

Editorial

What's the Future in ACL Reconstruction? An Expert Opinion

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EDITORIAL

The history of the treatment of anterior cruciate ligament (ACL) injuries is fascinating and filled with interesting anecdotes and sharp turns. Regrettably, it turned out that primary repair is not an option for the ruptured ACL due to its incapacity to heal [1]. Reconstruction with different augmentations devices has also only presented disheartening results. This has led orthopaedic surgeons to perform ACL reconstruction instead of repair. Initially ACL reconstruction was performed using arthrotomy with the goal to reproduce the native anatomy of the ACL. As with all modern surgery, minimally invasive surgical techniques were introduced in knee surgery and with it the start of arthroscopically-assisted ACL reconstruction [2]. In the beginning, arthroscopic ACL reconstruction was performed using a two-incision technique in which the femoral bone tunnel was drilled from outside-in. Over time this changed to one-incision technique in which the femoral bone tunnel is drilled inside-out through the tibial tunnel.

Recent studies found that this traditional single-bundle reconstruction fails to reproduce native ACL anatomy and does not fully restore the rotational stability of the knee joint and a more anatomic approach to ACL reconstruction was proposed [3]. The double-bundle technique brought the focus of ACL reconstruction back to restoring anatomy. It has shown superior results in terms of rotational stability in both biomechanical [4] and clinical studies [5]. However, it is vital to differentiate between anatomic and double-bundle ACL reconstruction. The latter is merely a step closer to reproduce the native anatomy of the ACL; however, it can still be done non-anatomically. Moreover, anatomic ACL reconstruction can also be performed using a single-bundle technique. Non-anatomic tibial and femoral tunnel placement represents one of the most important causes of ACL graft failure [6]. When the tibial tunnels are placed too anteriorly, it may lead to roof impingement, which is associated with loss of extension and abrasion of the graft [7]. To prevent this, some surgeons move their tibial tunnel more posteriorly. However, this approach creates tunnel mismatch [8]. Often, a tibial tunnel positioned at the PL insertion site is combined with an (high) AM femoral tunnel. It results in tunnel placement outside of the native insertion site, which can result in abnormal knee kinematics [9]. Multiple studies have demonstrated that non-anatomic tunnel placement results in limited range of

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motion, higher than physiologic graft tension, and ultimately graft failure [10,11]. Biological healing of the graft-bone interface may also be affected [12].

Anatomic ACL reconstruction can be defined as the functional restoration of the ACL to its native dimensions, collagen orientation, and insertion sites [13]. Use of a three-portal technique with a medial viewing portal facilitates a true anatomic ACL reconstruction. Anatomic ACL reconstruction can be performed in both single- and double-bundle reconstruction, and in primary, revision and augmentation surgery [14]. However, when different aspects of the surgery are compared, such as single- versus double-bundle techniques, it is necessary that both procedures are performed in an anatomic fashion. Most of the clinical studies comparing single-bundle to double-bundle reconstruction do not present a fair comparison since often one or both surgical techniques were not performed anatomically [15,16]. In addition, associated injuries such as cartilage injuries, meniscus tears and osteoarthritic changes should be taken into account when conducting comparative clinical studies.

Another future consideration is the further improvement of our outcome measures for ACL reconstruction. For example, in the office setting it is difficult to quantify differences in rotational stability in absolute terms [17]. New tools should be reliable, accurate, precise and valid. Examples of such tools that currently used for research purposes are dynamic stereo radiography, T2 MRI mapping of cartilage and quantification of graft healing on MRI [3,18,19]. Furthermore, there is a need of consensus on which outcome measures should be used, to facilitate homogeneous reporting of outcome amongst authors. For example, currently important outcome measures such as range of motion are underreported [20], even though it provides important clues to accuracy of tunnel placement and the presence of impingement. In addition, patient reported outcomes, such as the IKDC Subjective Knee Form, KOOS, Tegner Activity Scale and Marx Activity Scale, should be reported in all studies. The use of more accurate and standardized outcome measures could demonstrate the benefits of anatomic ACL reconstruction with regard to the restoration of normal structure and function of the knee.

Anatomic ACL reconstruction intends to replicate normal anatomy, restore normal kinematics and protect long-term knee

health. The road to anatomic ACL reconstruction has been long and winding. It is a detailed surgical procedure with a steep learning curve and many pitfalls. In the future, more reliable, accurate, precise and validated outcome measures are needed to evaluate its results.

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