COMPARISON OF BICEPS TENODESIS AND ANATOMIC REPAIRS FOR POSTEROLATERAL KNEE INSTABILITY

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Introduction

Significant insight into the role of the posterolateral corner in the stability of the knee has been provided over the last 15 years. The consequences of injury to this posterolateral anatomy has likewise begun to be established in the literature. These consequences have proven to be significantly disabling that treatment options have been addressed. While there is general consensus that direct repair should be attempted in acute injuries, the optimal treatment of chronic injuries with instability is debatable. Several techniques have been reported, including biceps tenodesis and anatomic repairs, but biomechanical testing of these repairs are limited in current literature. Our objective was to compare the biomechanical outcome of the biceps tenodesis and the achilles tendon anatomic repair in resisting the varus and external rotation loads.

Methods

Ten fresh-frozen cadaveric knees were tested. The specimen was secured to the testing apparatus (Fig. 1). Each knee was subjected to varus and external rotation (ER) load of 10 Nm while being held in a given flexion angle (0º, 30º, 60º, and 90º). The testing was repeated at each flexion angle after making the knee posterolaterally deficient by incising the posterolateral corner. Each knee was then reconstructed using the anatomic technique as described by Warren using an achilles tendon double limb graft. The graft was fixed to the femur prior to tibia and fibula fixation in eight of the the specimens and the fixation order was reversed in the remaining specimens. After testing the reamed knee, the graft was removed and the biceps tenodesis repair was performed and the laxity test was repeated. An electrogoniometer attached to the test specimen and a magnetic sensor system (Flock of Birds by Ascension Technologies) were used to measure the varus and external rotation laxity. The knee was maintained in the testing apparatus between to avoid any change in spatial relationships caused by removing and reattaching the knee. Lastly, by performing all tests on each specimen, each knee served as its own control in regard to inherent variation in native laxity.

Results

As expected, creating a posterolateral deficient state resulted in substantial increase in varus laxity and external rotation laxity under the constant loads. The largest increase in varus laxity occurred at 30º flexion in the deficient knee. Both repair techniques improved the varus stability of the knee. In comparison, the results were similar except in the more flexed positions (60º and 90º) where the biceps tenodesis overcorrected the laxity and resulted in an even tighter knee than the intact knee.

The largest increase in external rotation laxity in posterolateral injured knees occurred between 30º and 60º. Both repairs improved the stability of the deficient knee. Comparing the repair techniques revealed that the anatomic repair performed better at the more extended positions, especially when fixation to the tibia was accomplished first. The biceps tenodesis performed better at the more flexed position, but at the cost of overcorrection of varus laxity.

Discussion

The results of this study suggest that the repair techniques tested do indeed improve varus and external rotation stability in the posterolateral deficient knee. Overall, the anatomic repair seems to result in more stable knees at the more extended positions, which is functionally important. On the other hand, the biceps tenodesis performed better at the more flexed positions. However, it had the potential of overtightening the knee in the valgus direction. An interesting finding from this study is related to the order in which the the achilles graft was fixed in the anatomic repair technique. Fixation of the graft to the tibia prior to femoral fixation resulted in increased stability in external rotation. We feel this is due to the relative mobility of the tibia/fibular segment in comparison to the femoral segment in our testing apparatus. Fixation to the more mobile segment first allowed for increased rotational correction before anchoring the graft to the more fixed femoral segment. This may also be applicable in the in vivo setting, where the femur will be less mobile secondary to its attachment to the hip and pelvis.

One must be careful, however, if using only this data to determine the repair technique to employ. Specifically, as a static test, we were unable to investigate the effect of dynamic muscles on knee stability and any effect that tenodesis of a functional muscle, as in the biceps tenodesis repair, would have on this dynamic setting. Further dynamic, in vivo studies will be helpful in this area. Other factors such as surgeon experience and ease of procedure are also valid concerns when considering which repair technique to pursue.

Overall, this study provides useful biomechanical data to support the use of these repair techniques in addressing chronic posterolateral instability. It should be helpful, in combination with further studies, to further refine our surgical treatment options for this complex entity.

References