Three Dimensional Modeling of the Proximal Opening Wedge First Metatarsal Osteotomy

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NO CONFLICTS TO DISCLOSE

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My disclosure is in the Final AOFAS Mobile App
I have no potential conflicts with this presentation
Introduction

• Proximal opening-wedge first metatarsal osteotomy is often employed to reduce intermetatarsal angle in hallux valgus

• Concerns in performing the osteotomy:
  – head elevation
  – lack of consensus on osteotomy site location
  – Potential lengthening & increased adjacent joint contact pressure
Introduction

• Purpose:
  – Utilize a three-dimensional model computerized model to evaluate the effect of the osteotomy itself and variation of location on the geometry of the first metatarsal

• Hypothesis
  – Variance in starting point of the osteotomy will have minimal change in affecting overall change in geometry
Methods

• Three-dimensional computerized modeling software was used to create a proximal opening wedge osteotomy
• Varying wedge lengths (3-7mm) created
• Two starting points were evaluated:
  – 10mm and 15mm from the base of the first metatarsal
  – Both terminated at the lateral cortex 5mm from the base
• For each osteotomy, the metatarsal length, head height and metatarsal rotation were measured.
Three Dimensional Computerized Model of Proximal Opening Wedge Osteotomy
Results

- Comparison of metatarsal geometry with respect to starting location of osteotomy

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<th>Length (mm)</th>
<th>Rotation (°)</th>
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Results

• Increasing wedge lengths resulted in increases in both metatarsal length and elevation.
• Overall length increased 1.03mm and 1.04mm for the 10mm and 15mm groups respectively for the wedge lengths evaluated.
• Head elevation was 0.55 and 0.54mm respectively.
• Metatarsal head rotation was approximately 3 degrees for each mm increase in wedge length.
• No significant difference was noted with respect to metatarsal length or head elevation between performing the osteotomy 10mm or 15mm from the metatarsal base.
Discussion

• Proximal opening wedge osteotomies are popular due to relative technical ease, reproducibility and stability over time.

• Theoretical concerns exist regarding proximal opening wedge osteotomies due to:
  – Potential lengthening of metatarsal.
  – Potential increased pressure at 1st TMT and MTP joints.
  – Head elevation.
Discussion

• Proximal opening wedge osteotomies result in increased metatarsal length and head elevation
• Overall change is minimal and clinically insignificant over commonly employed wedge lengths
• Variation in starting point resulted in minimal change in length or head elevation
• Metatarsal head rotation of 3° per millimeter of rotation consistent with clinical observation
Conclusion

• Proximal opening-wedge osteotomy results in a minimal increase in overall metatarsal length and head elevation over a range of commonly employed wedge lengths
• Osteotomy could be performed 15mm from the base, increasing space for proximal fixation and potentially reducing stress on the first tarsometatarsal articulation
References

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