mm. CaseStudy

Correction of Hallux Valgus using mm.CS resorbable compression screws

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Dr. med. Guido Laps is a specialist in conservative and surgical treatment of the foot and ankle region, most of all for acute and chronic sport injuries, foot deformities and complex revision surgery. He achieved expert status in GFFC (German Society for Foot and Ankle Surgery), D.A.F. (German Association for Foot and Ankle e. V.) and EFAS (European Foot & Ankle Society). Since numerous stays and fellowships abroad with world-renowned specialists - especially in the Anglo-American region - he is a member of the largest American foot society, the AOFAS (American Orthopedic Foot and Ankle Society). Dr. Laps has additional qualifications in sports medicine. He is caring for numerous professional and competitive athletes and has been the team physician for the TSV Bayer Dormagen Handball Bundesliga team since 2007. Since October 2015, he has been founder and owner of a renowned private clinic in Cologne "Orthopädie am Gürzenich" – Campus for interdisciplinary sportorthopedics including PML (proMotion Lab), a center for functional and biomechanical analytics and training.

The Case

Introduction

Hallux valgus is the most common 3-dimensional deformity observed in ankle-foot surgery in adults and is characterized by the lateral deviation of the first ray, which can result in pain, swelling, arthrosis, discomfort, limited toe movement, stiffness and a limited gait pattern. Hallux valgus deformities are traditionally classified according to their severity by the resulting intermetatarsal (IM) and hallux valgus (HV) angles in the AP view on radiographs in the frontal plane into mild (IM 11°; HV 20°), moderate (IM 11-16°; HV 20-40°) and severe (IM >16°; HV >40°) [1]. Other significant radiological features for evaluation of the deformities are the proximal articular set angle (PASA) and tibial sesamoid position. For each stage of HV, a panoply of procedures have been described, implemented, and studied.

Operative treatment options consist of DMO (distal metatarsal osteotomy), DTSP (distal soft tissue procedure), PMO (proximal metatarsal osteotomy) and/or a Lapidus procedure with an open or minimally invasive approach depending on severity [2].

Conventional surgical treatment involves the use of titanium or steel wires or screws, which can cause potential complications such as infection, hardware irritation, and the need for implant removal. [3,4]. The use of bioresorbable screws based on polymer materials is associated with good results [3,4,5] but also displayed complications such as osteolysis, fistula formation, foreign body reaction, fluid collection and loss of mechanical stability [3,4,5]. First generation magnesium screws have achieved good results in correction of hallux valgus [6,7], but early signs of corrosion have been reported and 7 of 45 patients suffered from dorsal subluxation in the first three months, from which one was revised [6]. In 40 % of patients temporary signs of osteolysis, areas lytics, radiolucency and demineralization were found around the screws, which did not impair later consolidation [7].

In meta analysis, results in pain, angular correction, and PROM scores (AOFAS MTP-IP; MOFXQ, FAOS) did not show significant differences in comparison to conventional titanium headless compression screws by different authors [8,9,10]. The mm.X implants and their technological foundation incorporate a surface treatment to establish a controlled and decelerated absorption pattern to minimize gas evolution in the surrounding tissue and therefore realize a controlled healing period [11].

Patient Profile

A 45-year-old female presented to the clinic with a chief complaint of pain most of all while wearing shoes, discomfort and deformity of the right big toe at the medial eminence of the MTP-joint. Upon clinical evaluation and radiographic digital volume tomography imaging (DVT see figure 1), the patient was diagnosed with mild to moderate hallux valgus (HV: 16°; IM: 12°; PASA: 12° and sesamoid bone subluxation) and an additional symptomatic tailor's bunion. After a thorough discussion of the risks and potential benefits associated with treatment options, the decision was made to correct the deformity operatively by way of an open distal metatarsal osteotomy (modified Reverdin-Green-Laird osteotomy) with the use of resorbable magnesium implant screw in combination with an Akin osteotomy and a lateral release in minimal invasive technique and an additional DMMO for tailor's bunion.

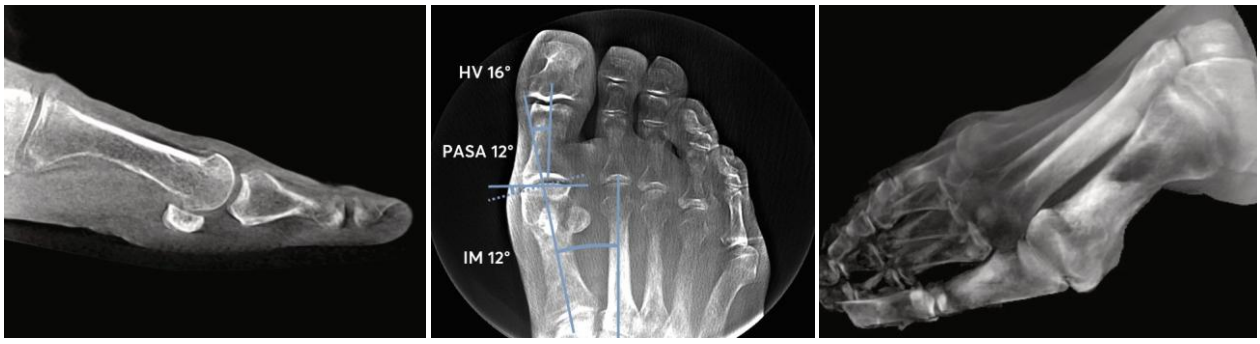

Figure 1: Preoperative Imaging in DVT reveals mild Hallux Valgus deformity.

Surgical Technique

The MTP joint was exposed through a small dorsomedial incision, using a saw to resect the medial eminence. Lateral release in minimal invasive technique was performed (lateral metatarsophalangeal capsulotomy and adductor tenotomy). The plantar osteotomy cut is created parallel to the weight bearing surface from medial to lateral, at 1 cm proximal to the MTP joint. A dorsal osteotomy cut was created that involves transecting the lateral cortex and a subsequent medial wedge removal for reduction of PASA. The metatarsal head was then transposed laterally to achieve the desired alignment (correction of IM and sesamoid bone position) in order to restore natural joint mechanics. The realigned metatarsal head was securely fixated in place with a 20 mm long mm.CS 3.5 resorbable compression screw, which required predrilling and a countersink (see figure 2). The phalangeal bone was addressed in a MIS technique through an Akin osteotomy using a highspeed burr and consequential realignment without any internal fixation. Taylor's bunion was also treated in a MIS approach (DMMO) leading to an orthograde fifth ray and realigned MT5 head and an appropriate dressing/taping according to the requirements of the MIS was applied.

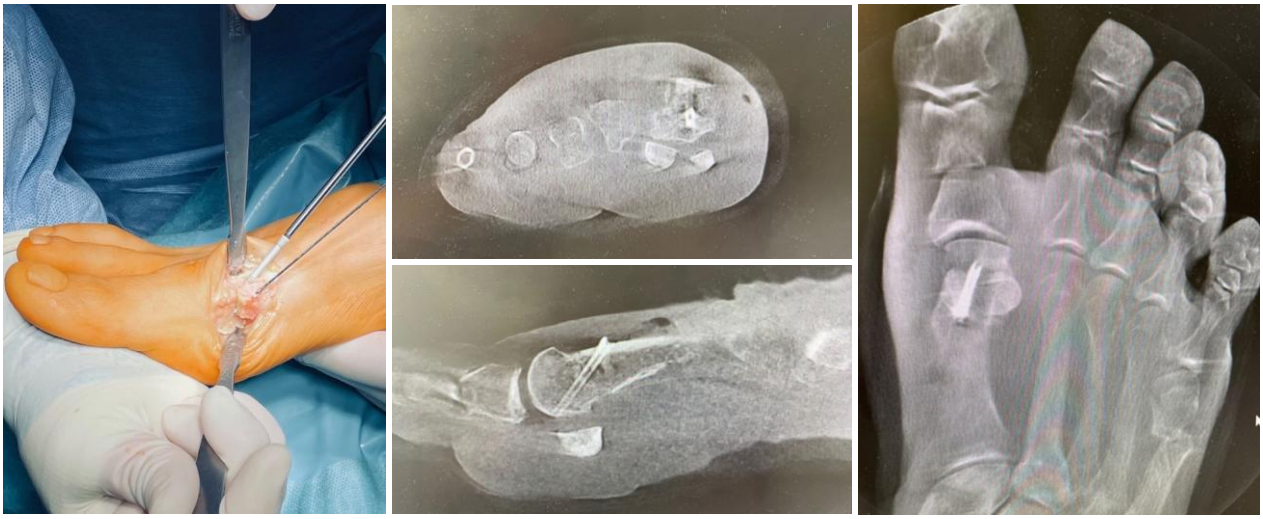

Figure 2: Intraoperative Imaging and DVT control post surgery.

Postoperative analysis

At six days postoperative, the patient reported a significant reduction in pain and discomfort. There was only slight swelling and she was able to walk without a limp in a special postoperative shoe with weight borne on the heel, and resumed some of her regular daily activities. DVT control revealed an aligned anatomical position and secure fixation (see figure 3).

Figure 3: Control at six day post surgery in DVT reveals good alignment.

The patient returned at twelve weeks postoperative, and reported, she was free from pain and had resumed all her preoperative daily activities and started running exercises. Radiographic imaging revealed an advanced bony consolidation in the regions of osteotomy in an anatomical position, with no signs of complications or abnormalities (see figure 4).

Figure4: Three months DVT control displays normal resorption pattern of mm.CS 3.5 screw.

After six months and again after 14 months the patient returned for a control at the clinics and was completely free from pain or any complications. The DVT control reveals a complete bony union and perfect realignment of the metatarsal bone. The performed MIS osteotomies at the first phalanx and the fifth ray have properly healed (see figures 5 and 6).

Figure 5: Control at six months reveals bony consolidation of osteotomy.

Figure 6: Radiographic control at 14 months reveals further resorption.

Discussion

The use of resorbable magnesium implant screws in combination with a proximal osteotomy of the first metatarsal head for the treatment of mild to moderate hallux valgus offers several advantages over traditional metal implants. The gradual resorption of the magnesium implants eliminates the need for a second surgery for the removal of hardware, thus reducing the risk of postoperative complications such as infection and hardware irritation The mm.CS screw has proven [12] high pull out forces and its material properties exceed those of existing PLLA screws by a factor of approx. 5 (related to tensile strength). It allows a postoperative treatment similar to conventional titanium screws. Further research is warranted to establish the efficacy and safety of this approach in the long-term, and to provide further evidence to support its use in the correction of hallux valgus. Medical magnesium GmbH is conducting a multi-center post market follow up study with leading surgeons in Germany to give a clear answer regarding decelerated bioabsorption and less signs of corrosion influence on the surrounding tissue, as displayed in this case report.

Literature List

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