Accuracy of Radiographic Techniques to Identify the True Calcaneofibular Ligament Insertion for Lateral Ankle Ligament Reconstruction

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Purpose:

To determine the most accurate method to locate the CFL insertion radiographically.

Methods

- 25 patients with lateral ankle sprains (CFL intact) received an ankle MRI to identify the “true” insertion of the CFL.
- The distance between the marked insertion site and three bony landmarks was measured on sagittal MRI.
- Three methods (Best, Lopes, Taser) for determining the CFL insertion were then applied to lateral ankle radiographs

Methods

Best

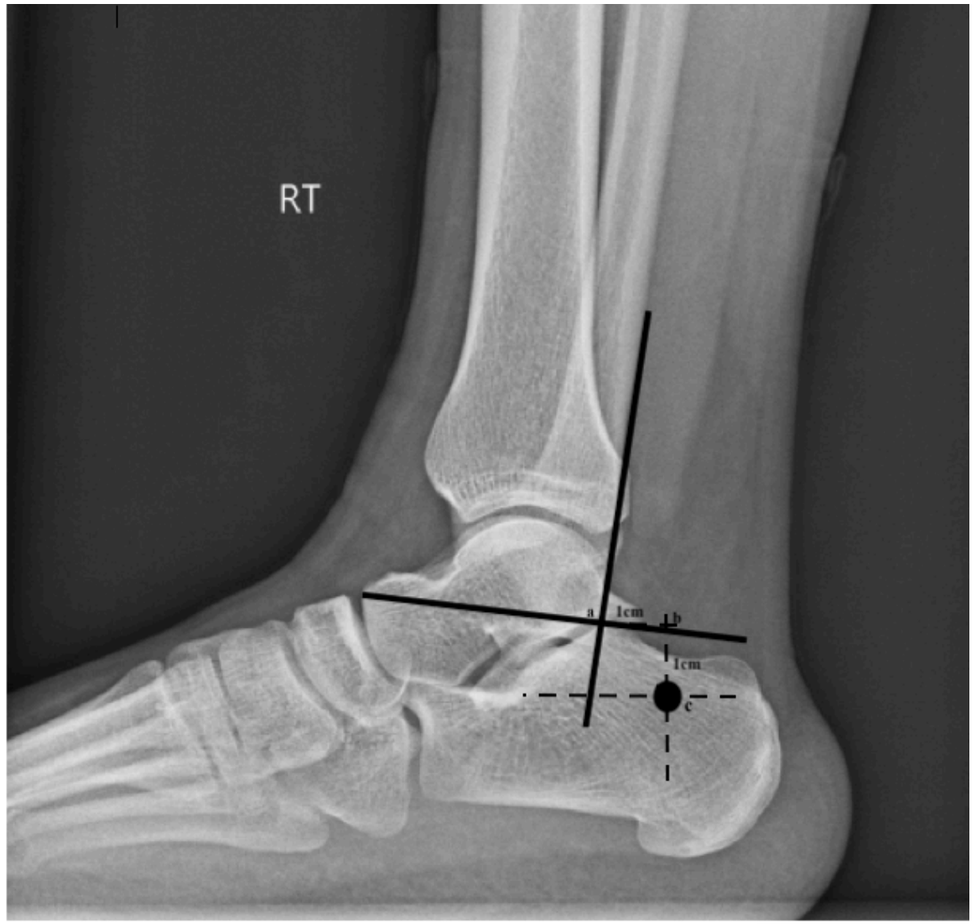
- *CFL insertion located at intersection of two lines:*
  - Vertical line tangent to the posterior convexity of the superior surface of the talus.
  - horizontal, perpendicular tangent line at the deepest concavity of the sinus tarsi.

● = estimated CFL insertion

Methods

Lopes

- *CFL insertion is 1 cm distal and 1 cm posterior to intersection of two lines*
  - Vertical line along the axis of the posterior diaphysis of the fibula.
  - Horizontal line tangent to the inferior tip of the lateral malleolus.



● = estimated CFL insertion

Methods

Taser

- *The CFL insertion is found 12mm distal to the posterior third of the superior surface of the calcaneus.*

● = estimated CFL insertion

Methods

- **X and Y coordinate distances from the insertion site (as determined by the Best, Lopes, and Taser methods) to three bony landmarks were measured, and compared to MRI measurements**
- Bony landmarks
  - *The most superior point of the posterosuperior surface of the calcaneus (A)*
  - *The posterior most aspect of the sinus tarsi (B)*
  - *The distal tip of the fibula (C)*

● = estimated CFL insertion

Statistical Analysis

- *The three techniques were compared to the MRI true insertion*
- *Mean differences from the true insertion with X , Y, and combined XY coordinates were recorded*
- ***Repeated measures ANOVA** used to analyze differences in the means across groups*
- ***Post-hoc analysis** was performed to evaluate differences in means between two specific groups*

Results

- Distance in the X direction: no significant difference between techniques (P=0.264)
- ***Distance in the Y direction: significant difference between techniques (P=0.015)***
- ***Distance in the XY direction: significant difference between techniques (P=0.001)***
- ***Best method significantly closer to true CFL insertion compared to Lopes method in Y (P=0.042) and XY (P=0.004) directions***
- ***Taser method significantly closer to true CFL insertion compared to Lopes method in XY direction (P=0.017)***
- No significant difference between Best and Taser methods

Results

The average, standard deviation, minimum, and maximum distances from the CFL insertion point as identified by each technique to the true insertion identified by MRI, are reported in the table.

Coordinate	Technique	N	Mean (mm)	Standard Deviation	Minimum (mm)	Maximum (mm)	P-value, Repeated Measures ANOVA	P-value, Post-Hoc Bonferroni test	
								Best	Lopes
X	Best	25	0.58	3.25	-4.40	9.10	0.264	-	-
	Lopes	25	0.29	5.01	-11.10	8.40		1.00	-
	Taser	25	1.67	3.47	-3.60	9.10		0.509	0.301
	Total	75	0.85	3.98	-11.10	9.10			
Y	Best	25	0.28	2.09	-5.70	3.80	**0.015****	-	-
	Lopes	25	-2.26	3.58	-9.50	5.30		**0.042****	-
	Taser	25	-0.92	2.08	-3.40	3.80		0.133	0.237
	Total	75	-0.97	2.84	-9.50	5.30			
XY	Best	25	3.18	2.18	0.78	9.14	**0.001****	-	-
	Lopes	25	5.86	2.72	1.70	11.10		**0.004****	-
	Taser	25	3.84	2.18	0.81	9.61		0.808	**0.017****
	Total	75	4.30	2.61	0.78	11.10			

Conclusion

- ***The Best and Taser techniques were found to be closest to the true CFL insertion when combining X and Y distances.***

- *If the Best and Taser techniques can be readily used in the operating room, they would likely prove the most reliable for finding the true CFL insertion for lateral ankle ligament reconstruction.*

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