

Keynote presentation

Open Access

Sailing charted seas: biomechanics and the orthopedic surgeon

George A Arangio

Address: Department Orthopaedic Surgery, Penn State, Milton S. Hershey Medical College

Email: George A Arangio - casarangio@aol.com

from 1st Congress of the International Foot & Ankle Biomechanics (i-FAB) community
Bologna, Italy. 4–6 September 2008

Published: 26 September 2008

Journal of Foot and Ankle Research 2008, **1**(Suppl 1):K2 doi:10.1186/1757-1146-1-S1-K2

This abstract is available from: <http://www.jfootankleres.com/content/1/S1/K2>

© 2008 Arangio; licensee BioMed Central Ltd.

Introduction

Biomechanical models have been used to study the distribution of foot forces, metatarsal stresses, heel pad, arch height, plantar aponeurosis, subtalar joint, extrinsic muscles, medial displacement calcaneal osteotomy, subtalar arthroereisis and lateral column lengthening calcaneal osteotomy in the normal and flatfoot. We review past research data and discuss results as they relate to relevant clinical topics. [1-6]

Methods

A three dimensional multi-segment biomechanical model [7] was used with anatomical data from normal feet, feet made flat and corrected feet. The model includes a series of equations that describe how the foot deforms under a theoretical applied load of 683 Newtons (70 Kg.) on one foot in static stance phase

Results

Lateral Column Lengthening Calcaneal Osteotomy (LCL) decreases the forces needed by ligaments to resist

moments at the medial arch joints by -79% and the talonavicular Joint -63% in the flattened foot.

Conclusion

The model has accurately predicted the deformation of the foot under a theoretical load of 683 Newtons. We have analyzed the effect of various surgical procedures on the flatfoot. We discussed the clinical relevance of the model data to the ankle sprain, 5th metatarsal stress fracture, posterior tibial tendon insufficiency, the flatfoot and the cavus foot.

Table I: Moments in Newton-meters (N·m)

Joint	Normal Nm	Flatfoot Nm	Flatfoot + LCL Nm
I st Metatarsal medial cuneiform	0.20	8.76	0.51
Medial – cuneiform navicular	0.33	14.48	0.84
Talo-navicular	5.61	21.63	8.05 (-63%)
Calcaneal-cuboid	5.69	0.00	7.72

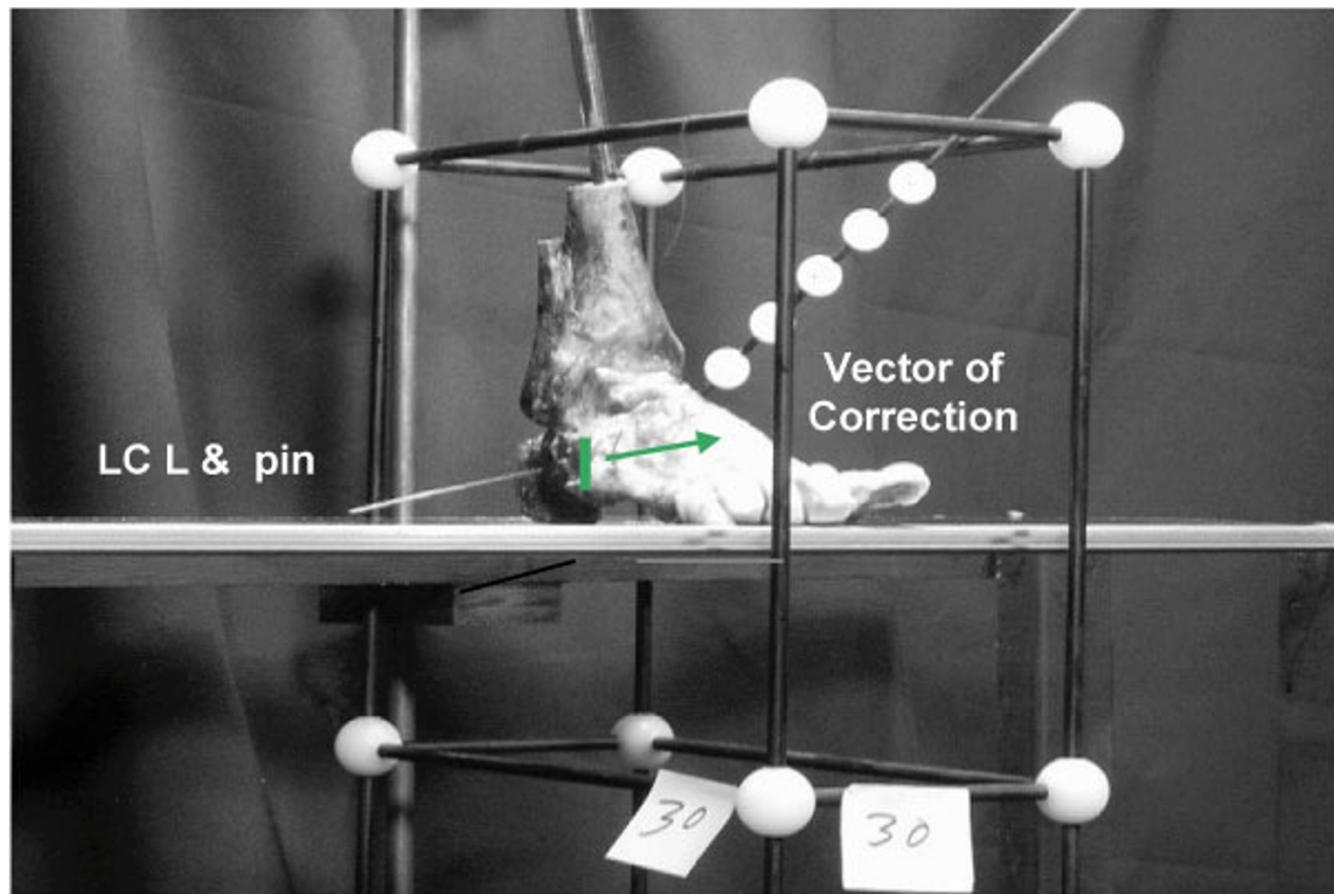


Figure 1
Cadaver Foot with calibrated cage and pointer for Direct Linear Transformation Photography illustrating LCL.

Acknowledgement

Eric P Salathe Sr. PhD.

References

1. Arangio GA, et al: *Clin Biomech* 2007, **22**:472-477.
2. Arangio GA, et al: *Clin Biomech* 2004, **19**:847-852.
3. Arangio GA, et al: *Clin Biomech* 2001, **16**:539-539.
4. Arangio GA, et al: *Foot Ankle Int* 2000, **21**:216-220.
5. Arangio GA, et al: *Foot and Ankle Surgery* 1998, **4**:123-128.
6. Arangio GA, et al: *Clin Orthop* 1997, **339**:227-231.
7. Salathe EP, et al: *J Biomech Eng* 2002, **124**:241-281.

Publish with **BioMed Central** and every scientist can read your work free of charge

"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:
http://www.biomedcentral.com/info/publishing_adv.asp

