

# Triple Arthrodesis for Equinovarus Foot using Ilizarov Technique: A Retrospective Study

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## ABSTRACT

**Introduction:** Equinovarus foot deformity is a significant problem in adolescents and its treatment remains challenging. Triple arthrodesis, even though an effective palliative tool in management of complex foot deformity, has its own limitations if it is done for acute deformity correction. Ilizarov technique offers gradual deformity correction, fusion and takes care of many known complications of acute correction. However, there are very few studies about effectiveness and functional outcome of triple arthrodesis for equinovarus deformity when done gradually with an Ilizarov fixator.

**Aim:** To study the effectiveness of triple arthrodesis, performed with Ilizarov technique for equinovarus foot deformity in adolescents and adults and to evaluate the early functional outcome and patient satisfaction rate for this procedure.

**Materials and Methods:** A retrospective analysis of 22 feet in 20 patients with equinovarus foot deformity between January 2015 and December 2018 was done. Patients underwent gradual deformity correction and triple fusion with Ilizarov fixator. Foot was assessed for any residual deformity and shortening. Functional outcome and

patient satisfaction were assessed by Ankle Hind Foot Scale (AHFS) and Likert scale, respectively using paired t-test. Final analysis was done with Statistical Package for Social Sciences (SPSS) software version 21.0.

**Results:** Twelve males and eight females with mean age of  $15.9 \pm 3.4$  years fulfilled the inclusion criteria and were included for final analysis of results. Fusion rate was 86.1% with mean union time of 12.5 weeks. Mean AHFS improved from 61.27 before surgery to 76.9 which was statistically significant ( $p < 0.0001$ ). One or more complications were seen in 15 (68.1%) feet but were managed satisfactorily without any significant impact on final outcome. Patient satisfaction rate for the procedure was 80%. After a mean follow-up of 18.1 months, plantigrade foot with equal foot length was obtained in all patients.

**Conclusion:** Triple arthrodesis with gradual deformity correction by Ilizarov technique effectively corrects equinovarus foot deformity and foot length discrepancy. Known complications of acute deformity correction can be avoided with equally good results. It corrects deformity and restores alignment of foot more accurately leading to a high patient satisfaction rate.

**Keywords:** Adolescents, Deformity, Fusion, Gradual correction, Ring fixator

## INTRODUCTION

Equinovarus deformity of foot can be congenital or acquired. It consists of structural abnormalities and/or muscular imbalances affecting the function of foot. The most recognisable congenital form is Congenital Talipes Equinovarus (CTEV) characterised by plantar flexion of ankle, inversion of hind foot and adduction of forefoot [1]. Global prevalence of CTEV (clubfoot) is 1 to 2 per 1000 live births with a male to female ratio of 2:1 [2]. A congenital clubfoot deformity can be further divided into idiopathic and non idiopathic types (syndromic) [3]. An acquired Equinovarus foot deformity can develop due to neurogenic cause (spina bifida, sciatic nerve injury, polio, and cerebral palsy), vascular cause (ischaemic contracture, paralysis), muscular dystrophy, tibial hemimelia or as a sequelae of infection, injury or burn [3]. Even after tremendous work and enough orthopaedic literature focused on diagnosis and management of these deformities, it remains a significant problem in adolescents with many challenges in treatment [1].

Triple arthrodesis is a well-established palliative tool for treatment of equinovarus deformity in adolescents and adults. It consists of fusion of subtalar, calcaneocuboid and talonavicular joints. Although, it is a useful tool for complex clubfoot deformity in adolescents, it has many disadvantages if done for acute correction of deformity [4-6]. Use of internal implant, risk of infection and wound breakdown are some well-known complications. Acute correction of deformity can put surrounding neurovascular structures at the risk of stretch injury. Malunion, over correction and residual deformity after procedure is a possibility which can be symptomatic and needs revision surgery [7-9]. Use of a plaster cast for immobilisation after the procedure

has its own problems. Furthermore, resection of lateral and dorsal wedges for acute correction further shortens an already short foot and is a significant concern for patient in terms of functional ability, cosmetic appearance and use of footwear [10,11].

Ilizarov technique with or without soft tissue and bony procedures has become popular as a minimally invasive tool in management of neglected, relapsed and resistant clubfoot in children [12-14]. It allows for gradual correction of deformity in all planes simultaneously without excessive stretching of neurovascular and other soft tissue structures. Problems of wound healing are significantly less and it allows for continuous manipulation in postoperative period thereby allowing for more accurate restoration of alignment [12,13].

However, there are very few studies reporting the results of triple arthrodesis with an external fixator [7,8,15]. Most of these studies performed acute deformity correction and used external fixator to hold the foot till satisfactory fusion [7,8]. Few studies performed gradual deformity correction using Ilizarov fixator [15,16]. However, observations were limited to its effectiveness in correcting deformity without any comment on functional outcome and overall patient satisfaction. Hence, this present study was conducted to evaluate the effectiveness of triple arthrodesis performed with Ilizarov technique for equinovarus foot deformity and to evaluate the early functional outcome and patient satisfaction rate for this procedure.

## MATERIALS AND METHODS

Retrospective analysis of data was done between October 2020 and December 2020 at Christian Medical College and Hospital, Ludhiana, Punjab. It included the patients undergoing triple arthrodesis with

ring fixator for equinovarus deformity between January 2015 and December 2018. Approval of Institutional Ethics Committee was taken (IECCMCL/01-1192020) and all procedures followed were in accordance with the standards mentioned in Helsinki declaration of 1975 and revised in 2013 [17].

**Inclusion criteria:** Children over 12 years of age, adults and those with a minimum follow-up of one year after surgery were included in the study. The upper age limit for inclusion of patients was not fixed.

**Exclusion criteria:** Patients with inadequate follow-up, age less than 12 years or with compromised vascularity of foot were excluded.

**Sample size calculation:** A total of 42 patients with equinovarus deformity of foot had undergone triple fusion in above mentioned time period (January 2015 to December 2018). Acute surgical correction and internal fixation either with screw or staple was done in 18 patients whereas 24 underwent gradual correction and fusion with Ilizarov fixator. Four patients did not turn up for follow-up after fixator removal and hence were excluded from this study.

### Data Collection

The clinical and radiological data of remaining 20 patients (22 feet) was evaluated for age, gender, cause of deformity and severity of deformity.

Severity of deformity was analysed preoperatively with Dimeglio score [18]. It consists of four major and four minor individual components:

**Major components:** Equinus, heel varus, derotation of calcaneopedal block and forefoot adduction are the major components and may carry a score between 0 and 4 each, based on their reducibility.

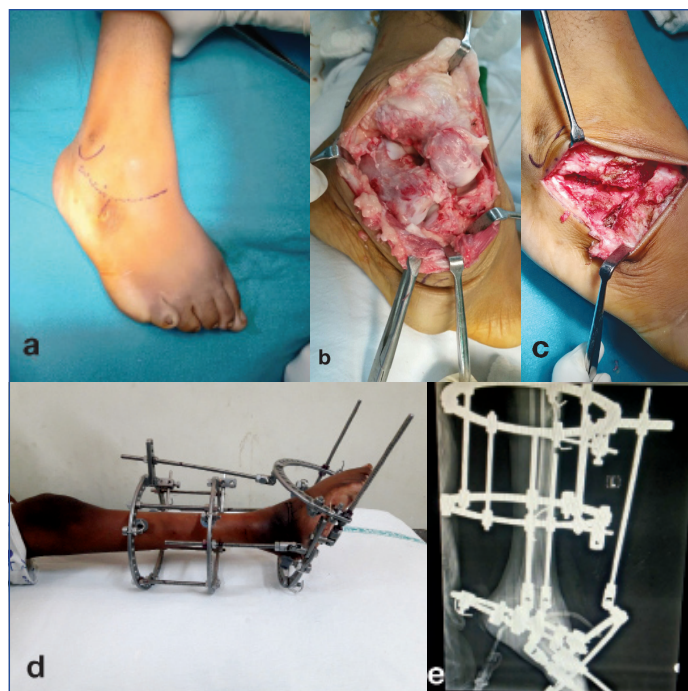
**Minor components:** Medial crease, posterior crease, cavus and poor muscle condition are minor components and carry score of 1 if present.

Minimum possible total score is 0 suggesting a normal foot, whereas maximum possible score is 20. Accordingly, deformity can be graded as benign ( $\leq 5$ ), moderate (6-10), severe (11-15) and very severe ( $> 15$ ).

**Ankle hind foot score:** Functional score was calculated with AHFS developed by American Orthopaedic Foot and Ankle Society [19]. The scale observes pain, function and alignment of foot with maximum score of 40, 50 and 10, respectively. Maximum possible total score is 100 suggesting best outcome. However, for patients undergoing triple arthrodesis and having no hind foot motion, maximum total score is 94. No cut-off points of AHFS are mentioned in the literature. However, to perform a regression analysis, functional score was categorised into good function (AHFS of 55-94) and poor function (AHFS  $\leq 54$ ) as suggested by de Groot IB et al., [9].

All patients underwent gradual deformity correction and triple fusion using Ilizarov principle of distraction osteogenesis under hospital protocol [Table/Fig-1]. Once satisfactory correction was achieved, distraction was continued further between hind foot and midfoot to correct any foot length discrepancy.

Patients were followed up in outpatient department on weekly basis during distraction phase and then on monthly basis till satisfactory fusion was achieved. Anteroposterior and lateral radiographs of foot were taken at every follow-up to see the status of union and rate of distraction was adjusted accordingly. All patients were encouraged to walk with support as soon as they were comfortable and pain free. They were kept non weight bearing for six weeks. Thereafter, they were allowed partial weight bearing and full weight bearing was allowed after 12 weeks. Once satisfactory fusion was evident on radiograph, fixator was removed and below knee walking cast was given for another four weeks. The cast was then removed and range of movement exercises were started for ankle and forefoot joints [15]. Ankle foot orthosis was advised for another 12 weeks.



**[Table/Fig-1]:** Surgical technique: a) Incision; b) Talo-calcaneal, Talonavicular and Calcaneocuboid joints after exposure; c) After removal of cartilage from three joints; d) After application of Ilizarov frame; e) Postoperative radiographs.

Functional outcome after surgery was evaluated every six months by AHFS. Patient satisfaction for the procedure was assessed on a 5-point Likert scale after 12 months of surgery. The patients were asked about their satisfaction level for overall result and were referred as very unsatisfied, unsatisfied, neutral, satisfied and very satisfied with score of 1 to 5, respectively.

### STATISTICAL ANALYSIS

Presentation of categorical variables was done in the form of number and percentage (%). On the other hand, presentation of continuous variables was done as mean $\pm$ SD and median values. Comparison of variables which were quantitative in nature were analysed using paired t-test. Data entry were done in Microsoft excel spreadsheet and final analysis was done using SPSS software version 21.0. For statistical significance, p-value of less than 0.05 was considered as significant.

### RESULTS

Details of 22 feet in 20 patients satisfying inclusion criteria is summarised in [Table/Fig-2]. Mean age at the time of surgery was 15.9 $\pm$ 3.4 years (range from 12-25 years). Twelve patients were male with male to female ratio of 3:2. Mean follow-up after surgery was 18.1 $\pm$ 5.1 months (range 12-30 months).

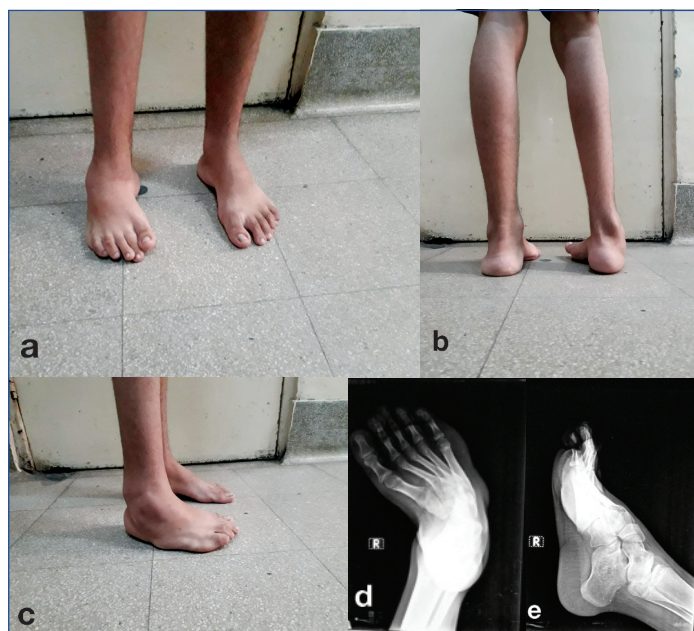
Two patients underwent fusion in both feet one after another, after an interval of six months. In those with unilateral correction, right foot was involved in 10 and left foot in 8 patients. Mean foot length discrepancy before surgery was 1.7 $\pm$ 0.95 cm (range from 1-3 cm). Idiopathic CTEV was the most common cause of deformity and was seen in eight patients. Ten patients had undergone earlier soft tissue release before undergoing triple fusion. One presented with chronic ulcer in weight bearing zone. They were treated in contact cast and definitive fusion was done once complete healing of wound was achieved. Mean Dimeglio score before surgery was 13.14 $\pm$ 2.46 (range from 9 to 17). The mean AHFS before surgery was 61.27 $\pm$ 9.73 (range from 47 to 85).

A plantigrade foot with restoration of foot length was achieved in all patients [Table/Fig-3,4]. Nineteen feet (86.36%) achieved union at all three joints, whereas non union of calcaneocuboid joint was seen in three feet. Mean time to radiological union was 12.5 $\pm$ 1.92 weeks (range from 10-15 weeks) and mean fixator time was 15 $\pm$ 3.1 weeks (range from 10-20 weeks). Mean postoperative AHFS was 76.91 $\pm$ 12.11 (range 54-94). The AHFS score improved in all patients showing mean improvement of 15.64 $\pm$ 7.36 (range 4-33). This was

S. No.	Age (years)/ Sex	Side	Diagnosis	Preoperative Dimeglio score	Preoperative AHFS	Preoperative FLD (cm)	Postoperative AHFS	Improvement in AHFS	Likert score	Complications
1	13/M	R	Spina bifida	15	74	1	84	10	5	Supramalleolar fracture tibia
2	12/F	R	Syndromic clubfoot	13	60	1	91	31	4	Calcaneocuboid non union
3	16/M	L	Spina bifida	11	85	1	94	09	4	Pin tract infection, Talocalcaneal and Calcaneocuboid non union
4	16/M	L	Talo-calcaneal coalition	10	60	2.5	93	33	5	None
5	16/F	L	CMT	17	47	2	56	09	3	Pin tract infection Toe contracture
6	12/F	BL	Recurrent clubfoot	R 16 L 16	R 63 L 57	None	R 74 L 71	R 11 L 14	5	Calcaneocuboid non union None
7	25/M	R	PPRP	9	66	1.5	89	23	5	None
8	23/F	R	Mirror foot	13	50	3	54	04	2	Toe contracture, Desquamation
9	16/M	R	CMT	11	59	3	82	23	4	Pin tract infection, Desquamation
10	16/M	L	Neglected clubfoot	12	62	2	85	23	4	None
11	16/M	R	Recurrent clubfoot	11	70	1	81	11	5	Pin tract infection
12	19/F	BL	Spina bifida	R 13 L 13	R 56 L 53	None	R 69 L 67	R 13 L 14	4	Toe contracture Toe contracture
13	15/M	R	Recurrent clubfoot	9	64	2.5	86	22	5	None
14	14/M	L	Neglected clubfoot	13	81	1.5	92	11	5	Pin tract infection
15	12/F	L	PPRP	15	59	1	77	18	5	Pin tract infection
16	17/M	R	Recurrent clubfoot	17	49	1	58	09	2	Blisters, desquamation
17	13/F	R	Syndromic clubfoot	16	63	3	78	15	4	None
18	14/M	L	Neglected clubfoot	11	51	3	65	14	3	None
19	17/M	L	Spina bifida	14	55	2	70	15	4	Toe contracture Pin tract infection
20	16/F	R	Recurrent clubfoot	14	64	2	76	12	4	Pin tract infection
<b>Mean</b>	<b>15.9±3.4</b>			<b>13.14±2.46</b>	<b>61.27±9.73</b>	<b>1.7± 0.95</b>	<b>*76.91± 12.11</b>	<b>15.64±7.36</b>	<b>4.1±0.97</b>	

**[Table/Fig-2]:** Details of patients who underwent triple arthrodesis with Ilizarov fixator.

CMT: Charcot marrie tooth disease; PPRP: Post polio residual paralysis; AHFS: Ankle hind foot score; FLD: Foot length discrepancy; R: Right; L: Left; BL: Bilateral; M: Male; F: Female  
\*p<0.0001 (paired t-test-pre-op AHFS vs post-op AHFS)



**[Table/Fig-3]:** Preoperative clinical images (a,b,c) and radiographs (d,e) of a patient with right foot deformity secondary to spina bifida.



**[Table/Fig-4]:** Clinical (a,b) and radiological (c) images 6 months after surgery on right foot depicting satisfactory correction of deformity and fusion of talocalcaneal, talonavicular and calcaneocuboid joints.

found to be statistically significant (p<0.0001). Nineteen patients (95%) had good results (AHFS more than 55), whereas one patient, a 23-year-old female, showed poor score of 54.

This patient had preaxial polydactyly (mirror foot) with associated ipsilateral fibular dimelia and 70° fixed flexion deformity at knee. Her foot and knee deformities were corrected simultaneously with Ilizarov fixator. Deformities were corrected effectively and gait

training was started in a caliper with weight bearing as tolerated. However, patient kept complaining of pain in foot and knee while walking and discontinued using caliper. She eventually presented with recurrence of knee contracture but continued walking with crutches.

According to Likert scale, 16 patients (80%) were either satisfied or highly satisfied with results of surgery while four patients did not appreciate the results. One or more complications were seen in 15 feet (68.1%) [Table/Fig-5]. Complications were referred as early if they occurred with fixator still on and late if after removal of the fixator. Among the early complications, most common were pin tract infection, toe contracture and desquamation. All patients complained about painful ankylosis after removing the frame which resolved with time and exercise. Three patients had asymptomatic non union of calcaneocuboid joint for which no further intervention was done. One patient sustained supramalleolar tibia fracture due to forceful dorsiflexion attempted to correct residual equinus after removing the frame. He was managed successfully in a long leg cast. Deep infection and wound problem at surgical site were not

seen in any patient. Results of present study were compared with those of previous studies in literature and were found satisfactory [Table/Fig-6] [4-11,15,20].

## DISCUSSION

The current study observed that gradual correction and triple fusion using Ilizarov fixator is effective in correcting foot deformity and avoids most of the complications associated with acute correction and fusion. Similar reports of performing triple arthrodesis successfully using ring fixator has been published in literature [15,16]. However, overall functional outcome and patient satisfaction rate with this technique is not known. The current study was carried out to analyse this knowledge gap and to compare the results with previous studies [7,15,16].

Talarico LM and Vito GR, used Ilizarov fixator and arched wires to perform triple arthrodesis and reported fusion in 84 (97%) cases [7]. In a similar study, Treadwell JR used external rail fixator and achieved union in all (100%) [8]. However, in both studies, acute correction of deformity was done by excising bone wedges and external fixator was used only for stabilisation. Moreover, Talarico LM and Vito GR, reported superficial skin infection in 35% and broken wire in 21% of cases [7]. Another 10% developed dehiscence at surgical site. Treadwell JR observed pin tract infection in 4 patients (50%) [8]. Emara K et al., performed gradual correction and triple fusion with Ilizarov fixator and compared the results with other group undergoing early fixator removal followed by internal fixation [15]. Fusion rate of 100% was observed in both

Complication	Frequency (%)
<b>Early</b>	
Pin tract infection	8 (36.3%)
Toe contracture	4 (18.1%)
Desquamation	3 (13.6%)
Blisters	1 (4.5%)
<b>Late</b>	
Non union	3 (13.6%)
Supramalleolar fracture tibia	1 (4.5%)

[Table/Fig-5]: Complications observed in current study.

S. No.	Author	Sample size (Foot)	Average/ Mean age (years)	Preoperative foot score	Surgical technique	Preoperative foot score	Average/ Mean follow-up (Months)	Complications	Conclusion
1	Seitz DG and Carpenter EB 1974 [4]	47 (66)	12.1	-	AC+IF+Cast	-	74	NU 6, Residual deformity 38, wound infections 10	Fusion rate 90.9% Satisfaction 79%
2	Galindo MJ et al., 1987 [5]	13 (19)	8.4	-	AC+IF+Cast	E+G 68%, F 16%, P 16%	48	NU 3, Residual deformity 9, AVN talus 2, Infection 1	Fusion rate 78.9% Mean FLD 0.8 Inch
3	Pell RF et al., 2000 [6]	111 (132)	54.9	-	AC+Cast+IF	60.7 (AHFS)	68.4	NU 3, WC 4, SPN 1, CN 1 TA rupture 1, PT 1, AOA 45.9%	Fusion rate 97.7% Satisfaction 91%
4	Talarico LM and Vito GR et al., 2004 [7]	87	63	-	AC+RF+arched wire compression	-	-	PTI 31, Broken calcaneum wire 18, wound dehiscence 9, NU 3,	Fusion rate 96.5%
5	Treadwell JR 2004 [8]	8 (8)	51	-	AC+Rail road fixator	-	15.9	PTI 4	Fusion rate 100%, Early weight bearing, Absence of prolonged immobilisation
6	de Groot IB et al., 2008 [9]	36	43.4	-	AC+Cast±IF	63 (AHFS)	73.2	NU 16, WC 4, PE 1, Dystrophy 1, AOA 47%	Fusion rate 55.5% Satisfaction 73%
7	Vlachou M and Dimitriadis D 2009 [10]	38 (52)	14.2	-	AC+IF+cast	G17, F28, P 7	10.2	Wound problems 8, Talo-navicular NU 2, Residual deformity 5	Fusion rate 96.1%
8	Wicks ED et al., 2016 [11]	111 (159)	11.4	-	AC+K-wire+Cast	-	73	NU 5 Partial union 9	Fusion rate 91.2% Satisfaction 85%
9	Emara K et al., 2011 [15]	27 (29) 29 (30)	25.2 26.6	-	GC+RF GC+RF followed by IF	G 21, F 5, P 3 (FC) G 21, F 6, P 3 (FC)	47.2 43.7	PTI 27, RSD 3, Psychosis 1, NPS 1, FC of toes 13, Paresthesia 3 PTI 10, NPS 2, FC of toes 12, Paresthesia 4	Fusion rate 100% Satisfaction 89.7% Recurrence 15 Fusion rate 100% Satisfaction 90% Recurrence 5
10	Jacob C et al., 2014 [20]	18 (22)	27.8	48.36	Not specified	80.55	6	Not specified	Satisfaction 95%
11	Current study	20 (22)	15.9±3.4	61.27±9.73	GC+Ring fixator	76.91±12.11	18.1 ± 5.1	NU 3, Supramalleolar fracture tibia 1, PTI 8, FC of toes 4, Desquamation 3, Blisters 1	Fusion rate 86.3% Satisfaction rate 80%, Restoration of foot length 100%

[Table/Fig-6]: Comparison with previous studies [4-11,15,20].

AC: Acute correction; GC: Gradual correction; IF: Internal fixation; AHFS: Ankle hind foot score; NU: Non union; WC: Wound complication; PE: Pulmonary embolism; AOA: Ankle osteoarthritis; SPN: Superficial peroneal neuritis; CN: Charcot's neuropathy; TA: Tendo achilles; PT: Peroneal tenosynovitis; E: Excellent; G: Good; F: Fair; P: Poor; PTI: Pin tract infection; FC: Ferreira criteria; RSD: Reflex sympathetic dystrophy; NPS: Necrosis of previous scar; FC: Flexion contracture; FLD: Foot length discrepancy; AVN: Avascular necrosis

groups. However, statistically significant decrease in fixator time and pin tract infection was observed in patients undergoing staged external-internal fixation. In current study, fusion rate was 86.1% which is comparable to the results of above-mentioned studies. Wedge excision was not performed in any patient and attempt was made to preserve foot length. Furthermore, foot was lengthened by distraction osteogenesis in case of residual shortening to achieve equal foot length on both sides. Eight patients (40%) developed pin tract infection and were managed satisfactorily with antibiotics and daily dressing.

The average duration of immobilisation in cast for patients undergoing acute deformity correction and triple fusion is 12 weeks. This prolonged immobilisation in plaster cast is known to increase risk of complications like deep vein thrombosis, osteoporosis and muscle atrophy and compromises overall quality of life [6,9]. Use of Ilizarov fixator allows early weight bearing, bathing, swimming and a number of other activities within tolerable limit [7]. This improves patient's quality of life and takes care of the complications of prolonged immobilisation [21]. Current study observed similar advantages with use of Ilizarov fixator.

Non union is a known complication of triple arthrodesis. Earlier studies using internal fixation and cast have reported union rate between 45% and 90% [11,15,20]. Talarico LM and Vito GR, reported non union in three patients (3.4%) with combined use of Ilizarov fixator, arch wire technique and bone stimulator [7], whereas, Treadwell JR and Emara K et al., did not find it in any patient [8,15]. In current study, three feet (13.6 %) developed non union at calcaneocuboid joint. However, no further intervention was done as it was asymptomatic till the last follow-up. Non union at talocalcaneal or talonavicular joint was not seen in any patient. This can be credited to controlled distraction and compression across joints by Ilizarov fixator. Comparatively high rate of calcaneocuboid non union in current study may be attributed to simultaneous distraction of lateral column of foot, and intermittent compression on lateral side during the process of distraction might have prevented this situation.

Pell RF et al., reported a mean AHFS of 60.7 after triple arthrodesis and internal fixation [6]. de Groot IB et al., in their study, divided the patients into fixation group and non fixation group [9]. Mean postoperative AHFS in fixation and non fixation group was 46 and 65, respectively. The difference was statistically significant and they concluded that patients without internal implant do better than those with implant in situ. In current study, internal fixation was not used and the mean postoperative AHFS was 76.91±12.11 (range 54-94). This high score can be attributed to lower mean age of patients (15.9±3.4 years). Most of our patients were children and didn't complain of pain in foot prior to surgery, thereby having a higher preoperative AHFS to start with. Mean improvement in AHFS in current study was 15.64±7.36 which was less when compared with that reported by Jacob C et al., [20].

The patient satisfaction rate in current study was 80%. This was in spite of the high complication rate of 68.1%. Most of the patients had some form of complication when fixator was on. They were managed satisfactorily without any major sequelae and didn't lead to premature termination of treatment in any patient. At the end, 16 out of 20 patients were happy with the result and recommended to go for surgery again in similar situation. Emara K et al., observed statistically significant less number of complications with early removal of Ilizarov frame without any significant difference in end result and patient satisfaction [15]. They recommended for early removal of external fixator after correction of deformity followed by percutaneous internal fixation using 6.5 mm cannulated screws. This shortened the duration of treatment, was more comfortable for patients and had low

risk of complications. Other studies using acute correction and internal fixation have reported satisfaction rate between 53% and 95% [4,6,9,20].

### Limitation(s)

This study was done on a small sample of 20 patients and with a short follow-up. Even though, results are encouraging, similar studies on a larger population with a longer follow-up is recommended. A comparison was not made with patients undergoing acute deformity correction and triple arthrodesis with internal fixation which is another commonly done procedure in our institution. However, an indirect comparison was made with literature supporting acute correction and internal fixation.

### CONCLUSION(S)

Triple arthrodesis with gradual correction by Ilizarov technique is effective in management of equinovarus foot deformity. It has comparable fusion rate and functional outcome when compared to triple arthrodesis with acute correction and internal fixation. Moreover, it obviates the need for excising large bone wedges, thereby restoring size of foot and can even lengthen a short foot by distraction of callous across the joint. Known complications of acute deformity correction can be avoided. It corrects deformity and restores alignment of foot more accurately leading to a high patient satisfaction rate.

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