I have no potential conflicts with this presentation
Internal lengthening nails:
Does lengthening with acute correction negatively effect bone healing during distraction osteogenesis?

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There is a concern about bone healing in patients treated with “acute correction & gradual lengthening”

Noonan Kenneth J, Price Charles T, Sproul Jack T.
Acute Correction and Distraction Osteogenesis for the Malaligned and Shortened Lower Extremity
Journal of Pediatric Orthopaedics 1998

Kamegaya Makoto et al
Limb Lengthening and Correction of Angulation Deformity: Immediate Correction by Using a Unilateral Fixator
12.0 years (range, 4.8-15.3)
Journal of Pediatric Orthopaedics 1996

- All of the papers about this subject were performed using with external fixator
- They concluded that it is suitable in children (immature physes)
Question:
Does acute correction and gradual lengthening in older patients has any negative effect on bone formation during lengthening by the using new internal lengthening nails?

(Precice & Fitbone & Lengthening over “retrograde” nail technique)
Three matched groups
(The age, amount of lengthening, etiology, difficulty of the procedure)

- All cases were treated with **retrograde femoral nailing technique**
- Lengthening with or without acute correction was performed by the osteotomy on distal meta-diaphyseal femur
- The amount of lengthening was **4 cm or more**
- **Exclusion criteria were as follows:**
  - Cases treated with antegrade technique
  - Smokers
  - Cases with metabolic bone disease
1st group: acute correction & gradual lengthening using by internal lengthening nails
(Fitbone-Wittenstein, Precice-Ellipse Technologies)
2nd group: only lengthening using by internal lengthening nails
(Fitbone-Wittenstein, Precice-Ellipse Technologies)

25 y old, 6.5 cm LLD

Acute lateral translation for to prevent MAD

Healing index: 1.076 ms/cm
3rd group: acute correction & gradual lengthening using by lengthening over “retrograde” nail (LORN) technique

LLD & valgus deformity  7° acute correction & 5.5 cm gradual lengthening  HI: 1.1 ms/cm

Lengthening Over a Retrograde Nail Using 3 Schanz Pins
Metin Kucukkaya, Ozgur Karakoyun, Unal Kuzgun

J Orthop Trauma - January 2013
ASAMI-North America 22nd Annual Scientific Meeting - 2012
Three matched groups  
(The age, amount of lengthening, etiology, difficulty of the procedure)

<table>
<thead>
<tr>
<th></th>
<th>1st group: 9 femurs</th>
<th>2nd group: 16 femurs</th>
<th>3rd group: 13 femurs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean amount of lengthening</strong></td>
<td>6.6 (± 2.97) cm</td>
<td>5.78 (± 1.07) cm</td>
<td>5.26 (±0.88) cm</td>
</tr>
<tr>
<td><strong>Mean age of p</strong></td>
<td>24 (±11.01) y</td>
<td>25.59 (±8.1) y</td>
<td>22.54 (±6.71) y</td>
</tr>
<tr>
<td><strong>Amount of the acute correction</strong></td>
<td>9° (4-22) d (+ acute rotation 0°-30°)</td>
<td>-</td>
<td>8° (5-11) d (+ acute rotation 0°-25°)</td>
</tr>
<tr>
<td><strong>Etiology</strong></td>
<td>Post-traumatic 6 Poliomyelitis sequela 2</td>
<td>Post-traumatic 7 Poliomyelitis sequela 1</td>
<td>Post-traumatic 8 Poliomyelitis sequela 1</td>
</tr>
<tr>
<td></td>
<td>Idiopatic (scoliosis) 1</td>
<td>Hemimelia 1</td>
<td>Rickets (2 femur/1 p)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Achondroplasia 1</td>
<td>Idiopatic 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cosmetic (4 femur/2 p)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Idiopatic 2</td>
<td></td>
</tr>
</tbody>
</table>

statistically were not different
## Results

The **average follow-up period was 30.8** (range 16-45) ms.

Solid consolidation was obtained in all cases.

The preoperative knee ROM was re-obtained in all cases at the end of treatment.

**Running back** was observed in 2 cases.

There was **no infection and broken nail**.

Scar formation was minimal. Groups of internal lengthening nails and all patients approved the cosmetic result.
Three matched groups

- Healing index (months/cm)
  (The number of months needed for radiographic consolidation for each centimeter of lengthening)

- The results were compared statistically by “Independet-Sampels T test” method
There was no significant differences between 1\textsuperscript{st} and 2\textsuperscript{nd} groups for the healing index (p:0.73)

However; healing index was better in the 1\textsuperscript{st} and 2\textsuperscript{nd} groups compared to 3\textsuperscript{rd} group (p < 0.05)
Case examples
3rd group - acute correction & gradual lengthening using by LORN technique

18 y old, LLD & varus deformity  10° acute correction & lengthening  HI: 1.56 ms/cm
1st group - acute correction & gradual lengthening

A 14 y old girl, valgus & rotational deformity + 4.5 cm LLD & scoliosis
1st group - acute correction & gradual lengthening
1st group - acute correction & gradual lengthening

Lateral view & entry point
Retrograde technique

1st group - acute correction & gradual lengthening
1st group - acute correction & gradual lengthening

Retrograde technique
1st group - acute correction & gradual lengthening

Is it working?
1st group - acute correction

4° angulation + 4 mm lateral translation & rotational correction

+ 1 m

+ 4 ms

4.5 cm distraction

+ 4 ms, HI: 0.9 ms/cm
1st group - acute correction & gradual lengthening

A 14 y old, 6° varus & apex anterior & 30° rotational deformity + 14 cm LLD
1st group - acute correction & gradual lengthening

Removing of the 1st Fitbone + insert 2nd Fitbone
1st group - acute correction & gradual lengthening

+ 11 ms, total distraction: 14 cm, HI: 0.8 ms/cm
A 35 y old, cosmetic case, after 6.5 cm femur lengthening, HI: 1 ms/cm
2nd group - only lengthening

Before

After

Removing of the nails at 2 ys
Discussion

The New “Intramedullary Cable Bone Transport Technique”
Metin Kucukkaya, Raffi Armagan, Unal Kuzgun


We observed that in most of the cases if you do not fix the transported bone segment externally, good bone healing could be obtained in spite of acute angulation & translation after osteotomy.

10 cm bone defect, HI: 34 d/cm
Conclusion

- It seems that acute correction in biologic limits has no serious negative effect on bone healing during gradual lengthening using by intramedullary distraction devices.
- Over reaming may cause prolonged healing index.
- Pins of external fixator may impair blood supply of the bone, and may cause prolonged healing index in the lengthening over “retrograde” nail technique.
Thank you

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