Research Article

Is there a difference between the flexible and rigid reamer in femoral tunnel length in ACL reconstruction in anteromedial portal

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Abstract

Background: Anterior cruciate ligament (ACL) reconstruction was functionally done on trans-tibial section and was creating vertical long tunnel. Nowadays, it is done by modified trans-tibial and anterior-medial portal which creates short tunnel compared to trans-tibial approach.

Objective: To compare femoral tunnel length using a flexible versus rigid reamer in ACL antero-medial portal reconstruction surgery.

Materials and Methods: Retrospective medical record analysis of all ACL reconstruction surgeries performed between February and December 2014 among 3 surgeons in security force hospital in Riyadh was done. In all of these procedures, the femoral tunnel length was measured with digital calipers from 20 to 48 mm and was reported in mm.

Result: A total of 309 ACL reconstructions were done, 151 (48.9%) using a flexible reamer and 158 (51.1%) with a rigid reamer. The overall mean tunnel length was 38.6 ± 5.2 mm. The mean tunnel length in cases that used the flexible reamer was 39.0 ± 4.9 mm, and the mean tunnel length in cases that used the rigid reamer was 38.1 ± 5.4 mm. The mean difference in the tunnel length between flexible and rigid reamer was 0.88 mm. There was no statistical difference between the mean tunnel lengths between flexible and rigid reamers. There were no significant differences in the tunnel length performed by 3 different surgeons.

Conclusion: The femoral tunnel lengths were not significantly different with the use of a flexible or a straight reamer.

KEYWORDS: Anterior cruciate ligament, reconstruction, flexible, rigid, reamers

Introduction

Anterior cruciate ligament (ACL) is one of the important ligaments on knee.T he ACL is the primary restraint to anterior translation of the tibia relative to the femur. It also acts as secondary restraint to tibial rotation and varus/valgus rotation.[1] An ACL injury is a twisting or tearing of the ACL in the knee, which may be partial or complete.[1] ACL injuries occur in about 68.6 per 100,000 persons per year, significantly higher in males between 19 and 25 years old.[2]. ACL injuries occur when bones of the leg twist in opposite directions under full body weight. Symptoms of ACL injury include a popping sound at the time of injury, knee swelling, and pain.

ACL reconstruction surgery is a surgical procedure that involves graft replacement of the torn ligament. The rate of ACL reconstruction increased significantly over time in all age groups.[2] ACL surgery is routinely done in orthopedic surgery. However, there is a need for these surgeons to perform reconstructive techniques with minimal or no technical error to decrease the incidence of graft failure.[3] In a study published in March 2016, most of the ACL reconstruction surgeries in North America were performed by subspecialty trained surgeons, 98% of which in sports medicine. The most preferred approach was an arthroscopic-assisted single-incision, the tibial tunnel placement shifted anteriorly and femoral tunnel placement shifted posterosuperiorly, use of transfixation

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pins and other devices decreased, and using hamstring autograft, and drilling the femoral tunnel through an accessory portal increased.[4]

Femoral tunnel length was shown to be correlated with the height and area of the lateral wall of the femoral intercondylar notch in anatomical single-bundle ACL reconstruction.[5] In a single bundle hamstring graft, a transportal approach for creating a femoral tunnel has recently become more popular than the trans-tibial technique.[6] However, a study has suggested that the 4 different approaches namely endoscopic transtibial teachnique, anteromedial portal technique, outside-in- technique, and outside-in retrograde drilling technique in femoral drilling had no significant differences in the advantages and disadvantages, and risks and benefits.[7] Femoral tunnel length is important because commonly used suspensory graft fixation devices are sensitive to the length of the femoral tunnel if the amount of graft in the tunnel is to be maximized. When it comes to reamers, an article published in July 2015 showed that the use of flexible reamers were more advantageous in the sense that it allows an additional way of uncoupling the tibial and femoral tunnels to clearly visualize and establish an anatomic starting point within the femoral footprint of the native ACL. Furthermore, the authors suggested that using flexible reamers prevent the complications associated with knee hyperflexion, short femoral tunnels and peroneal nerve injury in straight and rigid reamers.[8] In another study, the use of flexible reamers was shown to have longer femoral interosseous tunnel length compared to a rigid or a straight guide pin.[9] In the same study, they suggested that the femoral interosseous length more than 40 mm can be achieved using a flexible reamer, and not with a rigid straight pin.[9] Flexible guide pin system has gained popularity because of its theoretical advantages of longer femoral tunnel length, further distance from the common peroneal nerve and other structures, and lesser chance of injuring the cartilage of the medial femoral condyle. Because of this, we conducted this study to compare the femoral tunnel length using a flexible versus a rigid reamer in ACL anteromedial portal reconstruction surgery.

Materials and Methods

We conducted a retrospective medical record cohort analysis of all ACL reconstruction surgeries in the Arthroplasty and Sports Arthroscope Unit of the Orthopedics Department, Security Forces Hospital, Riyadh, Saudi Arabia between February and December 2014. The exclusion criteria was the following

(1) case with reversion ACL, (2) multiligmentus injury, (3) associated malalingment, (4) any associated orthopedic syndromes, (5) more than one surgeon, (6) any case converted from trans-tibial to medial portal or opposite, and (7) any case done by non-specialized surgeon. In all of these procedures, the femoral tunnel length were measured with digital calipers from 20 to 48 and reported in mm. Surgeries was performed by 3 surgeons in same hospital and the first surgeon was trained for rigid reamer and the second surgeon for flexible and the third was trained for both techniques.

Data obtained were recorded in a Microsoft Excel spreadsheet (Microsoft, Redmond, WA), and were analyzed using the Mann–Whitney test on the Statistical Program for Social Sciences (SPSS) version 20.0 (SPSS, IBM Inc., Chicago, Illinois, USA). The differences in tunnel lengths and distances from the guide pins to the common peroneal nerve and the femoral LCL origin using a flexible or a rigid reamer were compared. Variability in the surgeons who performed was also compared using the two types of reamers. Significance was set at *p* value less than 0.05.

Result

A total of 309 ACL reconstruction were done, 151 (48.9%) using a flexible reamer and 158 (51.1%) with a rigid reamer. The overall mean tunnel length was 38.6 ± 5.2 mm (range of 20–48 mm and median of 38.0 mm). Figure 1 shows the scatterplot of the tunnel lengths around the median.

The mean tunnel length in cases that used the flexible reamer was 39.0 ± 4.9 mm, and the mean tunnel length in cases that used the rigid reamer was 38.1 ± 5.4 mm. The mean difference in the tunnel length between flexible and rigid reamer was 0.88 mm. There was no statistical difference between the mean tunnel lengths between flexible and rigid reamers (p=0.139, 95% CI of -0.287 to 2.046). Figure 2 shows the mean and standard deviation (SD) of tunnel length between flexible and rigid reamer.

The mean (SD) tunnel length by one surgeon who performed all ACL reconstruction with flexible reamer was 37.9 ± 5.7 mm (95% CI of 36.8 – 39.0 mm). The mean (SD) tunnel length by another surgeon who performed all ACL reconstruction with a rigid reamer was 38.6 ± 4.8 mm (95% CI of 37.3 – 39.9mm). The mean (SD) tunnel length performed by a surgeon who used both flexible and rigid reamer was 39.0 ± 5.0 mm (95% CI of 38.2 – 39.8mm). There were no significant differences in

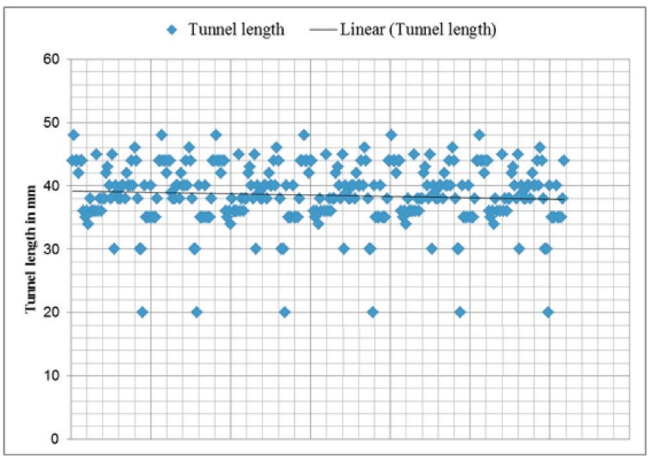

Figure 1: Scatterplot of femoral tunnel lengths around the median.

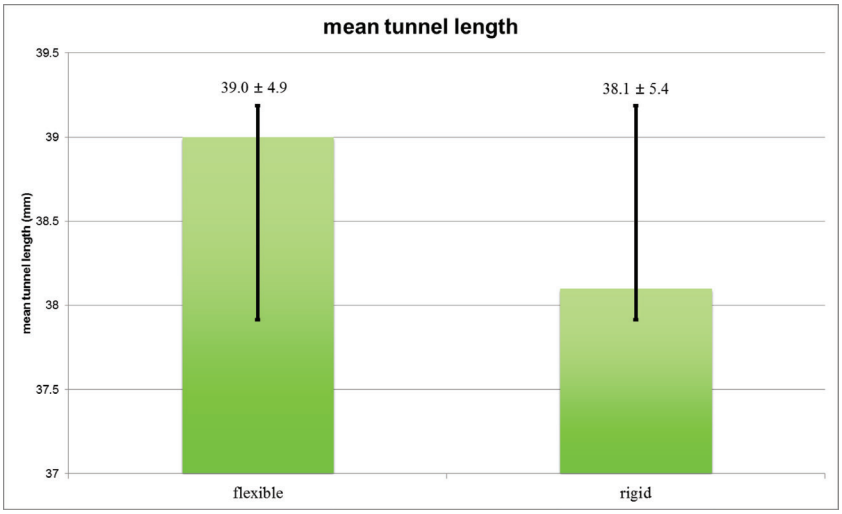

Figure 2: A comparison of the mean tunnel length between flexible and rigid reamers in 309 ACL reconstruction surgeries.

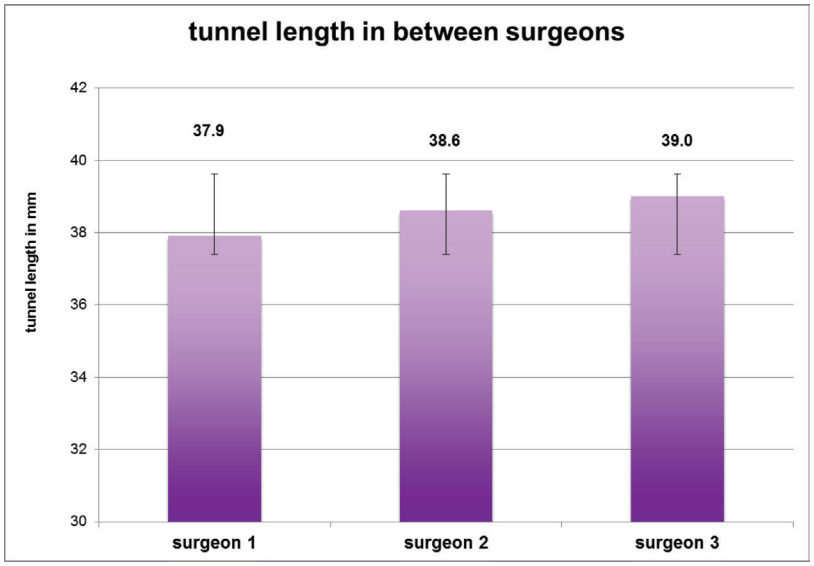

Figure 3: Mean tunnel lengths between three surgeons who performed the ACL reconstruction surgeries. Surgeon 1 cases done by rigid reamer, and surgeon 2 cases done by flexible, and surgeon 3 cases done by both techniques.

the tunnel length performed by 3 different surgeons ($p = 0.256$, 95% CI of -2.78 to 2.83) (Figure 3).

Discussion

This study investigated on the differences in ACL femoral tunnel length after drilling with a straight or rigid reamer compared to a flexible reamer guide. The mean tunnel length created using the flexible reamer was relatively longer than rigid reamer; however the difference of 0.88 mm between the two types of reamers was not statistically significant ($p = 0.139$). The mean interosseous distance with the flexible reamer was 39.0 mm (range, 20–48 mm), and the mean tunnel length in cases that used the rigid reamer was 38.1 mm, range from 20 to 48 mm. For the flexible reamer, there were 75 (49.7%) who had tunnel length of less than 40 mm. On the other hand, there were 90 (56.9%) with tunnel length below 40 mm. In contrast to the study that was conducted by Silver et al.[9] in 2010, they found significant difference in the tunnel length between straight and flexible reamer. This difference in the findings is probably due to the drilling technique that was

employed by the surgeons, as pointed out by Silver et al.[9] Furthermore, the average distance of the tunnels that were created by the flexible reamer was only 0.9 mm longer than the rigid reamer, which is significantly shorter as compared to the average difference of 6 mm in the study.[9] In that effect, the question on whether this tunnel length would allow the fixation device to be secured to the lateral femoral cortex. Since, a specific distance should be well accounted for engaging the suspensory devices.

Another issue is that most surgeons prefer to have 20 mm or more of length to give a better chance for healing and success of the reconstruction. Our study showed that all of the femoral lengths in both rigid and flexible reamers were 20 mm and above in length. In our case, drilling the femoral tunnel in the anteromedial porter leads to longer tunnels. However, our study showed that the use of flexible reamers and guide pins resulted in almost similar femoral tunnel lengths compared to use of the more rigid and straight guide pins.

The significant advantages of using a flexible reamer is the avoidance of the medial femoral condyle articular cartilage, and can curve around the medial condyle as pointed out by previous studies.[10, 11] These proposed advantages of the flexible reamer over the straight or rigid reamer may be obviated by the non-significant differences in the tunnel lengths between the two types of reamers. Another point that obviates the insignificant differences in our study is the fact that there were also no significant differences in the tunnel lengths that were created between the 3 different surgeons that performed the procedure.

Conclusion

The femoral tunnel length achieved with the use of a flexible or a straight reamer is not statically different.

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