Biomechanical Comparison of KinetiGraft and BTB Graft Fixated in a Porcine Tibia

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Objective

The KinetiGraft is a composite bone-tendon-bone graft composed of two cancellous bone dowels with tendon stitched to the dowels as seen in Figure 1. The construct provides an alternative to allograft or autograft BTB grafts for ACL reconstruction. The objective of the test is to compare the fixation strength of KinetiGrafts to BTB grafts.

Methods and Materials

18 porcine tibias were dissected of all soft tissue and potted in 2" pipe using bone cement. Nine KinetiGrafts with a final diameter of 10 mm were obtained. Nine BTB grafts were obtained from the same donors as the material harvested for construction of the KinetiGrafts. The tibial bone block was trimmed to create a 10 x 25 mm dowel. A 10 mm diameter tunnel approximately 35 mm in length was created in the porcine tibias. The distal end of the KinetiGraft was fixated in the porcine tibia with a 9 x 30 mm soft threaded titanium Soft Screw (AR-1390H-30). The tibial bone block of the BTB graft was fixated in the porcine tibia with a 9 x 30 mm titanium Cannulated Interference Screw (AR-1392).

The constructs were fixated in a material testing machine so that pull-to-failure was conducted in-line with the tunnel to create a "worst-case" loading scenario. The grafts were fixated to simulate the 30 mm intraarticular length of the native ACL. The constructs were precycled from 10 to 50 N 10 times followed by pull-to-failure at a displacement rate of 20 mm/min. A student's t-test ($\alpha = 0.05$) was used to compare the two groups.

Figure 1.

KinetiGraft

Results

No statistical difference in insertion torque, stiffness, load at 5 mm, yield load, or ultimate load was found between the two groups. The means, standard deviations, and p-values can be seen in Figure 2.

Figure 2.

Data for KinetiGraft and BTB graft

	Insertion Torque (in-lbf)	Stiffness (N/mm)	Load @ 5 mm of stretch (N)	Yield (N)	Ultimate (N)
KinetiGraft	36 ± 4	113 ± 19	502 ± 80	610 ± 143	635 ± 124
BTB	37 ± 4	109 ± 26	474 ± 105	640 ± 213	688 ± 193
p-value	0.571	0.761	0.582	0.757	0.549

Conclusions

No statistical difference was found in fixation strength between the KinetiGraft group and the conventional BTB group. The KinetiGraft's equivalency to a clinically used and accepted BTB graft suggests that the KinetiGraft is suitable for ACL fixation. In addition, the KinetiGraft eliminates some of the preparation time required to prepare a BTB implant for implantation.

Noyes et al. suggested the ACL must resist loads of 454 N during normal day to day activity. Both groups had load at 5 mm above 454 N (474 ± 105 N for the BTB group and 502 ± 80 N for the KinetiGraft group). The yield and ultimate load of both groups was above 600 N. Based on this data and the Noyes et al. study, both constructs tested in this study provide adequate fixation for ACL reconstruction.