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## Longterm outcome after Evans osteotomy in adolescence: A case study

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### Abstract

Identifying decompensation of idiopathic flexible flatfoot can be difficult due to varying levels of expression and the complexity of the condition, making patient selection for surgical treatment a challenge. This case report presents the long-term follow-up of an Evans operation performed due to painful flatfoot in adolescence, and discusses the probable mechanism behind the loss of correction.

**Keywords:** Flatfoot - adolescence – operation – longterm-outcome

### Introduction

In the paediatric population, flatfoot is a common finding presented as flexible, painless foot deformity usually without functional consequences, which frequently resolves by adolescence <sup>[1]</sup>. The clinical findings of flatfoot deformity imply a collapsed medial arch, hindfoot valgus, forefoot abduction and tightness of the gastrocnemius or gastrocnemius-soleus complex <sup>[2]</sup>.

Seldom, adolescent flexible flatfoot decompensation occurs. In those cases, when conservative treatment has failed, operative interventions have to be considered. Particular in young patients, joint preventing operations are favored to arthrodesis <sup>[3]</sup>. The results of the clinical and radiological evaluation can guide to the selection of the surgical technique. The main objective of surgery is to fully correct the architecture of the foot <sup>[4]</sup>.

However, the exact indication, time and method for adolescent flatfoot reconstruction are still not clearly given as long-term studies are still missed <sup>[2]</sup>. Decompensation of idiopathic flexible flatfoot may be difficult to identify, due to different levels of expression and the complexity of change, raising challenges in patient selection for surgical treatment. In this case report the long-term follow up of Evans operation due to painful flatfoot in adolescence is reported and the probable mechanism of losing the correction is discussed.

### Case Report

R, female, was 6 years old when presented to our clinic with flexible flatfeet. After three years she became symptomatic on both sides with pain in the medial side of the foot during physical and sporting activities and significant shortening of the calf muscles. The longitudinal arch was collapsed. Orthotic devices, stretching exercises and outpatient physiotherapy were performed as a first step therapy. Henceforth, the patient was regular checked clinically.



**Fig 1:** Clinical Presentation - Preoperative

At the age of 12 years pain in both feet increased and was even present in almost all activities of daily life.



**Fig 2:** Preoperative radiographs (AP and lateral views of both feet)

The antero-posterior and lateral radiographs in standing position of both feet showed the results itemised in the table below. Full weightbearing X-ray of both feet were taken and following radiologic parameters measured: the calcaneal pitch, lateral talar-first metatarsal - and lateral talocalcaneal angle by lateral view while the talo-metatarsal angle, talocalcaneal angle and talonavicular coverage angle was determined by anterior- posterior view (Table 1). [5] Increasing pain in the medial longitudinal arch led to a pre-operative gait analysis and physician- patient- parents conversation. The indication of surgery was contrived and performed primarily for the left foot at 12, 4 years of age. Lateral column lengthening according to Evans and elaborated by Mosca was performed [3]. The osteotomy was performed perpendicularly to the long axis of the calcaneus and parallel to the calcaneo- cuboid joint. After distraction a tricortical bone graft harvested from the ipsilateral iliac crest was implanted. To avoid complications like dorsal subluxation of the dorsal fragment during distraction one pin was inserted in the distal to proximal direction to stabilise the joint. Once calcaneal lengthening was achieved a flexion osteotomy of the first metatarsal bone addressing the forefoot supination. Postoperatively, a lower leg cast was applied and the patient mobilized without weight bearing. K-wires were removed 8 weeks after operation after consolidation of the osteotomies, a further lower leg cast was applied and the non-weight bearing was changed to 20 kg partial weight bearing for 2 weeks more.



**Fig 4:** Postoperative radiographs (AP and lateral views of the right foot)

The subject was followed up clinically, radiologically as well as using person-related outcome measures (PROMS) for 10 years after the foot surgery. The short term (6 months), mid-term (5 years) and long-term results are presented and discussed. Clinical inspection showed good foot correction in both feet 6 months after each operation with a restoring of the medial arch, no swelling, no redness and no pain. The subject could fully weight bear without any pain. Radiological parameters at this time showed significant improvement in all value. To re-evaluate the situation a clinical and radiological follow up 5 years after the index surgery was performed.



**Fig 3:** Postoperative radiographs (AP and lateral views of the left foot)

The same procedure with the identical follow-up protocol was performed on the right foot one year later.



**Fig 5:** Clinical presentation - Postoperative

At skeletal maturity (follow-up after 5 years), longitudinal arch correction was maintained. In contrast, the Meary angle, deteriorated (Table 1). Hindfoot valgus showed a loose of correction in the follow up. Kite’s angle on both sides stayed in the normal range (Table 1). The talonavicular coverage angle showed preoperatively a subluxation on both sides which was improved by surgery and the outcome attained at the 6 months follow up. However, there was a slight deterioration at follow up after 5 years.

Additionally, to clinical examination and radiologic follow-ups, we used different patient reported outcome measures to evaluate the foot improving surgery. There is no consensus or gold-standard scoring system in foot and ankle surgery to date. AOFAS which is based on the subjective and objective findings, was used to figure out the main criteria such as pain, function and alignment. The ankle- hindfoot score yielded 90 from 100 points and the midfoot score 76 out of

100 points. The loss of points resulted from the category pain, which the patient mentioned occasionally. The Maryland Foot Score showed an excellent result (93 out of 100 points), although the patient reported slight pain not affecting her activities of daily living. In addition, the Kieler- Calcaneusscore was performed. The outcome mentioned a good result (84 out of 100 points). In this respect again, pain limited the result.

**Table 1:** Hindfoot valgus showed a loose of correction in the follow up. Kite's angle on both sides stayed in the normal range

		Pre-operative		Post-operative		5 years follow up		Normal value
		Left	Right	Left	Right	Left	Right	
Lateral	CP [°]	10	13	20	23	20	22	18-20°
	TC angle [°]	47	54	47	31	54	54	25-45°
	TC - 1st angle [°]	29	36	7	9	20	13	0°
AP	TC angle [°]	15	25	8	20	29	31	15-30°
	TN angle [°]	25	31	10	18	18	22	<7°
	T- 1st meta angle [°]	12	19	10	9	14	11	0°

CP... Calcaneal pitch [°], TC... lateral talocalcaneal angle [°], T-1st meta... lateral talar- 1st metatarsal angle [°], TC angle... AP talocalcaneal angle [°], TN angle ... Talonavicular coverage angle [°], T-1st meta angle... AP talar- 1st metatarsal angle [°]

In the last clinical follow up after 10 years the subject was a walking, full weight bearing, without pain in daily life and free from discomfort.

## Discussion

This case report presents the long-term outcome of Evans calcaneus lengthening surgery in an adolescent subject that was clinically, functionally and radiologically followed up for 10 years. Although Evans technique is a standard foot surgery in paediatric and adolescent population – the long-term outcome of this procedure is rarely presented in literature.

Joint sparing osteotomies have the advantage of correcting the deformity, preserving the tarsal motion and realigning the foot without sacrificing mobility<sup>[6]</sup>. The Evans calcaneal osteotomy is currently the premier procedure for lateral column lengthening of a flexible flatfoot deformity. The clinical alteration ameliorates in a significant way and by reconstituting the calcaneal-cuboid joint to a proper alignment, joint pressure decrease and preserves the joint from arthrosis<sup>[7]</sup>.

In our pedicular case, we performed Evans osteotomy in a 12-year-old female patient with flexible flatfeet and considerable symptoms resulting in functional disturbance in both feet. Our results show satisfactory foot function and correction at skeletal maturity following a calcaneal lengthening surgery.

Postoperative outpatient follow-ups showed a walking, full weight bearing patient without pain in daily life and free from discomfort. The radiological parameters improve in all-upraised parameter in the first follow ups. Over the course of time, radiological findings slightly deteriorated however the patient continued to be free of symptoms with good functionality. As studies showed, calcaneal lengthening operation leads to significant clinical improvement<sup>[8, 9]</sup>. But there are still some difficulties to quantify radiological improvements of the three-dimension correction. Motion through the subtalar joint may have a largely rotational component which can be outside the plain of the radiograph<sup>[10]</sup>. Numerically we lost some correction radiographically in our 5 years follow up at skeletal maturity. On the one hand, the increasing load on the foot and thus the greater force exerted on the implant can lead to

a loss of the correction primarily achieved, on the other hand, with advancing age, the ossification of the foot proceeds, so the loss of correction can be explained. Another reason for the deterioration could be an increased load due to weight gain or bony remodelling during the healing process, resulting in radiological loss of correction. The current literature showed no similar surveys within the same deterioration at the last follow up. However, there are only very few studies with an observation period of 10 years.

Despite the loss of radiological correction, the functional outcome still remains well, with subjective satisfaction reflected by patient reported outcome measures. We used standardized questionnaires to determine the functional outcome and the quality of life (AOFAS, Maryland-Score, Kieler Calcaneusscore). All scores showed excellent to good results. Minimal loss of points resulted from the category pain, which the patient mentioned occasionally. Even in our last follow up after 10 years there were no signs of arthrosis.

In the short-term follow up, we achieved adequate clinical as well as radiological results compared to literature<sup>[9, 11, 12]</sup>. Even though, we lost some radiological correction at our follow up at skeletal maturity, clinical and functional restoration of the foot was still satisfactory. To our knowledge, no direct correlation has been found in the literature between the clinical presentation of adolescent flatfoot, the radiological findings and the outcome of patient reported outcome measurements.

## Conclusion

In conclusion Evans osteotomy in adolescent subjects with painful flexible flatfoot is a very valid and secure procedure, but appropriate patient selection is necessary. Suitable for this method are patients with painful flexible flatfoot, which cannot be straightened in the stance phase and after exhaustion of conservative therapy, such as insoles or shoe wear.

The success of the procedures should be judged on the basis of the relief of symptoms, the adequacy and maintenance of correction of the deformity, the restoration of function and a favourable long-term prognosis<sup>[3]</sup>.

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