

Second Screw Optimal Compression of the Posterior Facet with STJ Arthrodesis: A Comparison of Two Different “Extra-Articular” Screw Placements

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Introduction

Subtalar joint (STJ) arthrodesis has historically been a common method of treating a variety of foot and ankle pathologies. Previous research describes varying surgical methods, as well conflicting evidence on success rates for STJ arthrodesis¹⁻⁴. One of the potential limitations of STJ arthrodesis is the small joint size for the arthrodesis and the unique joint anatomy. The STJ is made of 3 facets with the posterior facet being the largest of the three. In certain circumstances, it is difficult to place multiple screws across the posterior facet, thus causing the need for an “extra-articular” screw.

Purpose

The purpose of this study is to provide a consensus on the optimal screw placement for the second screw that is extra-articular that will allow optimal compression across the posterior facet.

Methods

5 frozen cadavers were utilized for this study. The cadavers were thawed prior to the testing. The cadavers were dissected to expose the lateral aspect of the posterior facet of the subtalar joint. Ultra-low contact film was cut to match each of the of the cadavers unique anatomic characteristics of the posterior facet of the calcaneus. The film was carefully placed and secured within only the posterior facet of the joint. Two screw positions were utilized: (1) Posterior-inferior aspect of the calcaneus to the talar neck and (2) plantar aspect of the calcaneus to the dorsal talus just anterior to the posterior facet (Figures 1 and 2). A 6.5mm partially-threaded compression screw was used separately for each location. Care was also used to confirm that none of the screw was within or crossing the posterior facet of the STJ. The screws were carefully hand-tightened to 40lbs. The film was then analyzed using a Fujifilm Pressure Mapping System© while varying the location of the screw.

Figures

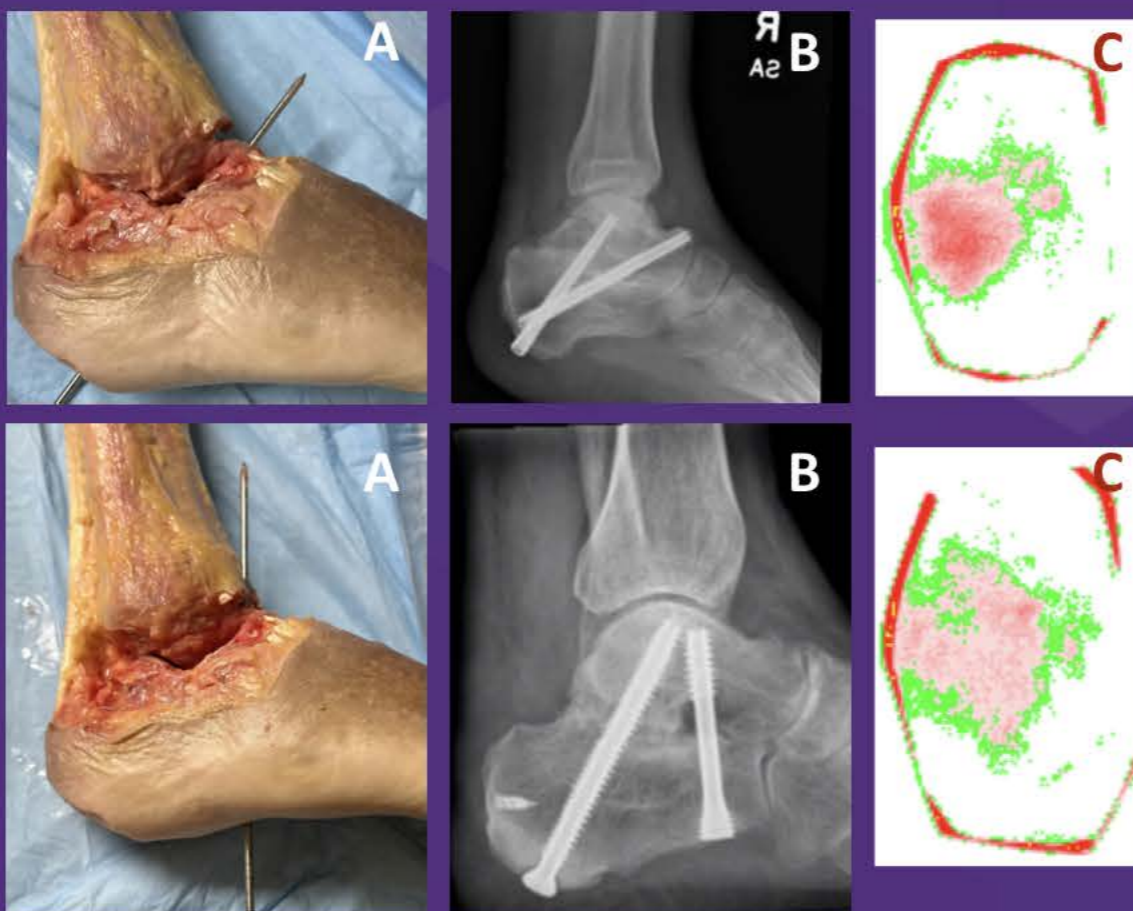


Figure 1
Posterior-
Inferior to dorsal
talar neck screw
A. Specimen
orientation
of the screw
B. Clinical
Radiograph
C. Pressure film

Figure 2
Plantar to dorsal
screw
A. Specimen
orientation
of the screw
B. Clinical
Radiograph
C. Pressure film

Discussion

Optimal fixation leading to optimal compression of an arthrodesis site is the goal of any arthrodesis procedure. The STJ is somewhat unique in which large screws are used for a relatively small joint surface. Given this, one screw is typically placed directly across the posterior facet and a second screw is placed wherever there is room for it. The plantar-inferior screw demonstrated increased compression of the posterior facet in all aspects studied compared to the plantar-dorsal screw. The plantar-inferior to dorsal-distal lead to an 18% greater pressure across the posterior facet with a 25% higher maximum pressure and 36% higher compressed area.

Conclusion

This cadaveric study shows that the compression pressure and area of the posterior facet greater when the second screw runs from posterior-inferior calcaneus to the dorsal distal talar neck compared to the plantar to dorsal screw configuration.

Results

Second Screw Placement Location	Average Pressure (Mpa)	Highest Max Pressure (MPa)	Pressed area (mm2)
Posterior-Inferior Calcaneus to Talar Neck (Specimen 1)	0.54	0.85	4
Posterior-Inferior Calcaneus to Talar Neck (Specimen 2)	0.81	1.99	77
Posterior-Inferior Calcaneus to Talar Neck (Specimen 3)	0.67	1.02	7
Posterior-Inferior Calcaneus to Talar Neck (Specimen 4)	0.72	1.16	33
Posterior-Inferior Calcaneus to Talar Neck (Specimen 5)	0.6	1.43	55
	Average Pressure(Mpa): 0.67	Average Max Pressure (Mpa): 1.29	Average Pressed Area (mm2): 35.2
Plantar Calcaneus to Dorsal Talus (Specimen 1)	0.29	0.29	<1
Plantar Calcaneus to Dorsal Talus (Specimen 2)	0.71	1.4	69
Plantar Calcaneus to Dorsal Talus (Specimen 3)	0.3	0.31	<1
Plantar Calcaneus to Dorsal Talus (Specimen 4)	0.75	1.38	13
Plantar Calcaneus to Dorsal Talus (Specimen 5)	0.72	1.46	31
	Average Pressure(Mpa): 0.55	Average Max Pressure (Mpa): 0.97	Average Contact Are (mm2): 22.62

References

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