Intraoperative simulation of weight-bearing as an aid to hallux valgus surgery

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Our disclosures are in the Final AOFAS Program Book.
We have no potential conflicts with this presentation.
Introduction

• The foot splays on weight bearing, increasing the bunion deformity
• Intra-operative fluoroscopic images do not reproduce the pre-operative weight bearing images. This may lead to under-correction of the deformities
• Very little published data available about intra-op imaging for hallux valgus correction
• No literature comparing pre-op weight bearing & intra-op simulated weight bearing imaging
• We describe an intra-operative technique to simulate the pre-operative weight bearing image with the intra-operative fluoroscopic image. We find that this acts as an aid to achieving correction, particularly in severe deformities and also enables assessment of the adequacy of the correction.
Literature – Value of Intra-op Imaging

- Benefits of intra-operative imaging include more accurate correction and fixation and the opportunity to adjust these depending on the images produced (1).
- Better correction reduces the rate of recurrence of hallux valgus deformity (2).
- Intra-op imaging helps to identify complications like fractures and to deal with it.
- Elliot et al (1) compared intra-op and post-op imaging after correction using scarf osteotomy in 28 feet.
  - No statistically significant difference in the intra-op & post-op weight bearing values of IMA, IPA or sesamoid position.
  - Statistically significant increase in the post-oper HVA compared to intra-oper HVA (p<0.001).
Materials and Methods

- We describe a technique of inserting a 2mm K-wire from the base of M1 to M2.
- The wire was inserted whilst adducting the 1\textsuperscript{st} ray away from the 2\textsuperscript{nd} ray with the foot in plantarflexion.
- This stabilises the M1 in the maximum position of metatarsus primus varus, reproducing the IMA & HVA seen on weight bearing images.

This enables:
- Greater ability to push the distal-most fragment laterally
- An assessment of the quality of correction in the position of greatest deformity (ie simulated Weight bearing)
Materials and Methods

- In total we have performed this on more than 200 occasions.
- All these patients had their intra-op fluroscopic images with K-wire, saved.
- We measured the IMA and HVA of both the pre-op weight bearing radiographs and the intra-op simulated weight bearing images before correction, for each of these patients.
- These values were then compared using statistical methods

Pre-op WB XR

Intra-op Simulated ‘WB’ XR
Results

- There were a total of 31 feet
- All patients had measurements from their pre and post op weight bearing x-rays and fluoroscopic intra-op simulated weight-bearing images
- 27 females & 4 males
- Mean age of patients: 53 yrs (range 27 – 76 yrs)

<table>
<thead>
<tr>
<th></th>
<th>Mean Pre-Op</th>
<th>Mean Intra-op</th>
<th>P Value</th>
<th>Mean Post-op</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intramedullary Angle</td>
<td>16.1° (9.9-27.7°)</td>
<td>17.9° (12.6-28.8°)</td>
<td>&lt;0.05</td>
<td>5.2° (3.6 -12.1°)</td>
</tr>
<tr>
<td>Hallux Valgus Angle</td>
<td>33.8° (13.5 -46.5°)</td>
<td>33.1° (13.5 -44.5°)</td>
<td>&lt;0.05</td>
<td>8.4° (0.7 -15.4°)</td>
</tr>
</tbody>
</table>
Results

Outcomes

1. The simulated WB image reliably reproduced the pre-op WB degree of deformity
2. In this sample of 31 patients there was an excellent correction at last follow-up
3. 15 of these cases were performed minimally invasively through a 3mm incision and in these cases the K wire stabilisation greatly assisted the ability to achieve adequate translation as the shaft was stabilised and the head could then pushed across
4. This was especially true in cases of severe deformity

Complications

• In this sample of 31 patients there were no complications
• However in the early experience of using this technique the Wire was placed transversely and distally.
• We noted a stress reaction (though no fracture) in M2 and the wire was then placed obliquely and more proximally no further stress reactions were noted
Conclusion

• We describe a simple and useful technique for simulating weight bearing intra-operatively to help guide the amount of correction required and achieved.

• In our study, there was no statistically significant difference in the IMA & HVA of the pre-op weight bearing radiographs and intra-op simulated weight bearing images.

• We also found that stabilising M1 against M2 allowed greater translation of the corrective osteotomy for severe deformities than is traditionally practised.

• We recommend oblique placement of the K wire to avoid a stress reaction in M2.

