Hybrid Techniques: The Best of Internal and External Fixation

Presented at McGill University
Visiting Professor February 29 - March 1, 2012

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External Fixation

- Gradual lengthening
- Gradual deformity correction
- Staged treatment for infection
- Pin tract infections
- Soft-tissue tethering from pins
- Long duration psychologically difficult
Hybrid Techniques

• Utilize the best of external fixation and internal fixation.
• External Fixation for distraction
• Substitute internal fixation for consolidation
• Decrease time in frame
• Protects against refracture
Techniques

• Lengthening over a nail (LON)
• Reconstruction around an existing IM nail
• Lengthening and then nailing (LATN)
• Lengthening and then plating (LAP)
• Bone transport over a nail
Lengthening and Then Nailing

LATN
Technique

Pin placement
To avoid contact
With future
IM nail:
Posterior transverse
Wire
Anteromedial pin
11:00
Anterolateral pin
2:00
After residual deformity correction
Custom LATN Targeting Device
Matched comparison

- LATN versus traditional lengthening with Ilizarov method
- Patients matched
  - Age
  - Etiology
  - Amount of lengthening
# RESULTS

<table>
<thead>
<tr>
<th></th>
<th>LATN</th>
<th>CLASSIC</th>
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<tbody>
<tr>
<td>Follow-up (mo)</td>
<td>40 (8-74)</td>
<td>41 (12-88)</td>
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<tr>
<td>Time in frame (weeks)</td>
<td>12 (3-27)</td>
<td>29 (14-55)</td>
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<tr>
<td>ED to frame removal (days)</td>
<td>9.6 (0-35)</td>
<td>130 (45-278)</td>
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<tr>
<td>EFI (mos/cm)</td>
<td>0.5 (0.3-1.1)</td>
<td>1.9 (1-4)</td>
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<tr>
<td>BHI (mos/cm)</td>
<td>0.8 (0.4-1.3)</td>
<td>1.9 (1-4)</td>
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60 y/o woman, failed pilon fx, osteomyelitis, bone defect
Bone defect + LLD = 13 cm
Ankle fusion, gradual shortening, IV antibiotics, planned staged LATN
Discussion

• LATN seems to be effective and safe
• Compared to classic method, time in frame is significantly less
• Bone Healing is hastened
• Protects against refracture
• No nonunions
Discussion

• Further study of LATN is warranted
  – Increased biomechanical stability of nail construct
    • Longer and wider nail
  – Biology of regenerate reaming
    • Autogenous bone graft, closed
    • Stimulate release of growth factors ???
Lengthening and Then Plating

LAP
Goals

• Decrease time in frame
• Prevent refracture of regenerate
• Correct periarticular deformity
• Osteotomy distal femur or proximal tibia
6 weeks post end distraction
Methods

• 13 patients, 15 bone segments
• Femur (6); tibia (9)
• Etiology
  – Congenital (4)
  – Malunion (4)
  – Bone defect/ transport (4)
  – Polio (1)
  – Growth arrest (2)
Results

• Lengthening: 3 cm (0.5 - 5.3)
• time in frame: 2.6 months (1.7-5)
• EFI: 1.0 (0.5-2.4)
• FWB/healing: 9.5 weeks (4.7-14)
• No deep infections
- Polio
- LLD
- Flexion deformity
- Weak quads
Intramedullary stimulation

harvest
LAP

- Can be effective for decreasing time in frame and preventing refracture
- Effective for correcting periarticular deformity
- Opportunity to stimulate regenerate in OR with drilling and injection (Harvest)
- Promising technique
Lengthening over a Nail
LON

- Paley (JBJS 1997) compared to classic femoral lengthening
- Decrease time in frame
- Quicker rehab and knee ROM recovery
- Protects against refracture
In frame
3 mos
Lengthening
Over an
Existing
IMN

LLD  3 cm
2.5 mo
Reconstruction of the Femur with Osteotomy Around an Existing Intramedullary Nail

- Presented at LLRS 2007, Chicago
- 6 patients
- 2.5 cm lengthening
- Frame time 35 days
- EFI: .49 mo/cm
- BHI: 1.13 mo/cm
- No deep infections, refractures
Bone Transport Over a Nail
Summary of Hybrid techniques

• Combine best of internal and external fixation
• Use ex fix for gradual distraction
• Use internal fixation to stabilize during consolidation
• Decrease frame time
• Protect against refracture
• Technical details about frame application
• Concern over deep infections
Thank You