

What are the physical characteristics of the distal tibiofibular syndesmosis in uninjured patients?

Qasim Rahman, BS¹; Albert T. Roh, MD²; Tabarik Al-Abbadi, MD^{1,2}; Giuseppe Carotenuto, MD¹; Margaret Kincaid, MD²; Charlotte Lansky, MD¹; Scott Penny, MD²; Paul Kang, MPH¹; Daniel G. Gridley, MD²
¹University of Arizona College of Medicine- Phoenix ; ²Maricopa Integrated Health System

Objective

The purpose of this study is to review the normal distal tibiofibular syndesmosis and characterize the parameters of the uninjured joint using both computed tomography (CT) and magnetic resonance imaging (MRI).

Background

The syndesmosis is a crucial component for the ankle joint as any injury to it can immobilize a person. The ultimate goal of treatment is to restore the syndesmosis and ankle joint to their respective pre-injury, anatomic alignments. Few studies have attempted to characterize normal syndesmosis joints. Many of these studies have had certain limitations: small population size, minimal diversity in subject demographics, and very few raters taking part in data collection.

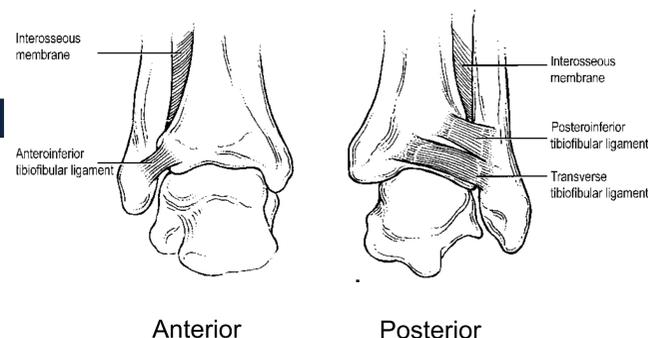
Methods

Our study is a retrospective review of 384 CT (269 male, 115 females, age: 18-80 years) and 220 MRI (77 male, 143 females, age: 18-75 years) exams of the lower extremity. Exclusion criteria included pediatric patients, previous injury, surgery, or chronic disease of the ankle.

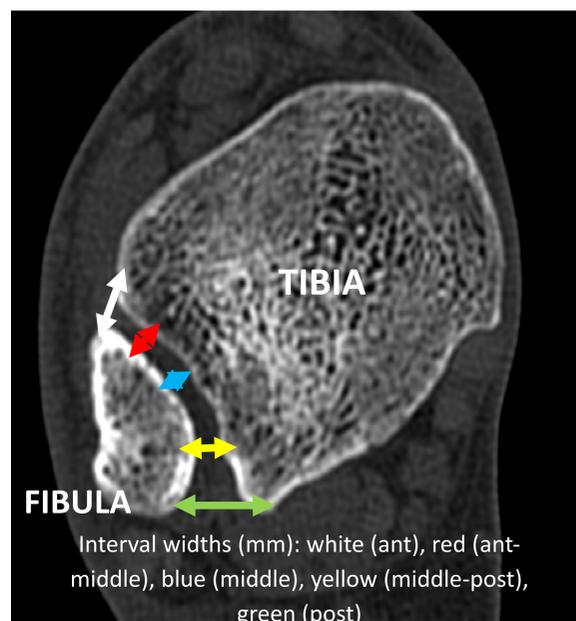
The protocol began with drawing a 1 cm line above the plafond.¹⁻³ From this, an axial image was obtained (location corresponding to white dashed line). Measurements were based on the space (width) of the distal syndesmosis joint. Five length (mm) measurements were taken as shown below

Measurements were compared using descriptive and inferential (t-test, one-way ANOVA) statistical analyses in context of age and gender.

Ligaments of Distal Syndesmosis



CT coronal: distal syndesmosis



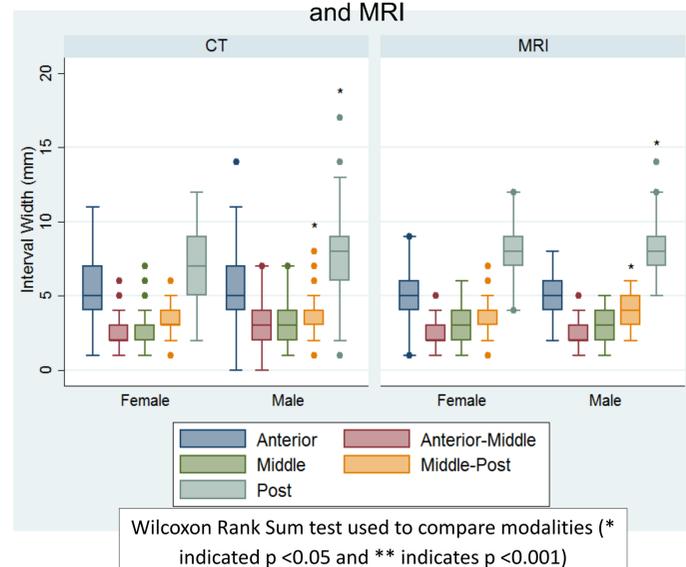
CT axial: distal syndesmosis 1 cm above tibiotalar joint

Results

CT vs. MRI demonstrated the following measurements. Least variation can be seen in the middle interval between the modalities

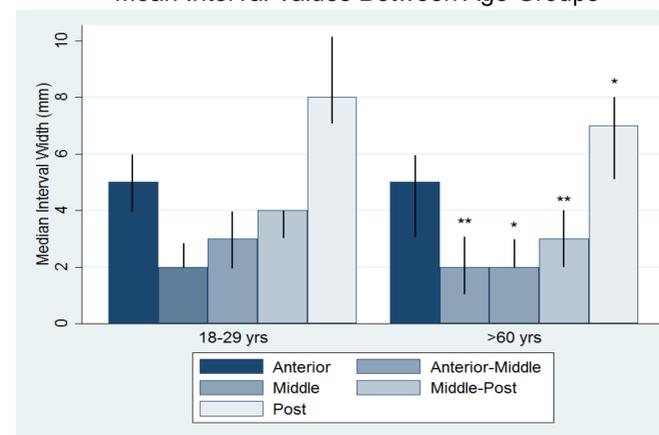
Intervals	CT (mm)	MRI (mm)
Ant	5.42 ± 2.07	4.89 ± 1.37
Ant-Middle	2.74 ± 1.21	2.36 ± 0.83
Middle	2.98 ± 1.30	3.03 ± 0.99
Middle-post	3.50 ± 1.26	3.75 ± 1.04
Post	7.39 ± 2.47	7.87 ± 1.68

Mean Interval Values Between Genders for Both CT and MRI



The male intervals were generally larger compared to females (both CT and MRI). The differences between genders became larger moving more posterior

Mean Interval Values Between Age Groups



Comparing age groups showed there was a significant difference ($P < 0.03$). The general trend demonstrated decreasing syndesmosis interval size with increasing age. This can be seen with the extremes of age which showed a decrease by greater than 0.5 mm for all values.

Discussion

This study highlighted that there is one reliable form of measurement available for assessing post-surgical success: the middle interval. It also showed some variations between gender. The bones in males tend to be larger than their female counterparts. As such, the overall contact between the tibia and fibula can be less, which leads to increased spacing within the ankle joint. Another trend was seen in patients of different ages. It was noticed that with increased age, there was less space between the bones comprising the ankle joint. The main reason for this can be attributed to the progress degenerative changes that occur with increasing age.

There were a few limitations of this study that must be addressed. One, height and weight were not considered as part of this study. This is important, because it has been established that with increased weight, the progression of osteoarthritis becomes more rapid secondary to excessive joint loading. Second, systemic conditions such as diabetes mellitus and autoimmune conditions were not considered.

Future directions of this study include a prospective analysis of how the ankle joint is characterized in patients suffering from syndesmosis injuries post-reduction.

Conclusions

The middle interval demonstrated statistical significance in the gender and age based differences. Therefore, the middle interval may be considered less than 5.5 mm* in the uninjured ankle with variations based on gender and age (see table below). The reported values can be referenced post-surgery to assess for appropriate reduction and normal alignment.

Age	Gender	Male	Female
<59 years		5.4 mm	4.8 mm
>60 years		4.8 mm	4.2 mm

* + 2SD (SD =1 mm)

Acknowledgements

I would like to sincerely thank all of the authors for their support and guidance throughout the project. I also thank Dr. Matthew McEchron for his support and dedication to the scholarly project program.

References

- Phisitkul P, Ebinger T, Goetz J, Vaseenon T, Marsh JL. Forceps reduction of the syndesmosis in rotational ankle fractures: a cadaveric study. J Bone Joint Surg Am. 2012 Dec 19;94(24):2256-61.
- Lepoja rvi S, Pakarinen H, Savola O, Haapea M, Sequeiros RB, Niinima ki J. Posterior translation of the fibula may indicate malreduction: CT study of normal variation in uninjured ankles. J Orthop Trauma. 2014 Apr;28(4):205-9.
- Dikos GD, Heisler J, Choplin RH, Weber TG. Normal tibiofibular relationships at the syndesmosis on axial CT imaging. J Orthop Trauma. 2012 Jul;26(7):433-8.