Segond's fracture: a biomechanical study using navigation

FERRETTI A, D'ARRIGO C, MONACO E, MAESTRI B, CONTEDECA F

Orthopaedic Unit and Kirk Kilgour Sports Injury Center, Sant'Andrea University Hospital, Rome, Italy
aferretti51@virgilio.it

Introduction: The Segond's fracture is described as a cortical avulsion of the lateral tibial plateau at the site of insertion of the middle third of the lateral capsular ligament. It is well known that Segond's fracture is usually associated with a tear of the Anterior Cruciate Ligament (ACL) and it is considered as an indirect radiological sign of complete rupture of the ACL. However, to the best of our knowledge, there are no studies investigating the effect of a Segond's fracture on the kinematic of the knee and especially on the rotatory instability and Pivot Shift phenomenon. The purpose of this study is to investigate the effect of a Segond's fracture on the kinematic of the knee with the use of navigation and the Pivot Shift test.

Materials and Methods: Ten whole fresh-frozen cadavers were used. A navigator (2.0 Orthopilot Navigation System, BBraun Aesculap, Tuttingen, Germany) was used to measure maximum manual Anterior Tibial Translation (ATT) at 30°, 60° and 90° of flexion, maximum manual Internal Rotation (IR) and maximum manual External Rotation (ER) at 0°, 15°, 30°, 45° and 90° of flexion. All procedures were performed three times and the mean value taken as the final result in each case. Moreover a Pivot Shift test was performed by the senior, most experienced, surgeon, and graded as mild (gliding), moderate (jerk) and severe (subluxation). Navigation measurements and Pivot Shift tests were performed in each knee with ACL intact, after arthroscopic cutting of the entire ACL and after a Segond's fracture was produced by exposing the antero lateral compartment of the knee underneath the ileo-tibial tract. Statistical analysis was performed using ANOVA 1-way and MANOVA tests and value for statistical analysis was set at p<0.05

Results: Navigation procedure: Cutting the whole ACL resulted in a significant increase of ATT at 30° and 60° of flexion, with no significant effect on IR and ER. Producing the Segond's fracture resulted in a significant increase of ATT at 60° and 90° of flexion, in a significant increase of IR at 30°, 45° and 60° of flexion with no significant effect on ER. Pivot Shift: The Pivot Shift was clinically undetectable in all knees with ACL intact. After cutting the ACL it continued to be undetectable in two cases, mild positive in six cases and moderate in two. The addition of the Segond's fracture resulted in an increase of the Pivot Shift in all cases with a moderate grade detected in three and severe in seven.

Conclusions: Despite the limitations of this study, which include manual loads applied to the knee during navigation measurements and subjective evaluation of the Pivot Shift, the results of this cadaver study indicate that the Segond's fracture has a significant effect on knee stability and especially on rotational stability, which is functionally the most important in case of ACL tear. Therefore, in case of an acute ACL tear, when a Segond's fracture is radiologically detected and an ACL reconstruction is performed, an inspection of the lateral compartment with repair of capsule and fixation of the fracture could be advisable in order to better restore knee stability.