

# INCIDENCE OF PLANTAR PLATE TEARS AND ASSOCIATED ANATOMIC VARIATIONS OF THE SECOND METATARSOPHALANGEAL JOINT: A CADAVERIC STUDY

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MY DISCLOSURE IS IN THE  
FINAL AOFAS PROGRAM BOOK.

I HAVE NO POTENTIAL CONFLICTS WITH  
THIS PRESENTATION.



# INTRODUCTION

- The plantar plate is a structure that has come to the forefront of forefoot reconstruction as a structure that can cause pain and deformity.
- Previous scientific literature on this topic has focused on diagnostic criteria<sup>1-2</sup>, imaging<sup>3-4</sup> and surgical correction<sup>5-6</sup> of pathology.
- The normal anatomic nature<sup>7-8</sup> and blood supply<sup>9</sup> to the lesser metatarsals has been previously investigated.
- A previous cadaveric study of the plantar plate found 15 plantar plate tears in 15 specimens with crossover toes<sup>3</sup>.
- The incidence of plantar plate tears in cadaveric specimens without crossover toes is unknown as previous studies have focused on cadavers with crossover toe deformities<sup>3,11</sup>.

# METHODS

- Twenty cadaveric specimens ***without*** crossover toes were selected from available specimens and the foot was harvested at the tibio-talar joint.
- A physical inspection was performed to note any digital deformities.
- The second ray was dissected free from the Lis Franc articulation, preserving all attachments to the metatarsophalangeal joint.
- The plantar plate and collateral ligaments were observed for any gross pathology. Pathology was noted and classified<sup>10</sup>.
- The plantar plate was measured with a digital venier caliper.
- The data was analyzed.

# RESULTS

- There were 6 male and 14 female cadaveric specimens.
- Male specimens: average age  $56.7 \pm 8.3$  (48 – 68)
- Female specimens: average age  $71.1 \pm 1.4.6$  (52 – 95)
- Medical records were unavailable for all specimens.

## INCIDENCE OF PLANTAR PLATE PATHOLOGY

- 14 of the 20 specimens studied were observed to have pathology of the plantar plate.
- 3/6 (50%) of the male specimens had plantar plate pathology.
- 11/14 (78.6%) of the female specimens had plantar plate pathology.

# RESULTS

- Length, width and thickness of the plantar plate was found to be different in specimens with and without hammered toes.

	<b>Length</b>	<b>Width</b>	<b>Thickness</b>
With a hammered toe	<b>16.9 ± 2.6 mm (12.7 – 20.9)</b>	16.2 ± 2.6 mm (12.2 – 20.1)	2.2 ± 0.5 mm (1.6 – 2.9)
Without a hammered toe	<b>13.3 ± 1.8 mm (10.5 – 14.6)</b>	15.8 ± 3.5 mm (9.5 – 19.3)	1.8 ± 0.3 mm (1.5 – 2.1)
Significance	<b>p &lt;0.01</b>	p = 0.068	p = 0.061

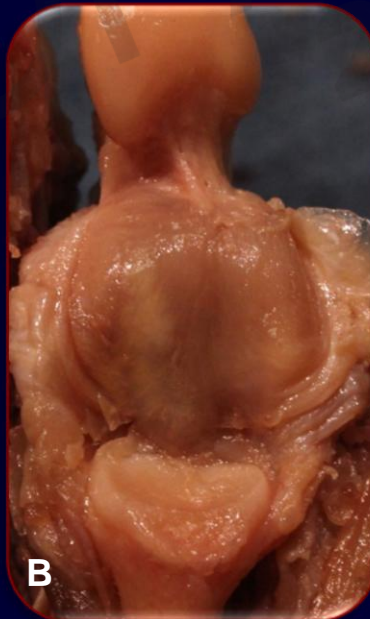
# RESULTS

- There were differences noted in the insertion of the plantar plate noted in specimens with and without hammered toes.

	With a hammered toe	Without a hammered toe	
Medial longitudinal band insertion (width)	3.4 ± 0.7 mm (2.7 – 4.9)	4.0 ± 0.3 mm (3.6 – 4.3)	p < 0.01
Lateral longitudinal band insertion (width)	3.4 ± 0.8 mm (2.0 – 4.1)	3.9 ± 0.6 mm (3.3 – 4.8)	p < 0.01
Central raffe	6.7 ± 1.2 mm (5 – 8.9)	3.7 ± 1.3 mm (2.2 – 5.4)	p < 0.01

# VARIATIONS OF THE PLANTAR PLATE

- A. The deep surface of either the medial or lateral collateral ligament were continuous with the plantar plate.
- B. The deep surface of both the medial and lateral collateral ligament were continuous with the plantar plate.
- C. The deep surfaces of the medial collateral ligament, the lateral collateral ligament and the plantar plate were distinctly separate.





# DISCUSSION

- Of the 20 specimens reported here, 70% had pathology of the plantar plate and 50% had pathology of the collateral ligaments. This suggests that the presence of plantar plate and collateral ligament pathology may be higher than initially postulated.
- The dimensions of the plantar plate have not been consistently reported in scientific literature. In the specimens with hammered toes:
  - The plantar plate was significantly longer ( $p < 0.01$ ).
  - The plantar plate was thicker ( $p = 0.061$ ).
  - The insertion of the medial and lateral longitudinal bands into the base of the proximal phalanx was narrower with a wider central raffe ( $p < 0.01$ ).
- Taken together, these findings suggest that:
  - The plantar plate may have a mechanism for responding to changes in load and alterations in tissue stress.
  - Attenuation of the plantar plate as part of the lesser metatarsophalangeal deformation process may not be an entirely accurate portrayal of this pathoanatomic process.
  - The insertion of the plantar plate onto the base of the proximal phalanx may be either a cause or a result of a digital deformity.

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