

12, 4, 1999 11

The Journal of the Korean Society of Fractures
Vol.12, No.4, November, 1999

Ilizarov

. . .

= Abstract =

Ilizarov Method for Treatment of Tibia Nonunion Associated with Bone Defects

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Sung Nam Jung, M.D.**

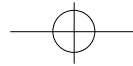
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Purpose : This study was to evaluate the results and complications in gap nonunions of the tibia treated by Ilizarov method.

Materials and Methods : We reviewed 30 patients of tibial nonunions (23 atrophic, 7 hypertrophic) with bone loss (1-13cm, mean 4.6cm) who were treated by Ilizarov technique. The causes of bone defect were open fracture with bone loss (15 cases) and infected nonunions (15 cases). Bone defects were closed by Ilizarov bone transport technique.

Results : All patients had satisfactory union. The mean distraction-consolidation index (distraction-consolidation time/ distraction gap) was 1.3 months/cm. The younger patients and metaphyseal lengthening healed faster than the older patients and diaphyseal lengthening. Even though, we met with the numerous complications such as pain around the pin site, pin site infection and delayed union, we could successfully treat most of them.

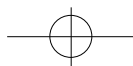
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Conclusion : The application of Ilizarov techniques to nonunions of the tibia with bone defect was very effective, but correct technique and careful follow-up examination was required to avoid complications.

Key Words : Tibia, Nonunion, Bone defect, Ilizarov.

lococcus. aureus) 7 , Acinobacter Baumannii 3 ,
(Escherichia Coli) 2 , (Pseudomonas Aeruginosa)
1 , 2 . 13
(43.3%), 9 (30%), 8 (26.7%)
가가 , 28
Gustilo-Anderson 8) IIIA 5
, IIIB 22 , IIIC 1 .
3,4,7), 1,2,10) 30 23 ,
, 1950 1 8 4.1 .
Ilizarov (distraction osteogenesis) 2 IIIA
, 2 IIIA 1
가 .
Ilizarov 25
Paley 13) A1 3 , A2-1 1 ,
A2-2 3 , B1 3 , B2 1 , B3 19 .
(hypertrophic) 7 , (atrophic)
23 . Ilizarov
,
,
1991 3 1997 12
Ilizarov
1 가 30 30
30 가 25 , 가 5
, 44 (13 65),
44 (12 92) .
15 ,
13 ,
2 , 1cm (one stage operation) , 6
13cm 4.6cm .
(Staphy 6cm 11



(bone transport)

. 8

(Fig 1A-E).

, 6

Ilizarov

가

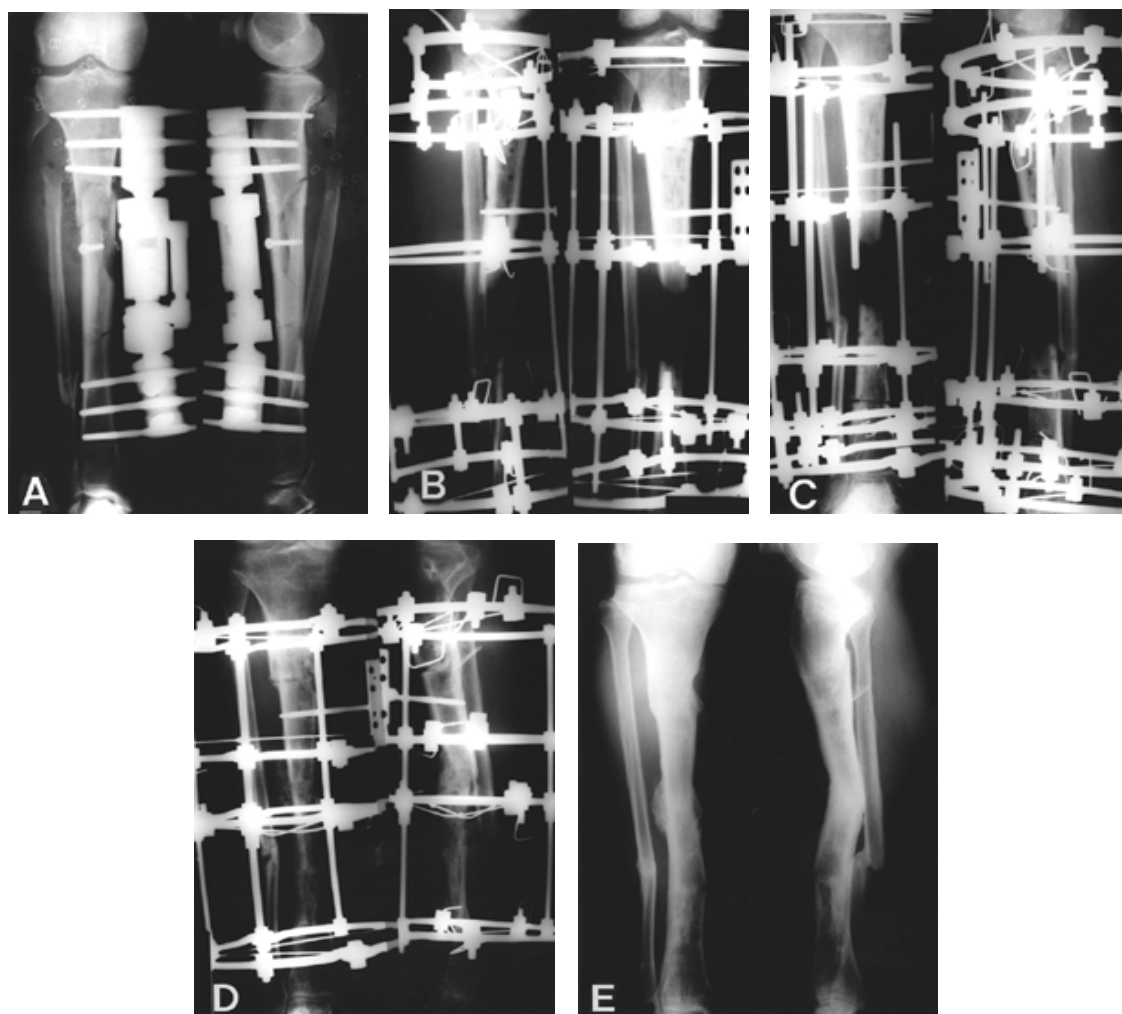
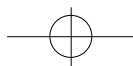


Fig 1. Serial roentgenograms of a sixty-one-year old male who sustained a Gustilo type IIIB open tibia fracture.

- A.** Roentgenograms after external fixation with Orthofix EF.
- B.** Roentgenograms 10 months post-trauma show extensive bone loss at the mid shaft of the tibia after resection of the infected avascular bone.
- C.** Roentgenograms one month after the operation using Ilizarov method. The corticotomy was done in the proximal and distal part of the tibia.
- D.** Roentgenograms 15 months after the operation show new bone formation by distraction osteogenesis.
- E.** Roentgenograms 27 months after the operation show the excellent bone union.



(local flap) 8 , (consolidation)
 (gastrocnemius myoplasty) 3 ,
 (vascularized free flap) 4 . ring rod 2-3
 Ilizarov 7-14 Ilizarov
 29 (bifocal lengthening)
 (Fig 2A-D) 1 Paley Catagni 14)
 (trifocal lengthening) 가 ,
 0.75-1.0mm , , ,
 가 , , 가 ,
 , 5.2cm(1 14cm) , , ,

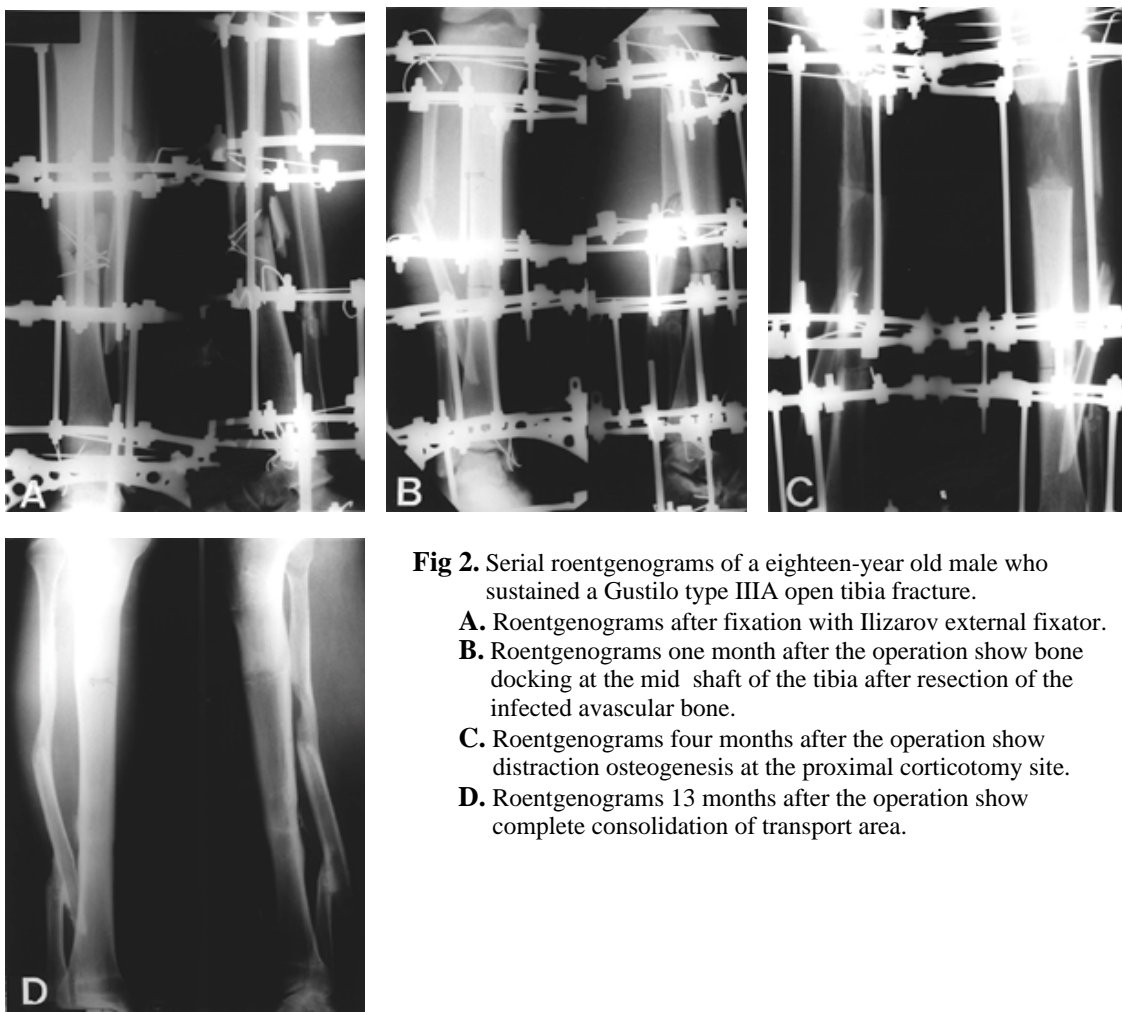
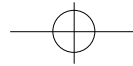
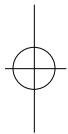


Fig 2. Serial roentgenograms of a eighteen-year old male who sustained a Gustilo type IIIA open tibia fracture.

- A.** Roentgenograms after fixation with Ilizarov external fixator.
- B.** Roentgenograms one month after the operation show bone docking at the mid shaft of the tibia after resection of the infected avascular bone.
- C.** Roentgenograms four months after the operation show distraction osteogenesis at the proximal corticotomy site.
- D.** Roentgenograms 13 months after the operation show complete consolidation of transport area.

**Table 1.** Classification of the results according to the modified ASAMI classification

	Bone result	Functional result
Excellent	Bone union, no infection Deformity <7° LLD < 2.5cm	Ability to perform previous activities of daily living(ADL), no pain or mild pain No limp, no soft tissue sympathetic dystrophy Knee or ankle joint contracture < 5° Loss of ankle or knee motion < 15°
Good	Bone union Failure to meet One of the other criteria	Almost all ADL with minimal difficulty No pain or mild pain Failure to meet one of the other criteria
Fair	Bone union Failure to meet Two of the other criteria	Most ADL with minimal difficulty No pain or mild pain Failure to meet two of the other criteria
Poor	Nonunion or refracture Failure to meet Three of the other criteri	Significantly limited ADL Significant pain requiring narcosis Failure to meet three of the other criteriaa



가 30

(Table 1).

- (distratation-가 (p<0.05).

consolidation time, (month)), - 1.2, 1.3 /cm

(DCI, - (months)/ (cm)) 가 17, 8, 2

, 3, 8, 11

SAS Proc t-test, 7, 4, Paley¹³⁾

ANOVA 0.05 (complications)

가

가가

16 가

12 7 8

3 8

11 3, - Ilizarov

(DCI, - (months)/)

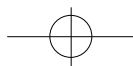
0.5 /cm 3.2 /cm 1.3

/cm . 30 - 1.2

/cm 30 - 1.7 /cm

, 가

1.2 /cm 1.6 /cm 가가



2 , 3 , 가
5 가 .
2 , 가 . ,
5 , 3 가 가

(Table 2).

Table 2. Complications

Problems	No.
Pin tract infection	16
Pin site pain	10
Knee flexion contracture	3
Delayed union	8
Obstacles	
Premature consolidation	2
Joint stiffness(knee, ankle joint)	5
Complications	
Angular deformity	3
Malunion	2

가
Ilizarov (distractor)
osteogenesis) 가
가
가

12) 16)

Ilizarov

Ilizarov

. 1989 Paley¹⁴⁾

Ilizarov

5
90 97.6%

25

Ilizarov

92%

ASIF(Association for the Study of Internal

1.0 1.3 /cm , 10cm

Fixation)

가

가

2,18),

Dendrions⁵⁾

28

가

Ilizarov

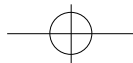
1

27

Ilizarov

78%, 64%

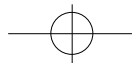
15)



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24 , 91.7%, 87.5% Ilizarov Paley¹³⁾ , 83.3%, 63.3% (DCI) 1.3 cm , 2 , 8 8 Ilizarov , 가가 가 , Ilizarov 2.2 가 , technetium 11.8 가 2 , 5 , 3 9,12) Fischgrund 6) Ilizarov 114 가 Ilizarov (distraction gap) , Ilizarov 가 , Monticelli Spinelli 11) 가 가 , Steen Fjeld 17) 가 30 Ilizarov 7cm - 8.6 - 가 30 1.2 /cm 5.1cm, 1.7 /cm , 7.3cm - 9.4 - 가 1.2 /cm 83.3%, 63.3% 8.0cm, - 4.9 - 가 1.6 /cm 1.2, 1.3 /cm 가 , 가





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