INTRODUCTION

While the stabilizing function of the medial knee has been well defined for the all-sectioned state, recent quantitative anatomy studies of the medial knee have created a need to verify the primary and secondary static stabilizing functions of the posterior oblique ligament, proximal and distal divisions of the superficial medial collateral ligament, and meniscofemoral and meniscotibial portions of the deep medial collateral ligament. Our hypothesis was that identification of the individual primary and secondary stabilizing functions of the components of the main medial knee structures would yield insight into both improved interpretation of clinical motion testing and provide guidance to the appropriate treatment plan for patients following a medial knee injury.

METHODS

Twenty-four non-paired, fresh-frozen cadaveric knees were equally divided into three groups. Each group used a unique sequence for sequential sectioning of the posterior oblique ligament, superficial medial collateral ligament (proximal and distal divisions), and deep medial collateral ligament (meniscofemoral and meniscotibial portions), which allowed for the isolation of the individual function of each structure. (Figures 1 & 2) Each specimen was tested at 0°, 20°, 30°, 60°, and 90° of knee flexion. A six-degree-of-freedom electromagnetic tracking system was used to monitor knee joint motion following the application of 10 Nm valgus loads and 5 Nm internal and external rotation torques.

RESULTS

The primary static stabilizer to valgus motion was the proximal division of the superficial medial collateral ligament with significantly increased valgus angulation measurements, compared to the intact knee, of 2.6°, 6.9, 6.7°, 8.4°, and 4.9° at 0°, 20°, 30°, 60°, and 90° of knee flexion, respectively, following sectioning of this component. (Figure 1) The primary external rotation stabilizer was the distal division of the superficial medial collateral ligament at 30° of knee flexion with 3.6° of increased external rotation, compared to the intact knee, following sectioning of this component. The primary internal rotation stabilizers (increased internal rotation compared to the intact knee listed in parenthesis) were the posterior oblique ligament at 0° (3.7°), 20° (5.2°), 30° (3.8°), 60° (6.5°), and 90° (3.6°) of knee flexion (Figure 2), the meniscofemoral portion of the deep medial collateral ligament at 20° (6.5°), 60° (9.3°), and 90° (3.4°) of knee flexion, the meniscotibial portion of the deep medial collateral ligament at 0° (3.3°) and 30° (9.2°) of knee flexion, and the distal division of the superficial medial collateral ligament at 0° (0.5°), 20° (2.8°), 30° (6.7°), 60° (4.8°), and 90° (3.2°) of knee flexion.

DISCUSSION

We found an intricate relationship exists among the main medial knee structures and their individual components for static function between the posterior oblique ligament, the two divisions of the superficial medial collateral ligament, and the meniscofemoral and meniscotibial portions of the deep medial collateral ligament to applied loads. Knowledge of the static stabilizing function of the individual components of the main medial knee structures will assist in the interpretation of clinical knee motion testing and provide guidance to the development of improved nonoperative and surgical techniques after medial knee injuries. Increases in external rotation at 30° of knee flexion were found which indicates that a positive dial test may be found not only for posterolateral knee injuries, but also for medial knee injuries.

REFERENCES


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