Correction of Lower Limb Deformity Using SIGN Nails

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Post-traumatic lower limb deformities are common in our population due to:
Lack of access to fracture trauma services
Poorly developed orthopedic infrastructure
Lack of trauma implant availability
Problems with post treatment follow up
Socio-cultural factors

Our indications for corrective surgery are mainly to improve function and cosmesis secondarily.
General considerations

\[ \text{aPPFA} = 90^\circ \]  
\[ \text{aNSA} = 170^\circ \]  
\[ (165–175^\circ) \]  
\[ \text{Sagittal} \]

\[ \text{aPDFA} = 83^\circ \]  
\[ (79–87^\circ) \]

\[ \text{aPPTA} = 81^\circ \]  
\[ (77–84^\circ) \]

\[ \text{aADTA} = 80^\circ \]  
\[ (78–82^\circ) \]

\[ \text{LPFA} = 90^\circ \]  
\[ (85–95^\circ) \]

\[ \text{mLDFA} = 88^\circ \]  
\[ (85–90^\circ) \]

\[ \text{JLCA} \]  
\[ (0–2^\circ) \]

\[ \text{MPTA} = 87^\circ \]  
\[ (85–90^\circ) \]

\[ \text{LDTA} = 89^\circ \]  
\[ (86–92^\circ) \]
Options for deformity correction: acute versus gradual
Internal or external fixation or combination
Acute correction with IM nail fixation
Advantages are:
- stable fixation allowing early weight bearing and joint motion
- no complications related to external fixator pins/frame
Disadvantages:
- Soft tissue problems
- Neurovascular complications
- Limited leg lengthening ability
Methods

5 cases: 4 post-traumatic deformity and 1 neglected congenital pseudarthrosis of the tibia

- 3 female and 2 male
- Mean age: 39.8 (range 17 to 62)
- Femur 2
- Tibia 3

Period: October 2013-March 2014

- All patients had an acute corrective osteotomy
- Stabilized with an intramedullary reamed and locked nail (sizes 9-10mm)
- Outcomes: Osteotomy union; ROM (range of motion) knee and ankle; infection rate; implants failure
Case #1 congenital Pseudarthrosis of Left tibia

- 17 year old female with a 14 year history of progressive left tibia deformity without trauma.
- Full ROM knee and ankle
- 6cm shortening
Pre-operative Xrays
Procedure

- Common peroneal nerve release.
- Double osteotomy of fibula
- Percutaneous Achilles tenotomy
Post-operative x rays
3 months follow-up

3 cm shortening
SQUAT AND SMILE
5 months X rays
SQUAT and Smile
Case #2 proximal tibial deformity

- 37 year old man
- Gun shot wound years ago
- 4 operations done elsewhere
- Anterior skin scarring with adherence to the tibia
- Full ROM of the knee
- 30° ankle equinus
Pre-operative x rays
Fibular osteotomy
Percutaneous Achilles tenotomy
Varus correction
Post-operative x rays
2 weeks follow-up

☐ Superficial skin infection
☐ Removal of one of the proximal interlocking screws
3 months follow-up
Case #3 neglected left supra condylar femur fracture

- 26 year old male
- Neglected left supra condylar fracture open Gustilo I
- Treated non operatively 4 months ago
- Malunion
- 4 cm shortening
- Limited ROM of the knee
Post-operative x rays
2 weeks follow-up

- Felt comfortable fully weight bearing
MONTHS FOLLOW-UP
Case #4 varus deformity right femur

- 57 year old female
- Distal 1/3 left femur fracture 4 years ago
- Treated by plate and screws
- Varus malunion
- Shortening 4 cm
lateral approach
removal plate and screws
osteotomy and deformity correction
Retrograde nailing with SIGN nail
Post-operative x rays

- good deformity correction
3 Months Follow-up
5 months follow-up

No pain in full weight bearing

Good knee flexion, but residual shortening
Case #5 neglected tibia fracture

- 62 year old female
- Open tibia fracture 2 years ago
- No previous operation
Procedure

- Common peroneal nerve release
- Fibular osteotomy
- Percutaneous Achilles tenotomy
5 MONTHS FOLLOW-UP

No pain on full weight bearing
All patients showed good clinical and radiological healing at 5 months follow-up.

- 4 had full range of motion of the knee and ankle.
- 1 had knee flexion contracture of 35°
- No deep Infection
- No Implant failure
- All patients had residual shortening, of which 2 had more than 2,5 cm shortening.
Results

Post-operative Complications

- Infection: 1 treated with local dressings and antibiotics
- Reoperation: 0
- Ankle equinus contracture: 0
Publications on post traumatic deformity corrections dominated by Ilizarov method

Very few papers on acute corrections and IM nailing

- **Tibial shaft malunion treated with IM nailing** by Wu CC Arch Orthop Trauma Surg 2000
- 37 cases all result of non operative treatment no infections
- Fibular osteotomy, closed wedge osteotomy, open reaming, IM nailing
- 100% union
- Time to union 6 months
- 2 infections
- Safe technique but precaution with soft tissues
IM locked nailing following acute correction of long bone malunions in the tibia and femur is a safe in our experience
SIGN nailing system allows locking in the absence of intra operative image intensification
No complex preoperative calculations required: insertion of the nail corrects the deformity in 2 dimensions
Rotational stability assured by proximal and distal locking
Excellent bone healing
No joint contractures as early mobilisation possible

But leg lengthening ability limited
And beware of skin and soft tissue issues at the osteotomy site
1. Herzenberg JE, Standard SC, Conway JD, Lamm BM, Siddiqui NA. The Art of Limb Alignment, 2nd ed. P1
5. B Spiegelberg; T Parratt; SK Dheerendra; WS Khan; R Jennings; DR Marsh
8. Wu CC; Chen WJ; Shih CH.. Tibial shaft malunion treated with reamed intramedullary nailing: a revised technique. Arch Orthop Trauma Surg 2000; 120: 152-6