunion.

## Corresponding address

### Dr. G. A. Morawe

Abteilung Fuß- und Sprunggelenkchirurgie,  
ORTHOPARC Klinik GmbH  
Aachener Straße 1021 B, 50858 Köln, Germany  
a.morawe@orthoparc.de

## Compliance with ethical guidelines

**Conflict of interest.** G.A. Morawe and M.H.T. Schmieschek declare that they have no competing interests.

This article does not contain any studies with human participants or animals performed by any of the authors.

## References

- Alvarez F et al (2005) Pathology of the fifth toe. Quintus varus. Foot Ankle Surg. <https://doi.org/10.1016/j.fas.2004.11.001>
- Ceccarini P et al (2017) Bunionette. Foot Ankle Spec 10:157–161
- Coughlin MJ et al (2007) Surgery of the foot and ankle. Mosby, Philadelphia
- Coughlin MJ et al (2013) Mann's surgery of the foot and ankle E-book: expert consult—online. Elsevier, Philadelphia
- Davies H (1949) Metatarsus quintus valgus. Br Med J 1:664
- De Prado M et al (2009) Minimally invasive foot surgery : surgical techniques, indications, anatomical basis
- Giannini S et al (2008) The minimally invasive osteotomy "S.E.R.I." (simple, effective, rapid, inexpensive) for correction of bunionette deformity. Foot Ankle Int 29:282–286
- Jahss MH (1991) Disorders of the foot & ankle: medical and surgical management. Saunders, Philadelphia

## Surgical Techniques

9. Kitaoka HB et al (1994) Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes. *Foot Ankle Int* 15:349–353
10. Koti M, Maffulli N (2001) Bunionette. *J Bone Joint Surg Am* 83-A:1076–1082
11. Laffenetre O et al (2015) Percutaneous bunionette correction: results of a 49-case retrospective study at a mean 34 months' follow-up. *Orthop Traumatol Surg Res* 101:179–184
12. Legenstein R et al (2007) Correction of tailor's bunion with the Boesch technique: a retrospective study. *Foot Ankle Int* 28:799–803
13. Lui TH (2014) Percutaneous osteotomy of the fifth metatarsal for symptomatic bunionette. *J Foot Ankle Surg* 53:747–752
14. Magnan B et al (2011) Percutaneous distal osteotomy of the fifth metatarsal for correction of bunionette. *J Bone Joint Surg Am* 93:2116–2122
15. Martinelli B, Valentini R (2007) Correction of valgus of fifth metatarsal and varus of the fifth toes by percutaneous distal osteotomy. *Foot Ankle Surg* 13:136–139
16. Masquijo JJ et al (2010) Symptomatic bunionette deformity in adolescents: surgical treatment with metatarsal sliding osteotomy. *J Pediatr Orthop* 30:904–909
17. Michels F et al (2013) Percutaneous bunionette correction. *Foot Ankle Surg* 19:9–14
18. Nestor BJ et al (1990) Radiologic anatomy of the painful bunionette. *Foot Ankle* 11:6–11
19. Roukis TS (2005) The tailor's bunionette deformity: a field guide to surgical correction. *Clin Podiatr Med Surg* 22:223–245, vi
20. Waizy H et al (2012) Minimally invasive osteotomy for symptomatic bunionette deformity is not advisable for severe deformities: a critical retrospective analysis of the results. *Foot Ankle Spec* 5:91–96
21. Weitzel S et al (2007) Transverse medial slide osteotomy for bunionette deformity: long-term results. *Foot Ankle Int* 28(7):794
22. Zvijac JE et al (1991) Distal oblique osteotomy for tailor's bunion. *Foot Ankle* 12:171–175