

Bioabsorbable Interference Screw Fixation in a Bone Tunnel:

**Comparison of 28 mm; 35 mm Single Screw Fixation
and Bi-Cortical Fixation with 20 mm and 17 mm Screws**

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Introduction

Initial tibial fixation strength is the weak link after ACL reconstruction using a quadrupled hamstring graft with bioabsorbable interference screw fixation because of bone mineral density and direction of load. The purpose of this study was to determine the biomechanical differences between unicortical 28 mm, unicortical 35 mm and bicortical fixation with 20 mm and 17 mm interference screws for tibial fixation of a soft tissue graft.

Material and Method

18 paired fresh frozen cadaveric knees average age 36.4(19-45) were randomized into group 1 (28 mm screws), group 2(35 mm screws) and group 3 (20 mm and 17 mm screws). After harvesting the hamstring tendons, all soft tissues were stripped from the knees and DEXA scan was performed for bone mineral density (BMD). BMD cut off point was 0.6g/cm² and we excluded two pairs from the study because of BMD. Quadrupled hamstring tendons were prepared by our previously described technique and were secured with either 28 mm, 35 mm or bicortical screws in the tibial tunnel which was impacted to within 0.5 mm of graft size from 2 mm less than a graft size. In groups 1 and 2, 28 mm and 35 mm screws were placed posteriorly in the tunnel to a level even with the anteromedial cortex. In group 3, 20 mm screws were placed posterior to the graft and 17 mm screws were placed anterior to the graft to a level even with the anteromedial cortex of the tibia. Failure mode, displacement prior to failure, ultimate failure load, and stiffness were tested with an Instron machine in the line with the tibial tunnel to stimulate a worse case scenario. The graft was cycled 10 times from 10 to 50 N before testing to failure at a rate of 20 mm/minute.

Results

For group 1 (one, 28 mm-screw fixation), the mean maximum load at failure was 0.4881±/0.1974 KN, displacement at failure was 18.427±1.7485 mm and stiffness was 38.978±/7.022 N/mm. For group 2 (one, 35 mm screw fixation) mean maximum load failure was 0.84251±/0.1199 KN, displacement at failure was 14.53±/1.689 mm and stiffness was 75.505±/13.42N/mm. For group 3 (double screw fixation) mean maximum load failure 0.5437±/0.2.665 KN, displacement at failure was 16.059±/8.587mm and stiffness was 57.69±/14.92 N/mm. The average bone mineral density was 0.847 gr/cm² (0.689-1.11 gr/cm²). The statistical analyses were done by ANOVA test. The statistical analysis showed significant difference at load to failure mode between 28 mm vs. 35 mm screws (p: 0.0287) and in stiffness between 28 mm and the other two groups (p: 0.0005 for 28 mm vs. 35 mm, and p: 0.04 for 28 mm vs. bicortical fixation).

Discussion

Quadrupled hamstring ACL reconstruction requires fixation of soft tissue in a bone tunnel. We have shown that 35 mm one screw and bicortical bioabsorbable interference screw fixation increase ultimate stiffness without compromising pull-out strength. In addition bicortical fixation and 35 mm screw will diminish joint fluid extravasation into the tunnel, and synovialization potentially increase a more satisfactory environment for Sharpey fiber formation. Significant variables in hamstring fixation within a bone tunnel include bone mineral density, impaction, gap size, screw placement, and size (width and length): Attention to these variables may provide secure graft fixation during biologic incorporation throughout the rehabilitation period.

Tibial Interference Fit Fixation Quadrupled Hamstring Graft

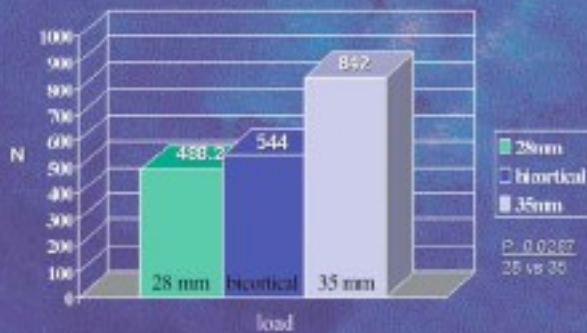
28 mm
17 mm and 20 mm Bicortical
35mm Delta Tapered

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Onur Tetik, M.D.

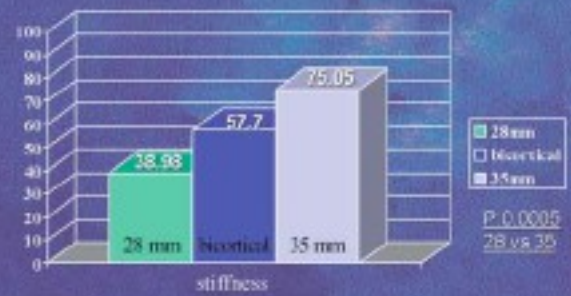
Bone Mineral Density

	28mm	Bicortical	35mm
1	1.11	1.092	0.954
2	0.689	0.703	0.863
3	0.793	0.760	0.773
4	0.764	0.750	0.889
5	0.824	0.797	0.807
6	0.973	0.932	0.781
Mean	0.854	0.839	0.844 g/cm ²
Norms	20-29 yo	1.3	
	30-39 yo	1.25	

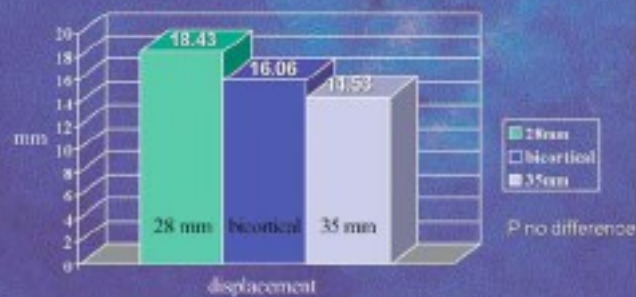
Load to Failure



Stiffness



Displacement





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