

Fixation of Medializing Calcaneus Osteotomy using Bioabsorbable 4 mm TRIM-IT Screws

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Objective

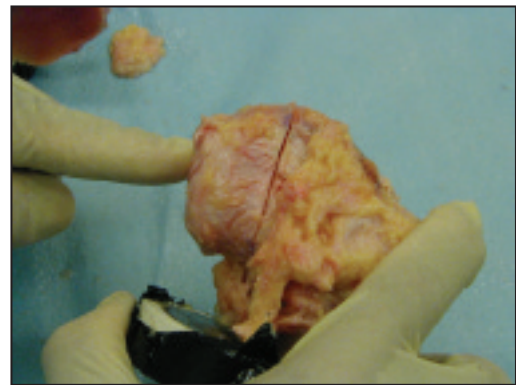
The objective of this study was to compare the yield and ultimate fixation strength of two different fixation methods for medializing calcaneus osteotomies. Group one consisted of two 4 mm TRIM-IT Screws, and group two consisted of one 6.5 mm stainless steel Synthes screw. A cadaver and polyurethane foam block model were used to compare the two groups.

Methods and Materials

Cadaver model: six matched pair of calcanei were used for the study (avg age = 51.7 ± 3.8 years). An osteotomy was made 2 cm from the posterior aspect of the calcaneus as seen in Figure 1, and the transected calcaneus was translated 1 cm medially. In group one, two 4 mm TRIM-IT Screws were used to fixate the osteotomy. The screws were aligned in the inferior-superior direction, and were placed approximately 1 cm apart. In the contralateral specimen, the osteotomy was fixated using one 6.5 mm stainless steel Synthes screw. Post fixation, the construct was fixated in a material testing machine in a manner that simulated heel strike. A compressive load was applied until failure of the repair occurred.

Polyurethane foam block model: 20 lbf/ft³ polyurethane foam block was chosen to simulate good quality cancellous bone in the calcaneus. 1.5" x 1.5" x 2 cm polyurethane foam blocks were used to simulate the osteotomized portion of the calcaneus and 1.5" x 1.5" x 2.5" polyurethane foam blocks were used to simulate calcanei. Six constructs were repaired using two 4 mm TRIM-IT Screws as previously described. Six constructs were fixated using one 6.5 mm stainless steel Synthes screw. The constructs were fixated in a material testing machine and a load was applied until failure of the repair occurred.

Figure 1. Osteotomy created in calcaneus



Results

Cadaver model: the yield load and ultimate load of TRIM-IT group was 434 ± 356 N and 590 ± 297 N respectively. The yield and ultimate load of the Synthes group was 378 ± 464 N and 542 ± 451 N respectively. The standard deviation was extremely high compared to the average; therefore, statistical comparisons were not conducted. The large standard deviation was due to difference in bone quality amongst the specimen. Limited conclusions can be drawn from this data.

Polyurethane foam block model: the yield and ultimate load for the TRIM-IT Screw constructs were 1243 ± 185 N and 1302 ± 162 N respectively. The yield and ultimate load of the Synthes screw constructs were both 1061 ± 61 N. The greater yield and ultimate load of the TRIM-IT Screw constructs were significantly different from that of the Synthes Screw constructs ($p = 0.045$, $p = 0.014$ respectively).

Conclusion

The fixation of a calcaneus osteotomy using two 4 mm TRIM-IT Screws is equivalent to fixation using one 6.5 mm metal Synthes screws. This was demonstrated in both a human cadaver and a polyurethane foam block model. The 4 mm TRIM-IT Screw is a viable bioabsorbable option for fixation of calcaneus osteotomies.