How Does Transecting the Anterior Cruciate Ligament Change the Limits of Passive Motion and Affect the Clinical Assessment of Laxity in TKA?

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INTRODUCTION

An important step in total knee arthroplasty (TKA) is assessment of laxity by the surgeon pre-, intra-, and postoperatively. In these clinical assessments, surgeons apply low loads in various degrees of freedom to determine when the passive restraints of the knee engage[1]. The limits of passive motion characterize the laxity of the knee under these low loads[2]. Because the anterior cruciate ligament (ACL) is resected during all TKA procedures, it is important for the surgeon to understand how transecting the ACL changes the limits of passive motion. Accordingly, the objective of the present study was to determine how the resection of the ACL changes limits of passive motion in internal-external (I-E) and varus-valgus (V-V) rotation and in anterior-posterior (A-P) and compression-distraction (C-D) translation from normal.

METHODS

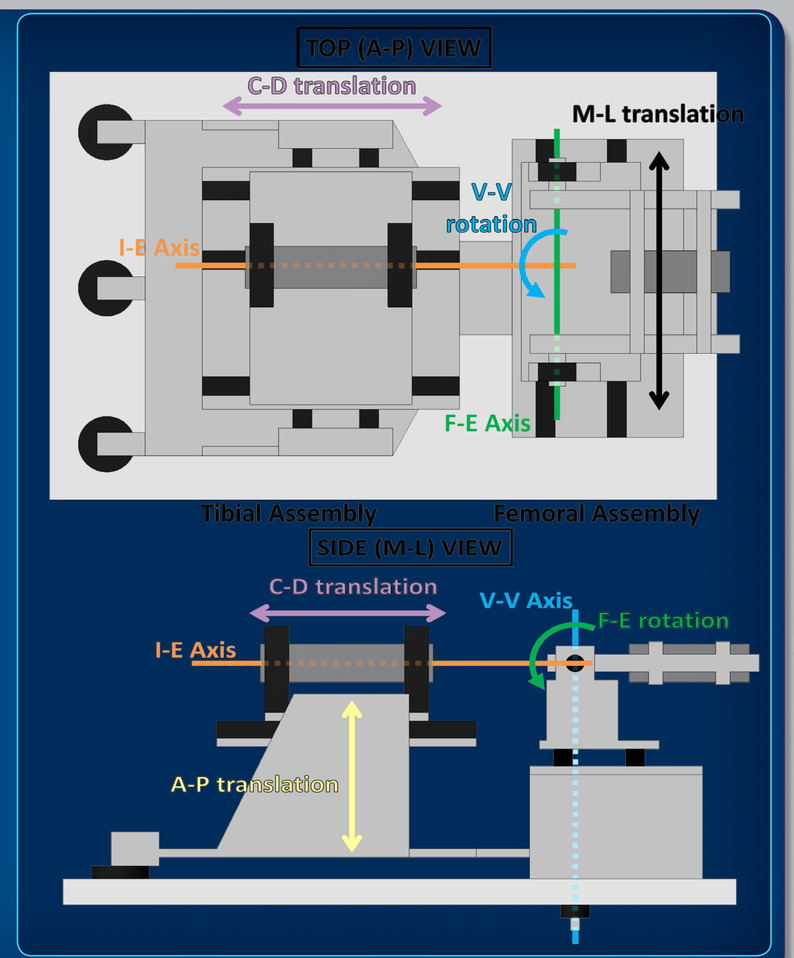
1 Seven fresh-frozen, cadaveric knees were included (average age: 69 years, range: 57 to 85 years). Specimens were free from degenerative joint disease, soft tissue damage, and evidence of previous surgery to the knee.

2 Following preconditioning, the limits of passive motion in I-E, V-V, A-P, and C-D were measured both before and after transecting the ACL over a range of flexion angles from 0° to 120° in 15° increments using the load application system (**Figure 1**).

3 The applied loads used to define the limits of passive motion were ± 3 N-m for I-E rotation[2], ± 5 N-m for V-V rotation[3], ± 45 N for A-P translation[4], and ± 100 N for C-D translation[5]. Throughout testing, a 45 N compressive tare load was applied to the tibia.

4 Each of the limits of passive motion before and after ACL resection was analyzed using a two-factor repeated measures analysis of variance. A *post hoc* Tukey's test was used to identify at which flexion angles there were significant changes in the limit between normal and ACL-deficient knee.

Figure 1. Functional schematic showing the six degrees of freedom of the load application system[2]. The A-P, M-L, and C-D translational degrees of freedom are allowed by linear bearings translating along linear rails. The F-E and I-E rotational degrees of freedom are allowed by rotation of radial ball bearings. V-V DOF is allowed by rotation of radial ball bearing and three air bearings.



RESULTS

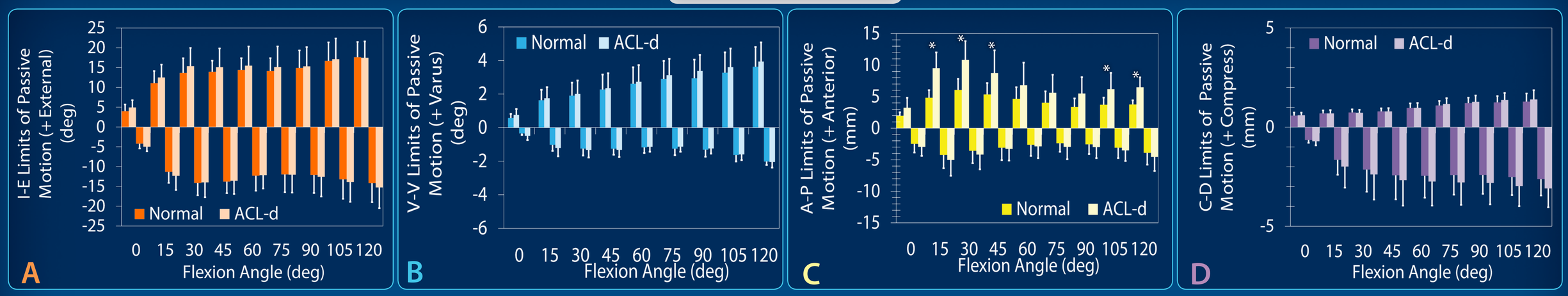


Figure 2. Four bar charts display the limits of passive motion in (A) I-E, (B) V-V, (C) A-P, and (D) C-D for the normal and ACL-deficient (ACL-d) tibiofemoral joints. Error bars show one standard deviation. An asterisk signifies that the limit in the ACL-deficient tibiofemoral joint was greater than that in the normal tibiofemoral joint based on a *post hoc* Tukey's test ($p<0.05$).

CONCLUSION

Resection of the ACL does not affect the clinical assessment of laxity except for an increase in anterior laxity under these low loads.

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1. Noyes, F.R., et al., Physical Therapy, 1980.
2. Blankevoort, L., et al., J Biomech, 1988.
3. Markolf, K.L., et al., J Bone Joint Surg Am, 1976.
4. Eagar, P., et al., J Biomech, 2001.
5. Mayman, D., et al., Clin Orthop Relat Res, 2009.

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