

Original Article

Management of recurrent hallux valgus accompanied by angular deformity and arthritis with first metatarsophalangeal joint arthroplasty

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Abstract: Objectives: The aim of the study was to evaluate the effectiveness of total toe arthroplasty in patients with deformities repeatedly accompanied by first Metatarsophalangeal joint arthrosis following unsuccessful Hallux valgus surgery. Methods: Evaluation was made of a total of 12 cases with previous surgical treatment for a diagnosis of Hallux valgus who developed recurrence and joint arthritis (10 females, 2 males, Mean age: 64.9 years; range, 58-71 years). Preoperatively, the Hallux valgus and the intermetatarsal angle grades of all patients were determined according to the Kellgren-Lawrence radiological criteria, and the first toe length and the total range of movement, in addition to the American Orthopaedic Foot and Ankle Society (AOFAS) scores were determined. The postoperative H. Valgus and the inter-metatarsal angles and the acute recovery angles were determined. Finally, the Hallux valgus, the inter-metatarsal angles and loss of correction compared to the early post-operative period, the first metatarsal-phalangeal joint movement range and the final AOFAS score were evaluated. The mean follow-up duration was 51.5 months (range, 38-64 months). Results: The mean H. valgus angle was $32.3^\circ \pm 2.64^\circ$ preoperatively and $13.8^\circ \pm 2.37^\circ$ in the early post-operative period ($P < 0.001$). The mean intermetatarsal angles was determined as 10.5° (range, 9° - 12°) preoperatively and 9.5° (range, 9° - 12°) postoperatively at the final measurements ($P > 0.001$). The mean preoperative toe length was 48.5 mm (range, 42-58 mm) and 48.2 mm (range: 42-57 mm) postoperatively ($P > 0.001$). Range of motion was measured as mean 24° (range: 18° - 28°), preoperatively, and 26.6° (min: 22° -max: 32°) postoperatively. AOFAS values of mean of 56.5 (range, 52-64) preoperatively, increased to mean 83.9 (range, 66-90) postoperatively ($P < 0.001$). Conclusions: The results showed that corrective first MTP joint total arthroplasty applied to selected Hallux valgus cases with accompanying arthrosis, has satisfactory clinical and radiological results in the mid-term follow-up examinations.

Keywords: Hallux valgus, revision arthroplasty, surgery, arthrosis, deformity

Introduction

Hallux valgus is one of the most commonly encountered forefoot pathologies in orthopedic practice. In recent studies, the incidence of Hallux valgus between the ages of 18 and 65 years has been reported as 23%, and 35% in patient groups older than 65 years of age. Females constitute the majority of this population [1]. Many procedures have been defined according to the degree of the deformity. However, cases of recurrence and insufficiency are still problematic issues in H. Valgus surgery [2, 3]. There is not many alternative surgical choices of primary surgery for this clinical problem. Various surgical choices have been

recommended by various authors according to the degree of deformity and the patient in primary H. Valgus surgery [3, 4]. Furthermore, according to the performed surgical technique, revision rates of 5.56%-8.82% have been reported [3]. A part of this group consists of patients with first MTP joint arthrosis accompanying the deformity. For this group, besides the deformity, the arthrosis creates a second problem and poses additional challenges in the management. Currently, surgical treatments such as resection arthroplasty and arthrodesis are applied in these patients [4, 5]. In spite of all the technological and implant design developments in revision surgery, there is not many alternative treatment options.

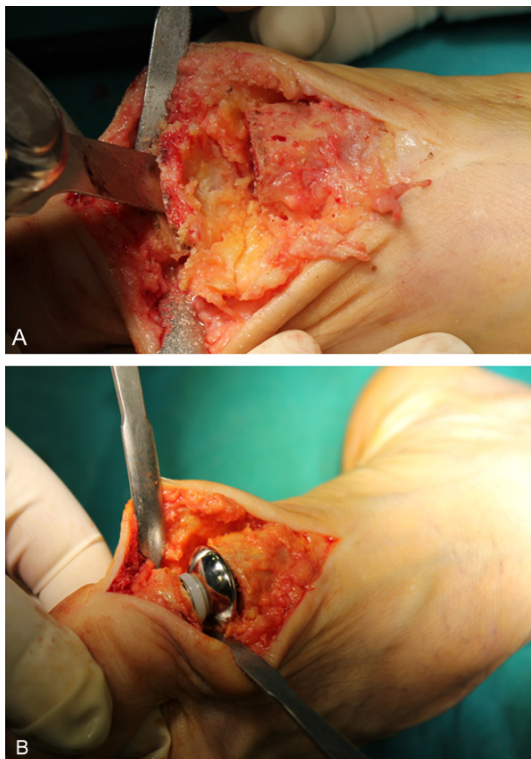


Figure 1. A. Intra-operative first Metatarsal and proximal phalanx osteotomies are seen. B. Intra-operative image of total toe arthroplasty application.

In this study, it was aimed to present the clinical results of total toe arthroplasty procedures that can correct valgus deformity besides protecting the joint motion range and first toe length. This can be a surgical alternative for the patient population with recurrent deformity accompanied by first MTP joint arthrosis following unsuccessful H. valgus surgery, however active these patients may be in their daily lives. To the best of our knowledge there has been no previous study in literature on this subject. The clinical results of this selected patient group are presented to demonstrate the effectiveness of the total joint arthroplasty surgical technique, which has been previously applied on different patient groups.

Cases and methods

This study conducted between June 2010 and May 2013 in our orthopaedi and traumatologia clinic. The study included 12 cases with a history of previous surgical treatment for a diagnosis of Hallux valgus, in whom recurrence and joint arthritis had developed (10 females, 2 males, Mean age: 64.9 years; min: 58; max: 71

years). The exclusion criteria were determined as an H. valgus angle of $\geq 35^\circ$, an inter-metatarsal angle of $\geq 15^\circ$, fewer than arthrosis symptoms, the presence of recurrent H. valgus without accompanying arthrosis, and inactive patients. All patients were provided with information prior to the surgical procedure, including alternative treatment protocols and that the treatment that would be applied is used for the treatment of similar diseases, although it is not a routine process for cases of recurrent and arthrosis-accompanied H. valgus. Informed consent was obtained from all patients. Pre-operatively, the H. valgus and the inter-metatarsal angle grades of all patients were determined according to the Kellgren-Lawrence radiological criteria, and the first toe length and total movement range, and the AOFAS and VAS scores were determined. Preoperative anesthesia consultations of the all patients included in the study were completed and the patients were hospitalized a day prior to the operation. Under spinal anaesthesia and pneumatic tourniquet providing 350 mmHg pressure to the femur, the approach in all the patients was with a long incision from the dorsal medial aspect of the first metatarsophalangeal joint. The capsule was reached and a V-shaped capsulotomy was performed. By applying soft tissue release, a lateral capsulotomy was achieved, followed by metatarsal and phalanx osteotomies. Having tested the implant, a total joint arthroplasty (TOEFIT PLUS[®] Smith & Nephew Orthopedics AG) was applied without cement (**Figure 1**). With the appropriate overcorrection, capsulorrhaphy was performed with 1/0 vicryl and the skin was closed with 3.0 prolene. A soft tampon was applied to all the patients and a short leg cast brace in the first web space holding the foot in adduction for 3 weeks in order to prevent correction. Partial weight-bearing was allowed in the 4th week, and full weight-bearing in the 6th week.

During the follow-up period, antero-posterior and lateral foot X-Rays were performed at 3-month intervals (**Figures 2, 3**). The early post-operative H. Valgus and the inter-metatarsal angles and acute recovery angles were determined. Finally, the H. valgus, the inter-metatarsal angles and loss of correction compared to the early post-operative period, the first metatarsal phalangeal joint movement range, the first toe length and the final AOFAS and VAS scores were evaluated (**Table 1**). The mean fol-

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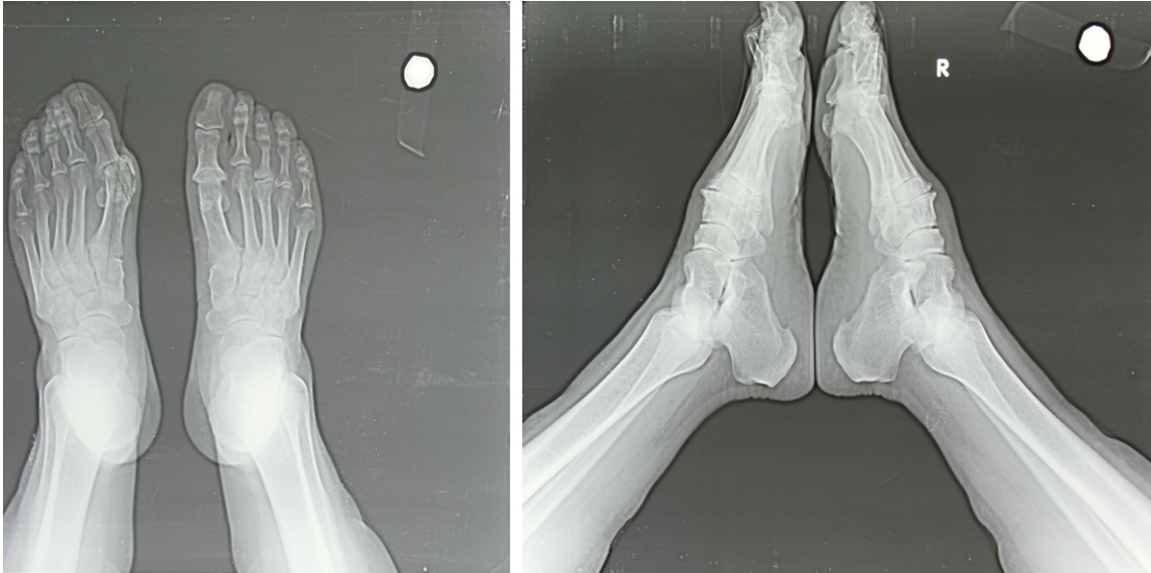


Figure 2. Preoperative AP and lateral foot X-Rays of a 65-year-old female patient; there is history of Right foot first toe distal metatarsal osteotomy 11 years ago. There are symptoms of recurrent Hallux valgus and joint arthrosis.

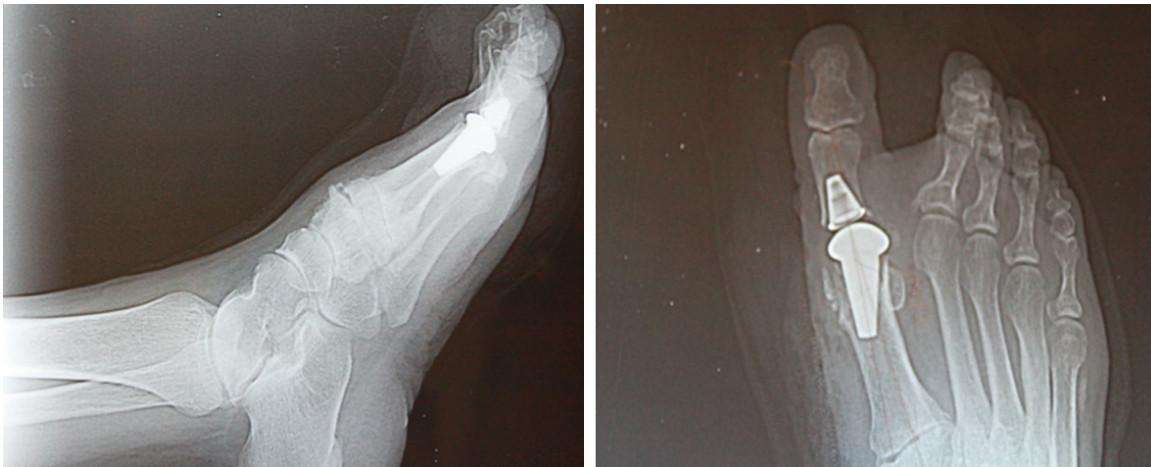


Figure 3. Anterior-posterior and lateral foot X-Rays on the Post-op first day; first MTP joint total arthroplasty in over-correction.

low-up duration was 51.5 months (min: 38-max: 64 months).

Statistical analysis

Statistical analysis was performed using the SPSS version 16.0 program. The characteristics of the patients were summarized by basic statistics. The numerical parameters are presented as mean, standard deviation, minimum and maximum values and 95% confidence interval in required cases, while the categorical variables are presented as number and percentage. Non-parametric Wilcoxon rank test

was used to evaluate the dependent variables. A value of $P < 0.05$ was accepted as statistically significant.

Results

The interval between the previous surgical intervention and the current intervention was mean 9.66 years (min: 8-max: 13 years). The transverse metatarsalgia, which was present in all the patients preoperatively, recovered in the 3rd postoperative month in 8 patients (67%). The preoperative H. valgus angle was mean $32.3^\circ \pm 2.64^\circ$, and mean $13.8^\circ \pm 2.37^\circ$ in the

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Table 1. Demographic, radiological and clinical data table

	N	Minimum	Maximum	Mean	StdDeviasyon
Age	12	58	71	64.92	4.641
Grade	12	3	4	3.75	.452
Pre-op H. Valgus angle	12	28	38	32.33	2.640
Post-op H. valgus angle	12	10	18	13.83	2.368
Final H. valgus angle	12	14	20	17.50	2.195
Pre-op IMA angle	12	9	12	10.50	1.000
Post-op IMA angle	12	9	11	9.50	.674
Final IMA angle	12	9	11	9.50	.674
H. valgus acute correction rate	12	15	23	18.50	2.505
H. valgus acute correction loss	12	2	6	3.67	1.303
Final IMA correction loss	12	0	0	.00	.000
Pre-op sagital plan movement	12	18	28	24.08	3.315
Post-op sagital plan movement	12	22	32	26.67	3.339
Pre-op first toe length	12	42	58	48.50	4.523
Post-op first toe length	12	42	57	47.42	4.379
Pre-op AOFAS	12	52	64	56.50	4.275
Post-op AOFAS	12	66	90	83.92	6.557
Follow-up time	12	38	64	51.5	8.135
Complication	0				

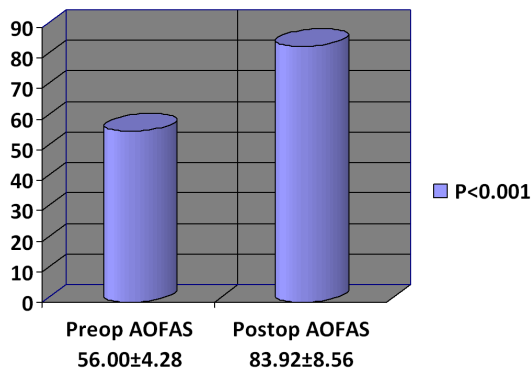


Figure 4. Pre-operative and post-operative AOFAS values; A significant increase is seen in the post-operative period statistically.

early post-operative period and correction of mean 23° (min: 15°-max: 23°) was obtained (P<0.001). The H. Valgus degree was determined as mean 17.5° (min: 14°-max: 20°) at the final follow-up examination, with loss of correction determined as mean 3.6° (min: 2°-max: 6°). The mean IMA was 10.5° preoperatively (min: 9°-max: 12°), and 9.5° (min: 9°-max: 12°) postoperatively at the final measurements (P>0.001). Mean toe length was measured as 48.5 mm (min: 42-max: 58 mm) preoperatively and 48.2 mm (min: 42-max: 57 mm) postopera-

tively (P>0.001). Range of motion was determined as 24±3.31° preoperatively, and 26.6±3.34° postoperatively (P>0.001). The mean AOFAS values of preoperative 56.5±4.28 increased to 83.9±8.56 postoperatively (P<0.001) (**Table 1; Figure 4**).

The postoperative H. valgus and IMA angles and the VAS values were determined to be statistically significantly lower than the preoperative values. The postoperative range of motion and the AOFAS values were statistically significantly higher than the preoperative values. No statistically sig-

nificant difference was determined in respect of first toe length (**Table 2; Figure 5**).

A negative relationship, which was not significant statistically, was determined between the patient age and postoperative AOFAS and VAS values. There was a negative correlation between the final H. valgus angles and the AOFAS and VAS values, which was not statistically significant (**Table 3**).

Discussion

In the surgical treatment of Hallux valgus pathology, different implants for fixation of the osteotomy region such as K wire, screws, and low-profile plate screw plates are in current use. Successful results have recently been reported with new materials such as polydioxanone bio-absorbable screws [4]. However, in spite of all the new implant designs and materials, recurrence of the deformity and insufficient clinical outcomes are still observed. Revision rates of 5.56%-8.82% have been reported according to the applied surgical technique [3]. Satisfactory results have been reported with first MTP joint arthrodesis and Keller's arthroplasty, which are the surgical procedures applied in these cases. Furthermore, good clini-

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Table 2. Pre-operative and Postoperative Clinical and Radiological data

	PRE-OP	POST-OP	P
H. V angle	32.33°±2.64°	13.83°±2.37°	<0.001
IMA angle	10.50°±1.00°	9.50°±0.67°	0.002
Range of motion	24.08°±3.31°	26.67°±3.34°	0.004
AOFAS	56.50±4.28	83.92±8.56	<0.001
VAS	5.23±0.68	0.62±0.16	<0.001
First Toe length (mm)	48.5±4.523	48.2±4.379	0.002

A statistically significant increase was observed in the Range of motion and AOFAS values and decreases in the H. valgus, IMA and VAS values.

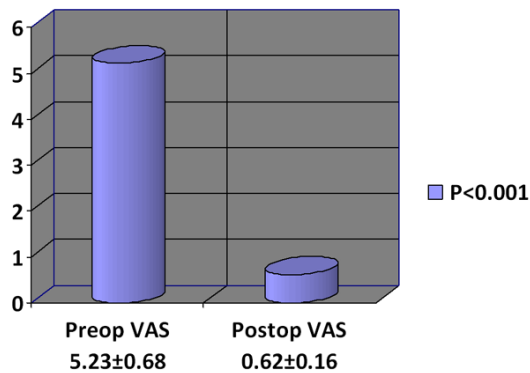


Figure 5. Pre-operative and Post-operative VAS values; There is a significant decrease in the post-operative period statistically. P<0.001.

cal results have been reported in literature with salvage osteotomies such as the Scarf procedure [5].

Better clinical results have been obtained with reconstructive surgical techniques in which the joint distance is preserved. In a clinical and radiological comparison of metatarsal osteotomy and Keller's excision arthroplasty applied in Primary H. Valgus cases, statistically significantly better results were reported in the osteotomy group [6]. However, in cases in which there is accompanying joint arthrosis, although angular correction has been obtained with these procedures, chondral problems will lead to clinically unsatisfactory results. Avascular necrosis of the first metatarsal head is one of the postoperative complications after distal metatarsal osteotomies which are applied for Hallux valgus treatment, and when large soft tissue dissection is applied this can lead to patient dissatisfaction [7, 8]. In a cadaver study of H. valgus by Doty et al., chondral lesions were detected in the first MTP joint [9]. Quite clearly, joint chondral lesions in primary or

recurrent cases, can be a part of H. Valgus pathology. Therefore, the surgical technique to be selected should also resolve this problem besides correcting the angular correction if there is an accompanying arthrosis. In this patient population, first MTP joint arthrodesis and Keller's resection arthroplasty are applied and successful results have been obtained with these surgical techniques [10-13].

Revision and failed cases constitute 9.3% of the first MTP joint arthrodesis applied due to different etiological causes. However, non-union and malunion are general problems encountered in arthrodesis cases. Non-union rates of approximately 5.4% and malunion rates of approximately 6.1% have been reported [14]. Furthermore, another unwanted result is the development of shortness of the first toe length according to the degree of the osteotomy performed.

It has been stated that protection of first line metatarsal phalangeal joint length has positive effects on the clinical outcomes after postoperative interventions. Schulz et al. reported better clinical scores in cases where a shorter proximal phalanx osteotomy was applied following resection arthroplasty [15]. Protection of the range of motion in addition to the joint length can be considered to provide advantages for active patients. First MTP joint motion is completely lost in arthrodesis procedures. The loss of range of motion following distal metatarsal osteotomies has been reported in literature [16].

With the first MTP joint total arthroplasty applied in the current study, it was aimed to treat the arthrosis in addition to angular correction, and to eliminate the negative effects on joint length and motion, which are the disadvantages of current arthrodesis, and resection arthroplasty applications. Fujiko et al. applied similar surgery to H. valgus cases accompanied by rheumatoid arthritis using a differently designed hinge type toe implant and reported 95% successful results after a mean of 8 years of follow-up [17]. Duncan et al. reported satisfactory short-term clinical and radiological results in H. rigidus cases which were surgically treated with total joint arthroplasty [18]. In the

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Table 3. The correlation between the final H. valgus angle with AOFAS and VAS values

		POST-OP AOFAS	POST-OP VAS
Final H. v angle	Pearson Correlation	-.193	-.177
Sig. (2-tailed)	>.549	.583	
N	12	12	

There is a negative correlation, which is not significant statistically.

current study, satisfactory results were also achieved in short and mid-term follow-ups of recurrent H. valgus cases with accompanying arthrosis following total toe arthroplasty performed with similar implants.

In conclusion, corrective first MTP joint total arthroplasty for selected cases with recurrent H. valgus with accompanying arthrosis provides satisfactory clinical and radiological results in the mid-term follow-up. In the active patient group, the advantages of this procedure include correction of the postoperative angular correction, improvement of clinical scores with partial protection of the first MTP joint range of motion and the toe length. The limitations of this study are the lack of different clinical studies supporting the results of the performed surgery, long-term clinical and radiological results of the procedure could not be obtained and the study had a limited patient population. Future prospective studies on this topic with longer follow-up periods will improve the understanding and reliability of the application.

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Disclosure of conflict of interest

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References

[1] Wülker N and Mittag F. The treatment of hallux valgus. *Dtsch Arztebl Int* 2012; 109: 857-67.

[2] Coughlin MJ and Roger A. Juvenile hallux valgus: Etiology and treatment. *Foot Ankle Int* 1995; 16: 682-97.

[3] Lagaay PM, Hamilton GA, Ford LA, Williams ME, Rush SM and Schuberth JM. Rates of revision surgery using Chevron-Austin osteotomy, Lapidus arthrodesis, and closing base wedge osteotomy for correction of hallux valgus deformity. *J Foot Ankle Surg* 2008; 47: 267-272.

[4] Alcelik I, Alnaib M, Pollock R, Marsh DJ and Tulloch CJ. Bioabsorbable fixation for Mitchell's bunionectomy osteotomy. *J Foot Ankle Surg* 2009; 48: 489-494.

[5] Bock P, Lanz U, Kröner A, Grabmeier G and Engel A. The Scarf osteotomy: A salvage procedure for recurrent hallux valgus in selected cases. *Clin Podiatr Med Surg* 2009; 26: 459-473.

[6] Zembsch A, Trnka HJ and Ritschl P. Correction of hallux valgus. Metatarsal osteotomy versus excision arthroplasty. *Clin Orthop Relat Res* 2000; 376: 183-194.

[7] Edwards WH. Avascular necrosis of the first metatarsal head. *Foot Ankle Clin* 2005; 10: 117-27.

[8] Goforth WD, Kruse D, Brantigan CO and Stone PA. Acute Ischemia after Revision Hallux Valgus Surgery Leading to Amputation. *J Foot Ankle Surg* 2013; 28: 301-303.

[9] Doty JF, Coughlin MJ, Hirose C, Kennedy M, Grebing B, Smith B, Cooper T, Galono P, Viladot R and Remington R. Articular chondral damage of the first metatarsal head and sesamoids: analysis of cadaver hallux valgus. *Foot Ankle Int* 2013; 34: 1090-1096.

[10] Kitaoka HB and Patzer GL. Arthrodesis versus resection arthroplasty for failed hallux valgus operations. *Clin Orthop Relat Res* 1998; 347: 208-214.

[11] Grimes JS and Coughlin MJ. First metatarsophalangeal joint arthrodesis as a treatment for failed hallux valgus surgery. *Foot Ankle Int* 2006; 27: 887-93.

[12] Jarde O, Chabaille E, Ganry O, Havet E and Vives P. Recurrent hallux valgus treated with metatarsophalangeal arthrodesis. A series of 32 patients. *Rev Chir Orthop Reparatrice Appar Mot* 2001; 87: 257-262.

[13] Ozkurt B, Aktekin CN, Altay M, Belhan O and Tabak Y. Range of motion of the first metatarsophalangeal joint after chevron procedure reinforced by a modified capsuloperiosteal flap. *Foot Ankle Int* 2008; 29: 903-909.

[14] Flamme CH, Wülker N, Kuckerts K, Gosse F and Wirth CJ. Follow-up results 17 years after

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- resection arthroplasty of the great toe. Arch Orthop Trauma Surg 1998; 117: 457-460.
- [15] Schulz CU, Feitenhansl A, Pellengahr C and Maier M. Resection-interposition arthroplasty in symptomatic hallux valgus: a revision of indication and technique. Z Orthop Ihre Grenzgeb 2003; 141: 440-444.
- [16] Roukis TS. Nonunion after arthrodesis of the first metatarsal-phalangeal joint: a systematic review. J Foot Ankle Surg 2011; 50: 710-713.
- [17] Fujioka H, Doita M, Saura R and Mizuno K. The long-term result of implant arthroplasty for hallux valgus deformity in rheumatoid arthritis. Ryumachi 1999; 39: 561-7.
- [18] Duncan NS, Farrar NG and Rajan RA. Early result of first metatarsophalangeal joint replacement using the ToeFIT-PLUS™ prosthesis. J Foot Ankle Surg 2014; 53: 265-268.