Presoaking Hamstring Graft with Vancomycin Does Not Jeopardize the Biomechanical Properties and Does Not Elongate the Graft Even after Cyclic Loading

Hyung Jun Park[1], Seung Baik Kang[2], Chong Bum Chang[3], Moon Jong Chang[4], Tae Woo Kim[5], Ja-Young Choi[6], Tae Soo Bae[7], Dai-Soon Kwak[8]

[1]Korea University, Ansan Hospital, [2]Seoul National Univ Borame Hospital, [3]Seoul National University Bundang Hospital, [4]Seoul National University SMG-SNU Boramae Medical, [5]National University Hospital, [6]Dept of Radiology, [7]Jungwon University, [8]The Catholic University of Korea

INTRODUCTION:

Although presoaking of the graft with vancomycin before implantation could reduce the postoperative infection after anterior cruciate ligament reconstruction (ACLR), there are concerns about the biomechanical properties. The purpose of the study was to determine whether presoaking the graft with vancomycin jeopardized the biomechanical properties after cyclic loading. We also wanted to elucidate whether vancomycin presoaking elongated the graft.

METHODS:

Ten paired gracilis and semitendinous tendons were harvested from fresh-frozen human cadaveric specimens. After the prepared two tendons were folded in half to make 4-strands, the grafts were randomly assigned the vancomycin and control group (Table 1). The graft was exposed to the antibiotic solution for 15 minutes (5mg/mL) which was prepared by mixing 1 g of vancomycin with 200 ml of normal saline (NaCl 0.9%). The control group was soaked in normal saline for 15 minutes. The prepared grafts were attached to the actuator of a dynamic tensile testing machine (Figure 1). All grafts were tested with a total of 3000 cycles of cyclic loading followed by a pull-to-failure. The cyclic loading protocol consisted of a position control block and a load control block to simulate the graft in vivo in postoperative phage after the ACLR (Figure 2).

RESULTS:

The presoaking with vancomycin did not jeopardize the biomechanical properties of the graft. The mean Young's modulus of the specimen was 36126.57 MPa (standard deviation, SD, 4768.46) in the vancomycin group and 35116.10 MPa (SD, 3806.07) in the control group (P = 0.182). In addition, the vancomycin presoaking did not elongate the graft. The mean total elongation of the graft was 0.87 mm (SD, 0.23) in the vancomycin group and 1.01 mm (SD, 0.27) in the control group (P = 0.063) (Table 2).

DISCUSSION AND CONCLUSION:

Presoaking the graft with vancomycin does not jeopardize the biomechanical properties and does not elongate the graft even after cyclic loading in our in-vitro study. Our results should be considered when deciding whether or not to presoak hamstring grafts using vancomycin for ACLR.

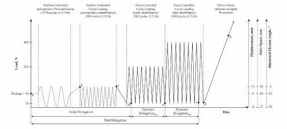

Table 1. Baseline characteristics of the included specimens

	Vancomycin (N = 10)	Control (N = 10)	*P* value
Age, years			
Sex ratio, F/M	5/5	5/5	1†
Laterality ratio, R/L	6/4	4/6	0.656†
Diameter, mm	8.20 ± 0.79	7.85 ± 0.88	0.362*

Values are presented as mean ± standard deviation

Abbreviation: N, number; F, female; M, male; R, right; L, left

Statistical analysis: * independent sample t-test, † chi-square test

Table 2. The biomechanical properties and the elongation of the graft according to the presoaking solution

	Vancomycin (N = 10)	Control (N = 10)	*P* value
Initial elongation, mm	0.11 ± 0.14	0.13 ± 0.19	0.531
Dynamic elongation, total, mm	0.76 ± 0.10	0.88 ± 0.15	0.063
Dynamic elongation 250, mm	0.48 ± 0.08	0.55 ± 0.12	0.527
Dynamic elongation, 450, mm	0.28 ± 0.04	0.33 ± 0.03	0.498
Total elongation, mm	0.87 ± 0.23	1.01 ± 0.27	0.457
Young's modulus, MPa	36126.57 ± 4768.46	35116.10 ± 3806.07	0.182
Ultimate failure load, N	1653.00 ± 753.75	1609.00 ± 585.67	0.142
Ultimate tensile displacement, mm	7.77 ± 2.12	8.12 ± 1.38	0.912
Mode of failure			
Graft slippage	0	0	
Intra-substance tear	10	10	
Proximal	0/10 (0%)	0/10 (0%)	
Middle	0/10 (0%)	3/10 (30%)	
Distal	10/10 (100%)	7/10 (70%)	

Values are presented as mean ± standard deviation

Abbreviation: N, number

Statistical analysis: independent sample t-test