RESULTS

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I. Clinical results :

Using the recent clinical assessment, ***(Simon, 1985)***, the feet were graded as excellent in 45.8% (11 feet), good 29.2% (7 feet) and poor in 25% (6 feet). Thus, the satisfactory result was 75% (18 feet) and unsatisfactory result was 25% (6 feet) (Table 7, Fig. 14).

Physical examination of the feet and deformity showed that following the distraction out of 21 feet (87.5%) with preoperative equinus deformity, 6 feet (28.6%) had residual unsatisfactory deformity. Also out of 15 feet (62.5%) with varus heel, only 3 feet (12.5%) had residual deformity. All the 24 feet (100%) were suffering from adduction forefoot of which 5 feet (20.8%) had a residual deformity. There were 14 feet (58.3%) with preoperative cavus deformity, but only 4 feet (16.6%) remained with a residual deformity (Table, 8) (Fig. 15).

Of 18 feet with satisfactory results, 11 feet has an excellent results; a plantigrade foot was achieved in all these patients, with satisfactory radiographic appearance and ankle range about 20°, 7 feet has a good results as the foot is plantigrade but 3 feet had minimal equinus deformity ($\leq 5°$) and 4 feet had residual forefoot adduction ($\leq 15°$).

Table (7) : Result of treatment given.

End result	No. of feet	%
- Excellent	11	45.8
- Good	7	29.2
- Unsatisfactory	6	25.0
Total	24	100.0

Fig. (14): Result of treatment given.

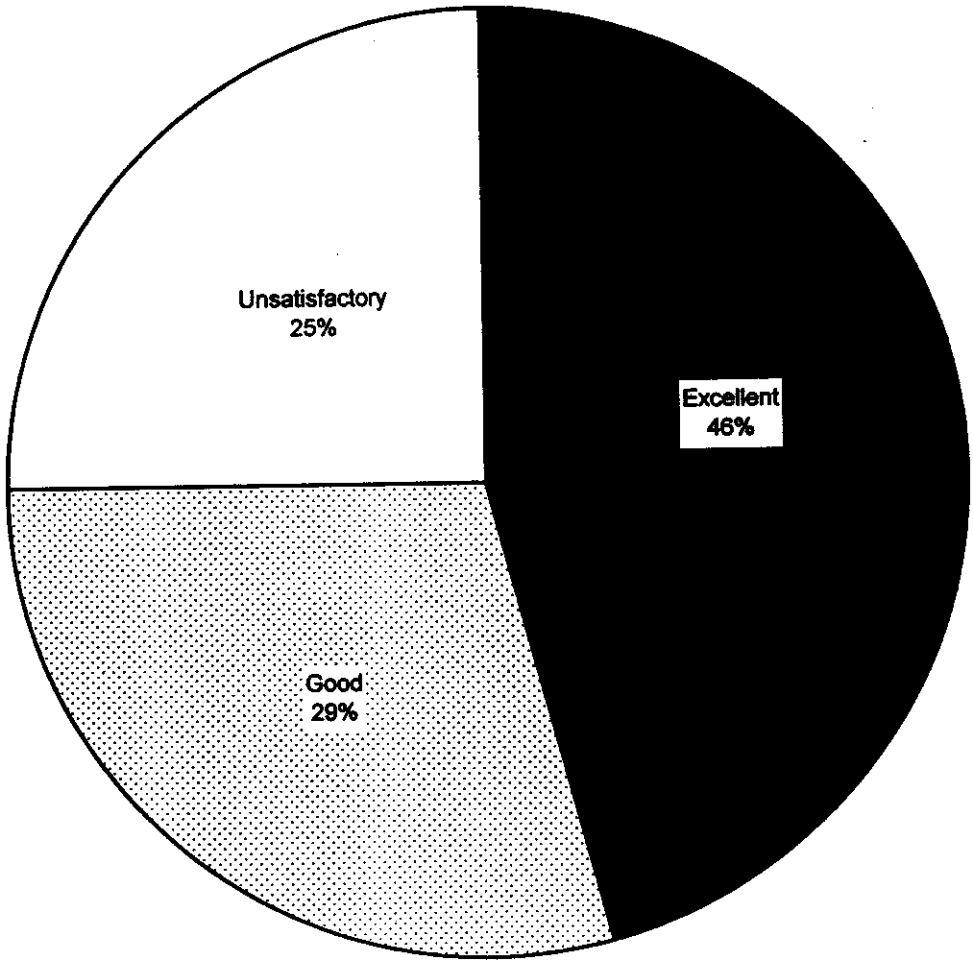
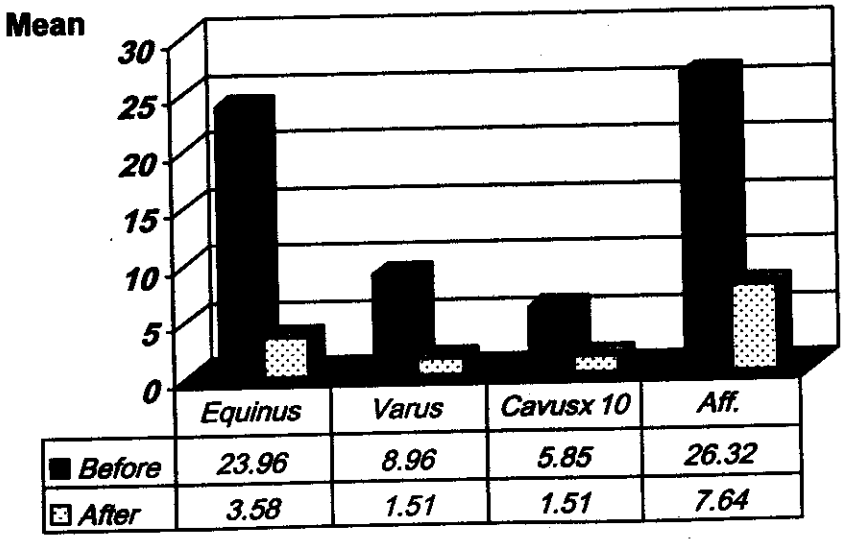


Table (8): Clinical assessment of the deformities before and after intervention.

Deformity		Before	After	t-value	p-level
- Equinus ankle:	Mean	23.96°	3.58°	14.36	0.001
	S.D.	11.82	1.74		
- Varus heel:	Mean	8.96°	1.50°	10.52	0.001
	S.D.	5.40	2.87		
- Cavus midfoot:	Mean	5.8°	1.5°	18.18	0.001
	S.D.	0.53	0.36		
- Adduction forefoot:	Mean	26.32°	7.64°	15.24	0.001
	S.D.	9.10	6.77		

* Significant

Fig. (15):Clinical evaluation of deformity before and after intervention.



The mobility is sufficient to permit full activity without pain and shoes of normal size were worn, also the parents were satisfied by the end results.

There have been 6 feet with an unsatisfactory result. All had moderate or severe degree (unsatisfactory) of the different combinations of deformity and there were a significant restriction in the range of motion and activity.

Two cases dropped from the follow up after removal of the external fixator and reapplication of the external fixator was done and a satisfactory results was achieved.

Two idiopathic cases had painful feet and moderate residual heel varus and forefoot adduction. Tripple arthrodesis was done for both.

One arthrogrypotic case, following the correction by external fixator complained of painful foot, subtalar stiffness and slight heel varus. Also, this case was subjected to subtalar fusion.

In one case, there was dynamic forefoot adduction after external fixator and tipialis posterior transfer was done to balance the forefoot.

Table (9): Correction period.

Item	Value (Weeks)
1- Time of correction:	
Mean	4.30 ± 0.67
Rang.	3 – 5
2- Fixation period (static period):	
Mean	3.20 ± 0.63
Rang.	3 – 5
3- Cast immobilization period:	
Mean	8.22 ± 2.11
Rang.	6 – 12
4- Rehabilitation:	
Mean	10.44 ± 1.67
Rang.	8 – 12

In the adopted technique, there is no fixed time for the correction period. The correction period includes; time of correction, fixation period, cast immobilization period, and re-habitation period (Table 9).

Time of correction :

The mean time of correction was 4.30 ± 0.67. With this adopted technique the correction period was not fixed and changed according to; severity of deformity, age of the patient, number of previous operations, severity of scarring, and type of deformity either relapsed or neglected.

There was a positive correlation between the time of correction and the age of the patient as shown in (table 10).

So the time of correction is prolonged with increasing the age of the patient to reach a corrected foot.

Also there were positive a correlation between the time of correction and the number of previous operations as in (table 11).

The correction period was increased with increasing number of previous operations and associated sever scarring.

The type of the deformed foot either neglected or relapsed affect the correction period as in (table 12).

In this study the time of correction of severe deformed and relapsed clubfeet more than the time needed for the neglected cases.

From the above correlation we found that :

- 4 feet were fully corrected at 3 weeks.
- 12 feet were fully corrected at 4 weeks.
- 8 feet were fully corrected at 5 weeks.

Table (10) : Relation between age of patients and correction time :

No. of patients	Age of the patients (in years)	Correction period
5	2.5-7	3 weeks
12	8-11	4 weeks
7	12-14	5 weeks
Total 24 feet	Mean age 8.05 ± 4.09	Mean time of correction 4.30 ± 0.67

Table (11) : Relation between number of previous operations and correction time :

No. of previous operations	No of patients	Correction time
One	6	3 weeks
Two	8	4-5 weeks
Three	2	$\geq$ 5 weeks

Table (12) : Correlation between types of clubfoot and correction period

Type of deformity	No of patients	Correction period
Relapsed C.T.E.V.	16	4-5 weeks
Neglected C.T.E.V	4	3-4 weeks

Fixation period :

It is a static period. When maximum correction is achieved, we leave the fixator in a static phase to allow the stretched ligaments and tendons to accommodate the normal shape.

This period was fixed at 3 weeks. All cases reached to a satisfactory state at 3 weeks.

Cast immobilization period :

After removal of the fixator under general anesthesia, the foot is now is supple and pliable and above knee cast is fitted.

The cast was changed every two weeks and the patient was allowed to walk and bear weight fully.

At 6 weeks there are 6 cases had a satisfactory result, at 8 weeks there are 6 cases 4 had a satisfactory result and 2 cases had unsatisfactory result.

At 12 weeks 2 cases had a satisfactory result. A satisfactory result was determined by ability of the patient to evert the foot, planter flexion and extension of the ankle (ankle range of motion) and clinical appearance of the feet (Table 13) (Fig. 16).

Rehabilitation period :

After removal of the cast, the foot is fully corrected and maintenance of this correction is maintained by rehabilitation which includes; physiotherapy, special shoe wear and night splint Physiotherapy is performed to gain more range of motion and to relief pain. Special shoe wear and night splint is performed to avoid recurrence (Table 14) (Fig. 17).

Table (13) : Result of treatment according to cast immobilization periods

Cast immobilization period / Result of treatment	6 W		8 W		10 W		12W	
	No.	%	No.	%	No.	%	No.	%
- Satisfactory	6	100	4	67	2	50	2	100
- Unsatisfactory	0	0	2	33	2	50	0	0
Total	6	100	6	100	4	100	2	100

NB. Two cases omitted.

Fig. (16): Result of treatment according to cast immobilization period.

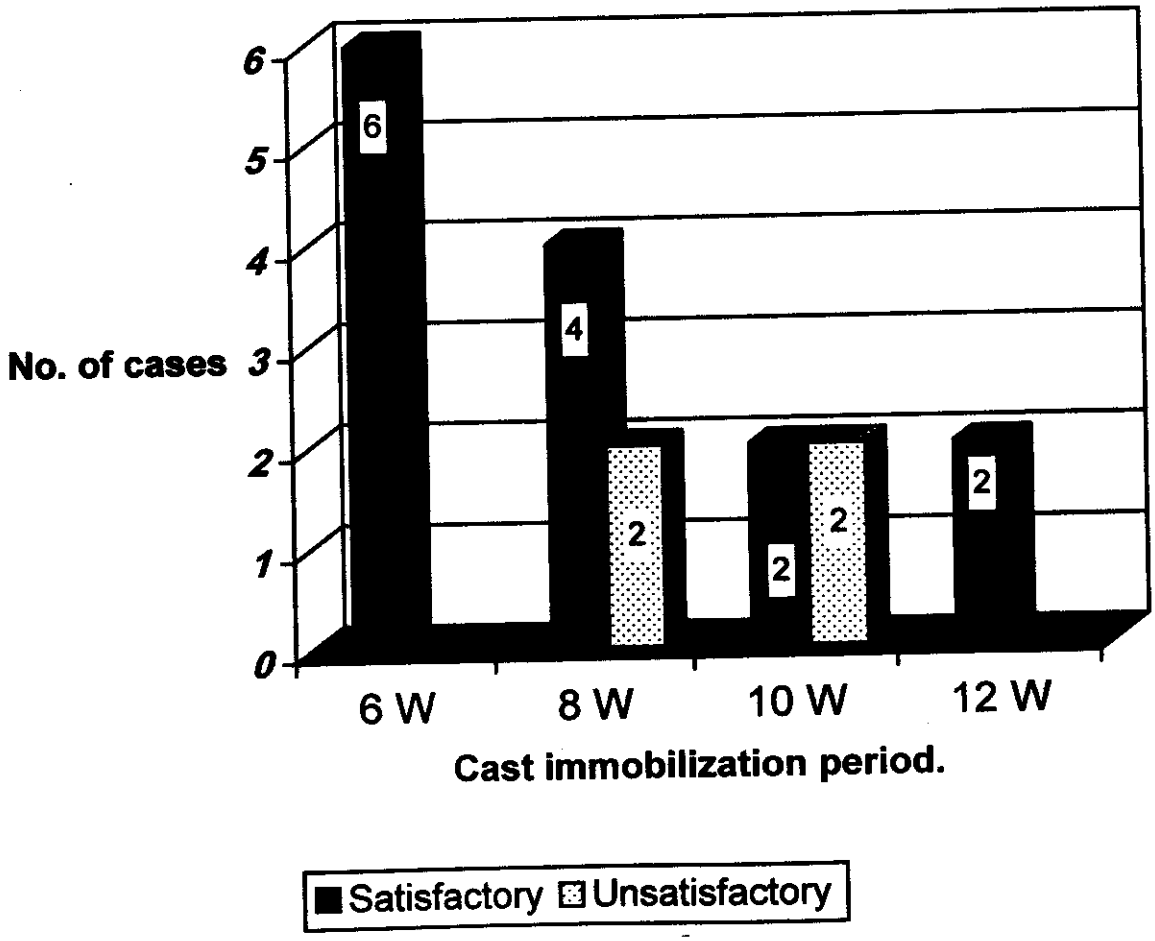
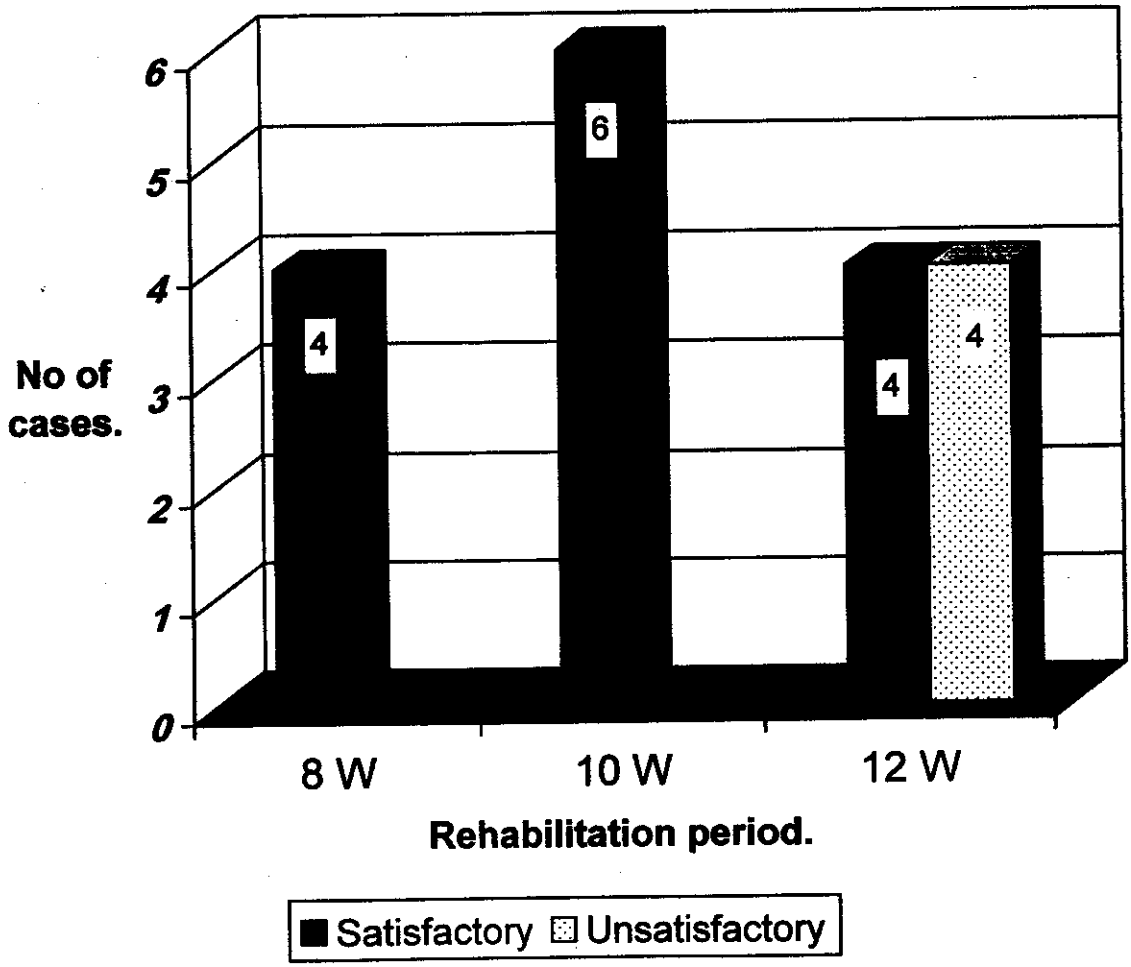


Table (14): Result of treatment according to rehabilitation period.

Rehabilitation period / Result of treatment	8 W		10 W		12 W		Total	
	No.	%	No.	%	No.	%	No.	%
- Satisfactory	4	100	6	100	4	50	14	70
- Unsatisfactory	0	0	0	0	4	50	6	30
Total	4	100	6	100	8	100	19	100

NB. Two cases dropped.

Fig. (17): Result of treatment according to rehabilitation period.



The anterio-posterior calcaneus-2nd metatarsal angle (5-30°) determines the adduction deformity of the fore-foot. All 24 cases had an angle below the normal range. After intervention 10 feet have unsatisfactory radiological result. Only 5 cases of them had unsatisfactory clinical result, and the remainder had satisfactory clinical result.

The lateral calcaneus-1st metatarsal angle (140°-160°) determines the cavus angulation of the mid foot. The results in the feet with satisfactory or unsatisfactory clinical result were similar, and averaged 145°-164°, and no feet had angle below the normal range.

The lateral tibio-calcaneal angle (70°-90°) determines the equinus position of the heel. Before intervention, 20 feet had an unsatisfactory angle, and after intervention 8 feet had unsatisfactory radiological result. Only 2 of then are assessed clinically as being satisfactory, and the remainder being recorded as clinically under-correction.

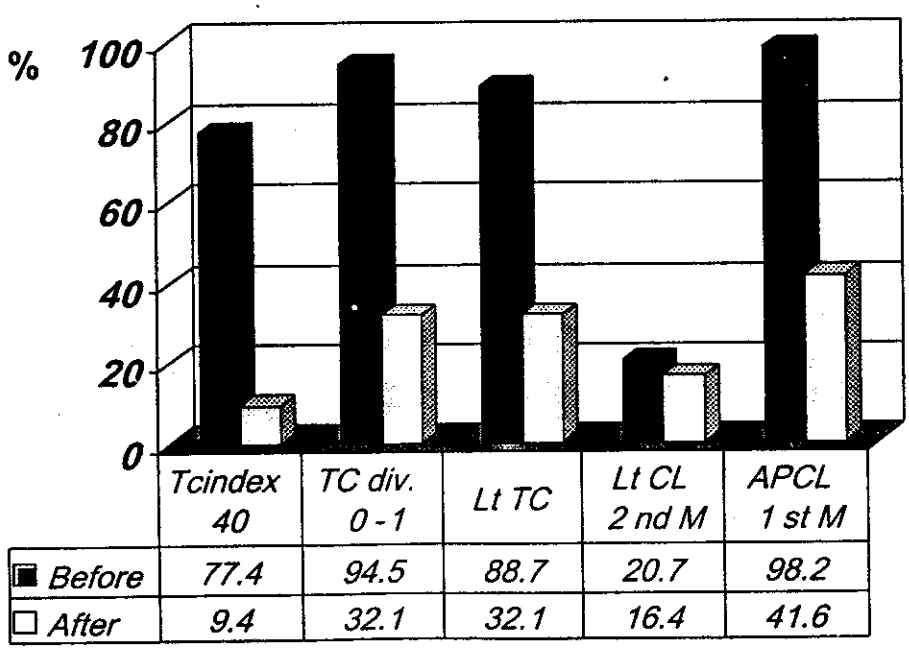
On the antero-posterior view, navicular position with references to the longitudinal axis of the talus represents the talo-navicular subluxation. The antero-posterior talo-1st metatarsal angle (0-20°) can offer information regarding subluxation at the talo-navicular joint, when the navicular was ossified. After intervention 8 feet had unsatisfactory radiological results, 4 of then had satisfactory clinical result (Table 15), (Fig. 18) summarize the results of our roentgenographic evaluation on the antero-posterior and lateral views, before and after intervention.

Table (15) : Changes in measurements of angles on pre-operative and post-operative radiographs in degrees (mean) :

View	Mean change in degree		Significance of difference
	Pre-	Post-	
Antero. Posterior view :			
Talo. Calcaneal angle.	17.67°	28.67°	P < 0.001
Talo-calcaneal diverge.	2.5 +	0.83 +	P < 0.001
Calcaneo-2nd metatarsal.	50.49°	278.83°	P < 0.001
Navicular position	2	1	N.S.
Lateral view			
Talo. Calcaneal angle.	21.9°	35.1°	P < 0.025
Calcaneo-1st metatarsal	145.7°	151.7°	N.S.
Tibio-calcaneal angle	100.79°	88.67°	P < 0.05

N.S. = Not significant

Fig. (18) : Radiological results of 24 feet follow up at 36 months before and after treatment



Complications :

On application of this external fixator for management of relapsed and neglected clubfoot, many complications were found as infection, recurrence oedema and pain.

Under correction; did not occur in the studied cases as under correction present after removal of the fixator was corrected by the casting and physiotheraphy. In this study, there were no cases under corrected after removal of the fixator.

Infection; 4 cases had superficial pin tract infection. All these cases were controlled by the usual care of the pins with no sequel of osteomylitis.

Recurrence occurred in 4 cases. 2 cases were due to drop of follow up and external fixator was applied again and a satisfactory result had reached. One case was arthrogryposis and failure of external fixator followed by tripple arthrodesis. One case after external fixator had dynamic foot adduction and tipialis posterior transfer was done (Table 16).

Oedema may occur during lengthening but subsided by elevation of the limb and deceleration of the rate of lengthening.

Some cases with application of the fixator elongation of tendoachilis was done in 4 cases to accelerate time of correction as the tendon was so tight and short (Table 17).

N.B. :

This study was carried out on 24 feet of neglected and relapsed clubfoot, by the end result we had satisfactory clinical & radiological results 75% (18 feet cases) and unsatisfactory clinical & radiological results 25% (6 cases).

In comparison of our results to other results we will find that it is near to it for example :

- ***Watts (1994)*** by using a ***Wagner*** lengthening apparatus for correction of sever forefoot adduction in relapsed congenital T.E.V. He had 4 patients ranged from 5-12 years.
- His results was excellent, all patients were fully corrected without pain or deformity (100%).
- ***Joshi (1994)*** by using assembled external fixator for management of relapsed and neglected T.E.V. He had 16 patients ranged from 5 months to 6 years. His results was satisfactory for 14 patients (87.5%) and poor (unsatisfactory for 2 patients 12.5%).
- ***Grill (1984)*** by using Ilizarov for management of neglected and relapsed T.E.V. He had 20 feet ranged from 7-16 years.
- His results was satisfactory for 16 feet 80% and unsatisfactory for 4 feet 20%. So by comparison of these results to our result we will find that our apparatus is accepted and its results is good.

Table (16): Post operative complication.

Item	No. patients	%
1. Under correction: Present.	0	0
Absent	20	100
2. Infection: Present.	4	20
Absent	16	80
3. Recurrence: Present.	4	20
Absent	16	80

Table (17): Additional operation.

Additional operation	No. of patients	%
A. Current status:		
- Not need additional operation	10	50
- Need additional operation	10	50
1. With external fixation:		
- Elongation of Tendoachilis.	4	40
2. After external fixation:		
- External fixation again	2	20
- Tripple orthrodesis.	2	20
- Tendon transfer	1	10
- Subtalar fusion	1	10