Biomechanical Evaluation of Threaded Headless Screws Compared to Traditional Headed Screws in Subtalar Fusion Model

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My disclosure is in the Final AOFAS Program Book. I have no potential conflicts with this presentation.
Background:

• Headless screws shown to be equal or superior to traditional screws in:
  – maintaining fixation in an osteotomy
  – fracture reduction and fixation

• Headless screws provide a locking mechanism in the setting of lower compressive strength versus traditional screws

• Hypothesis:
  – Headless screws hold a subtalar arthrodesis fusion model with less deformity in cyclic loading than conventional screws
Method:

• 12 matched pairs -> subtalar arthrodesis in-situ

• 2 screw fixation of the subtalar joint
  – 1 extremity w/ Integra 7.5mm headless cannulated screws
  – Contralateral side w/ AO 7.3mm partially threaded cannulated screws
  – Joint surface was not prepared
Method:

- Talus / calcaneus excised and mounted on loading frame
- Differential variable reluctance transducers used to measure motion
- Torque applied rate of 1 degree / sec
- 0 N of axial load
- Stiffness and subtalar motion was assessed
- Paired t-test to determine statistical significance
Results:

- Headless screws compared to traditional screws demonstrated less motion before and after cyclical loading to internal and external rotation (p<0.05)
Results:

- Statistically significant higher initial stiffness to internal and external rotation ($p<0.02$ & $p<0.0002$)
- Higher final stiffness to internal and external rotation but not statistically significant

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<tr>
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<th>Initial Stiffness</th>
<th>Final Stiffness</th>
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<tbody>
<tr>
<td>Headless Screw</td>
<td>0.97</td>
<td>1.14</td>
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<tr>
<td>Traditional Screw</td>
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<td>0.90</td>
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<td>1.23</td>
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<tr>
<td>Traditional Screw</td>
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Discussion:

• Headless screws demonstrated statistically significant increased stiffness and less motion compared to traditional screws

• Possible improved biomechanical properties due to proximal locking mechanism

• Clinical application in fusions that require more stability or in patients with osteopenic bone

• Provide less soft tissue irritation

• Further studies are needed to determine the clinical significance of using headless screws in subtalar fusion
Conclusion:

• The headless screw model was able to hold a subtalar arthrodesis with less deformity to cyclic loading compared to conventional headed screws.
References


8. Hintermann B, Valderrabano V, Nigg B. *Influence of screw type on obtained contact area and contact force in a cadaveric subtalar arthrodesis model*. Foot Ankle Int. 2002 Nov;23(11):986-91

