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# Tibiocalcaneal arthrodesis using screws in the treatment of equinovarus deformity of the foot in adult: a retrospective study of 42 cases

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# ABSTRACT

The authors have retrospectively studied 42 cases of tibiocalcaneal arthrodesis using large cannulated AO screws, staples and iliac crest graft mixed in treatment of fixed equinovarus deformity of the foot in adult patients. There were 25 men and 17 women aged 22 to 70 (mean, 45) years. All patients were reviewed with an average of 5 years. The operations were performed between 2005 and 2012.Preoperatively, all patients had 50° of the mean calcaneal varus deformity and 75° (60-90°) of equinus deformity on Meary's radiological. There were 24 idiopathic, 8 post traumatic,6 neurologic associated with IMC,4 polio. Clinical and functional outcome was assessed with the kitaoka score, the x-rays included an AP and lateral view of the ankle and Meary view .Resultats were excellent in 73%, good in 18 %, fair in 9%. X-rays showed 3 nonunions after 2 years and were reported. We noted 2 postoperative cutaneous necrosis; the shortening was an average 2 cm. After a mean follow-up duration of 5±2.93 years; All patients stated that they improvement of pain and function. 40 patients returned to independent ambulation, wearing custom-made shoes with molded insoles. We belive that the tibiocalcaneal arthrodesis should be used to treat the fixed equinovarus deformity in the adult whatever its etiology.

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## Introduction

The fixed equinovarus deformity of the foot in adult present a social problem for to obtain a plantigrade foot, painless ,compatible with sport activities and shoe insert(1). The tibiocalcaneal arthrodesis is surgical correction of deformity and stabilization of the tibia to the calcaneus and remaining head and neck of the talus may be required for salvage (2, 3). Adams prefers a transfibular open technique employing cannulated screws for fixation. This technique has been well described and it has almost been exhaustively studied biomechanically (4). It gives a best functional result, but at the expense of shortening. We have used a modification of his technique using large cannulated AO screws, staples and iliac crest graft. The purpose of this investigation was to evaluate the outcome of tibiocalcaneal arthrodesis using crossed screw in the fixed equinovarus deformity in the adult.

# **Materials And Method**

## 1. Series

We retrospectively reviewed 42 patients between January 2006 to December 2012. 22 men and 17 women aged 22 to 70 (mean, 45) years with fixed equinovarus deformity of the foot treated by tibiocalcaneal arthrodesis (fig.1). The man follow-up period was 24 (range, 6-48) months. Preoperatively, all patients had 50° of the mean calcaneal varus deformity and 75° (60-90°) of equinus deformity on Meary's radiological. There were 24 idiopathic, 8 post traumatic,6 neurologic associated with IMC,4 polio .Patients were assessed post operatively using kitaoka's scoring.

# 2. Method

A retrospective review of 42 patients who underwent

tibiocalcaneal arthrodesis in treatment of fixed equinovarus deformity. The Ray- evaluation compared to contralateral foot was measured by Meary radiograph (fig.2). The arthrodesis was made by Meary's screw crossed method and staples. All patients were evaluated postoperatively by interview and, clinical and functional examination including the criteria of the AOFAS-score gives scores from 0 to 100. A score of 90 -100 is judged as an excellent result, 75-89 as good, 60-74 as fair and below 60 as poor.

## Surgical Technique

The preparation of the articular surface of the upper and lower ankle for arthrodesis. A lateral curvilinear incision or an anteromedial incision is made over the distal on fourth of the fibula down to the calcaneus. Malleolus was often resected completely for obtaining a contact tibiocalcaneal. The remnants of the talar body are removed while preserving the talar head and neck after lengthening Achille tendon and soft part released (fig.3). All articular surfaces are denuded including the tibial plafond, medial malleolus and calcaneus .Multiple small drill holes are made in the denuded areas to stimulate bleeding and growth factors for bony healing. The resected fibula or iliac crest graft is placed between the calcaneus and the tibia to assist with bony fusion.K-wires can be used to hold the reduction with the foot plantigrade and the hind foot in 5 degrees of valgus and 5-10 degrees of external rotation. The crossed screw and staples are used alone or associated to stabilize the tibia to the calcaneus. The first screw is placed from the anterolateral tibia aimed distal and posterior into the calcaneus, another screw from the posterior tibia can be aimed distally and anteriorly Into

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the talar head that is resting anteriorly on the tibia.In 34 cases the crossed Meary's screws were made (fig. 4), and staples in 8cases (Fig. 5).The cast is changed at 2-4 week intervals until fusion is acquired, often up to 3-6 months(Fig.6). **Kitaoka Score (5)** 

	CATEGORIES	POINTS
1.PAIN	-none	40
	- Mild occasional	30
	- Moderate daily	20
	- Severe, almost always present	0
2. Function-activity	- No limitation, no support	10
limitations/support	-No limitation of daily	7
requirements.	activities, limitation of	
	recreational activities, no	
	support	
	-Limited daily and recreational	4
	activities, cane.	
	-severe limitation of daily and	0
	recreational activities, walker,	
	crutches, wheelchair, brace.	
3.Maximum walking	- creater than 6	5
distance(blocks)	- 4-6	4
	- 1-3	2
	-less than 1	0
4.Walking surfaces	-No difficult on any surface	5
	-Some difficult on uneven	3
	terrain, stairs, inclines, ladders	
	-Severe difficult on uneven	0
	terrain, stairs, inclines, ladders	
5.GAIT ABNORMALITY	-None,Slight	8
	-Obvious	4
	-Marked	0
6.SAGITTAL MOTION	-Normal or mild restriction	8
(flexion plus extension)	(30° or more)	
	-Moderate restriction (15°-	4
	29°)	
	-Severe restriction (less than	0
	15°)	
7.HINDFOOT MOTION	-Normal or mild restriction(	6
(Inversion plus eversion)	75°-100° normal)	
	-Moderate restriction (25°-	3
	75°normal)	
	-Market restriction (less than	0
	25° normal)	
8.ALIGNEMENT AXIAL	- Good, plantigrade foot, ankle-	10
	hindfoot well aligned	~
	-Fair, plantigrade foot, some	5
	degree of ankle-hind foot	
	malalignement observed, no	
	symptoms	0
	- roor nonpianigraal joot,	U
	severe matalignement,	
Ο ΔΝΚΙ Ε-ΗΙΝΠΕΩΩΤ	Sympions.	8
STARII ITY	Definitely unstable	0
(antreronosterior varus-	-Definitely unsiddle	0
valous)		
	l	I

**Outcames** 1. Fusion

96% fusion rate occurred at an average of 12 weeks (range, 6 to 48 weeks). The radiographic union was ascertained by the appareance of continuous osseous trabeculae across the arthrodesis.

2. Complications:

• Two cases of infection on the surgical wound which responded to local wound care and oral antibiotics

• 3 cases of nonunion that caused recurrence after 2 years .And hardware failure in 4 cases removal for symptomatic screw heads: two on the plantar posterior surface of the calcaneus and two over the medial malleolus.

Figure 1. Fixed equinovarus deformity of the foot in adult



Figure 2: Meary's radiograph



Figure 3: Released soft parts and lengthening Achille tendon



Figure 4. Meary's screw crossed method



#### Figure 5. Arthrodesis employing the staples



Figure 6. Plantigrade foot at 6 months postop.in a 35-yearold man with neurologic foot associated to IMC



2. Clinical results.

All patients were examined at an average of 3.1 years (range 1.4 to 6.2 years)

-The average leg length discrepancy was 2 cm

-The average position of fusion was 2 degrees of dorsiflexion and 5 degrees of plantar flexion.

# Functional Evaluation

1. Walking surfaces

-28 patients had No difficult on any surface

- 12 patients had some difficult on uneven terrain, stairs, inclines, ladders

-2 patients had Severe difficult on uneven terrain, stairs, inclines, ladders

# 2. MOBILITY OF MIDFOOT:

 $\bullet$  An average of dorsiflexion of midfoot was 10  $^\circ$  and plantar flexion 15% in 35 patients;

And Ankylosis in 7 patients.

3. FOOTWEAR:

 $\bullet$  25 patients wear the shoes market with heel single trade 2cm

• 17 patients used orthopedic shoes

4. ALIGNEMENT AXIAL

-31 Patients had Good, plantigrade foot, ankle-hindfoot well aligned

-9 patients had fair, plantigrade foot, some degree of anklehind foot malalignement observed, no symptoms

-2 patients with Poor nonplantigrade foot, severe malalignement, symptoms.

5. Activities limitations

• 32 patients were never limited

- •7 were limited to sport
- 3 were limited to activities
- No patient was limited to walking
- 6. THE PAIN TO THE WALKING
  - Painless in 18 patients
  - 15 had pain in heavy activities
  - 7 had pain in sports
    - 2 had pain in daily activities
- Discussion

Arthrodesis has been an accepted treatment for painful arthritis of ankle and subtalar joints in 1882 reported by Albert (6).In 1948 Adams performed a tibiocalcaneal arthrodesis with a long three flanged nail driven from the os calcis into the tibial shaft Numerous techniques exist describing fusion approaches and implants, all having in common a similar goal: a solid ,pain free arthrodesis in biomechanically stable and functional position(4). The indications of tibiocal caneal arthrodesis in our series include idiopathic equinovarus fixed deformity, sequelae post traumatic, neuromuscular clubfoot associated with IMC, and polio. Johnson (7) et al reported some indications include a vascular necrosis of the talus or a failed total ankle arthroplasty with subtalar intrusion. They used an IM Nail for tibiotalocalcaneal but the long-term were not known as yet. The patients with rheumatoid or osteoarthritis failed ankle are candidates of tibiocalcaneal arthrodesis (8). Other indications include Charcot arthropathy, neuropathic ankle deformity, and skeletal defects after tumor reconstruction, pseudarthrosis as well as fixed and various flail deformities about the hindfoot and ankle are olso candidates to tibiocalcaneal arthrodesis (9, 10). When there is significant instability, subluxation or arthritis involving not only the ankle and hind foot but olso the transverse tarsal joint then coupling midfoot to the hindfoot by fusing the talonavicular, calcaneocuboid and calcaneonavicular articulations is indicated(11).Contraindications of tibiocalcaneal and pantalar arthrodesis include a dysvascular extremity or one that has a severe active infection(12). The fixation was made by cannulated AO screws, Blount clips associated to iliac crest graft. All articular surfaces are denuded including the tibial plafond, medial malleolus and calcaneus .Multiple small drill holes are made in the denuded areas to stimulate bleeding and growth factors for bony healing. Jarde placed plate and screws and obtained fusion (1). Adams in 1948 performed a tibiocalcaneal arthrodesis with a long three flanged nail driven from the os calcis into the tibial shaft (4).Leikkonen in 1950 placed a metal spike from the calcaneus through the talus and tibia for ten days after performing a primary fusion (13).Kuntscher recommended placing an intramedullary nail through the foot into the femur for simultaneously ankylosing the ankle and knee joints (14). The fibular graft can be placed through a hole made in the calcaneus, talus and tibia by a cannulated drill over a guide wires. Blair described in 1943 a sliding tibial graft that was fixed to the talar head and neck to obtain tibiotalar fusion in cases of comminuted fractures and fracture/dislocations of the body of the astragalus resulting in either a vascular necrosis or significant collapse (15). Tibiocalcaneal arthrodesis using Ilizarov fixator is a viable alternative to amputation in patients with infected nonunion or large bone loss of the talus (16). In neuropathic ankle, Alvarez (17) treated by blade plate fixation for tibiocalcaneal arthrodesis and obtained 93% of fusion at an average of 16 weeks. The complications such as infections, non union, and tibial stress fracture were reported in literature. Johnson et al. (18) obtained

47% nonunion of triple arthrodesis caused by obesity, short immobilization and the loss of reduction. In our series: 96% fusion rate occurred at an average of 12 weeks (range, 6 to 48 weeks). The radiographic union was ascertained by the appearance of continuous osseous trabeculae across the arthrodesis. Two cases of infection on the surgical wound which responded to local wound care and oral antibiotics. 3 cases of nonunion that caused recurrence after 2 years .And hardware failure in 4 cases removal for symptomatic screw heads. An average shortening of 2 cm was obtained. In series of Mirzayan all feet were stiff and had an average of 3.5cm limb length discrepancy (19) According to KITAOKA score (20) the results were excellent in 73%, good in 18 % , fair in 9%. And 40 patients returned to independent ambulation, wearing custommade shoes with molded insoles.

#### Conclusion

The goals of tibiocalcaneal arthrodesis in treatment of fixed equinovarus deformity in adult was to obtain plantigrade foot, relief of pain and deformity, compatible with sport activities and shoe insert. 42 patients there were 25 men and 17 women aged 22 to 70 (mean, 45) years. The operations were performed between 2005 and 2012. Resultats evaluated according to KItaoka's scoring were excellent in 73%, good in 18%, fair in 9%, after a mean follow-up duration of 5±2.93 years; All patients stated that they improvement of pain and function. 40 patients returned to independent ambulation, wearing custommade shoes with molded insoles. We belive that the tibiocalcaneal arthrodesis should be used to treat the fixed equinovarus deformity in the adult whatever its etiology.

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