Hindfoot Motion Following Total Ankle Arthroplasty

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

- There has been a resurgence in ankle replacement for ankle arthritis.
- No previously published study has evaluated the effect of TAA on the surrounding joints.
- Ankle arthrodesis results in increased arthritis in adjacent joints.
- Presumably, TAA has a sparing effect on hindfoot and midfoot joints, because there should be no altered mechanics in the adjacent joints.
Purpose

- To evaluate the status of the functional hindfoot joints in patients who underwent STAR total ankle arthroplasty.

- Comparing post-arthroplasty motion at one year to motion in the unaffected limb in order to establish baseline understanding of hindfoot motion in cases treated for ankle arthritis.
Materials and Methods

- Retrospective study that included patients enrolled in the FDA clinical trial involving the STAR.
- 46 patients (37 females, 9 males) with an average age of 66.1 years ±10.4 (range 43.0 – 85.3).
- The average weight was 76.8 kg ± 15.0 (range 48.9 to 109.0) and average height was 164.9 cm ± 8.8 (range 149.9 to 182.9).
- 28 right ankles affected and 18 left ankles affected.
- This study was approved by the Baylor Institutional Review Board.
Gait Analysis

- The mean gait analysis time from surgery was 4.9 years ± 1.8 years (range; 2.0 - 9.1 years).
- 12-camera Vicon Motion Capture System
- An Euler sequence of rotations ordered by sagittal, coronal, and then transverse were used to calculate hindfoot and ankle angles.
- A minimum of 20 strides across a 10 meter capture volume at a self-selected pace were used for analysis.
- Kinematic parameters of interest include sagittal plane ankle range of motion and all three planes of motion of the hindfoot.
- Temporal-Spatial variables examined were percent stance time and step length.
- Statistical analysis involved a paired Student’s t-test. Significance was set at p < 0.05.
Results: Temporal-Spatial Parameters

- A significant difference was found for both percent stance time and for step length between the affected and unaffected limbs.

- Stance time on the affected side was $61.1 \pm 2.2\%$ of the gait cycle compared to $63.2 \pm 2.1\%$ for the unaffected side ($p<0.05$).

- Step length was longer on the affected side at 55.5 cm compared to 53.9 cm on the contra lateral side ($p<.05$).
Sagittal Plane Ankle-Dorsi/Plantar Flexion

- Affected ankle range of motion was 16.8 ± 4.5 degrees and the unaffected ankle had an increased range of 23.6 ± 5.0 degrees. *p*<0.05.
Hindfoot Sagittal Plane-Dorsi/Plantar Flexion

- Range of motion was $12.7 \pm 4.2$ degrees on the affected side and $17.3 \pm 3.5$ degrees on the unaffected side. p<0.05.
Range of motion was $4.7 \pm 2.4$ degrees on the affected side and $7.5 \pm 2.4$ degrees on the unaffected side. $p<0.05$.
Transverse Plane-Internal/External Rotation

- Range of motion totaled 4.1 ± 1.5 degrees in the affected side and 4.9 ± 1.6 on the unaffected side. p<0.05.
Discussion

- This study evaluated and quantified the residual hindfoot function in temporal-spatial parameters, range of motion and power post total ankle arthroplasty with the STAR prosthesis in 46 patients.

- Sealey and Myerson in 2008 used radiographic measurements to evaluate motion of the hindfoot following ankle arthrodesis. They showed that there was statistically significant hypermobility of the subtalar and medial column joints following ankle arthrodesis (35).

- This study shows a statistically significant decrease in motion of the hindfoot joints after ankle replacement.
Conclusion

- This shows a significant decrease in hindfoot motion after total ankle arthroplasty as compared to the patients’ unaffected side.

- This decrease in motion may be what conserves hindfoot joints post ankle replacement in comparison to post-arthrodesis.
References

37. Brodersen VL. Hindfoot motion following reconstruction for posterior tibial tendon dysfunction. Foot Ankle Int 2009;30(7):613-618.