INTRODUCTION

Human cadaveric knees are routinely used in the study of total knee arthroplasty (TKA). The process of acquiring, preparing, and performing TKAs on human cadaveric knee specimens is both time and cost intensive. Therefore, it is advantageous to collect as much data as possible on a particular specimen. However, the soft tissues of a human cadaveric knee specimen will degrade over time. Accordingly, the objective of this study was to determine how many days the laxities of a knee with a TKA can be measured before clinically important changes occur.

METHODS

1. Three fresh-frozen human cadaveric knees were included (ages 69, 90, and 92). TKA using kinematic alignment was performed on each knee.

2. Following preconditioning, the laxities in internal-external (I-E) rotation, varus-valgus (V-V) rotation, anterior-posterior (A-P) translation, and compression-distraction (C-D) translation were measured at 120°, 120°, 30°, and 120° flexion, respectively, five times each using a load application system (Figure 1).

3. The procedure for step (2) was repeated at the beginning and end of days 2 through 7. Day 1 was used as a baseline. During each day, the regular laxity testing was performed two times. Regular laxity testing consisted of measuring the I-E, V-V, A-P, and C-D laxities from 0° to 120° flexion in 30° increments. In total, there were 80 laxity cycles and 6 hours of testing per day. One laxity cycle consisted of loading the knee to its positive limit, negative limit, unloaded position, negative limit, positive limit, and unloaded position.

4. To determine how many days of laxity testing were performed before significant changes occurred, a single-factor repeated measures ANOVA was performed. Dunnet’s test was used to compare the mean laxities at the beginning of Day 1 to each time point from the beginning of Day 2 to the end of Day 7.

RESULTS

Figure 2. Mean (bar) and standard deviation (error bars) of the (A) I-E, (B) V-V, (C) A-P, and (D) C-D laxities over the course of 7 days. Statistically significant differences (p < 0.05) are marked with an asterisk (*). Clinically important differences are marked with a caret (^). All comparisons are relative to the beginning of Day 1. The earliest statistically significant and clinically important difference was a 1.4° increase in varus laxity at the end of Day 4 equal to the 1.4° clinically important threshold (Creaby, BMC Musculoskelet Disord, 2013). There were 280 laxity cycles and 3.5 days of testing from the beginning of Day 1 to the end of Day 4.

CONCLUSION

When planning TKA studies which involve measuring laxities in human cadaveric knee specimens, consideration should be made for the total length of testing. Testing should be kept to less than 3.5 days of 6 hours of testing per day as well as less than 280 testing cycles.