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Primary Repair of Anterior Cruciate Ligament Tear

A Systematic Review

Submitted for Partial Fulfillment of Master Degree in Orthopedics

By

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List of Abbreviations

Abb.	Full term
ACL	*Anterior cruciate ligament*
AP	*Anteroposterior*
BEAR	*Bridge-Enhanced ACL Repair*
BEAR	*Bridge-enhanced ACL repair*
CENTRAL	*Cochrane Central Register of Controlled Trials*
CI	*Confidence interval*
DIS	*Dynamic Intraligamentary stabilisation*
FGF-2	*Fibroblast Growth Factor 2*
GDF	*Growth and Differentiation Factor*
IBLA	*Internal brace ligament augmentation*
ICJME	*International committee of medical journal association*
LFC	*Lateral femoral condyle*
MCL	*Medial Collateral Ligament*
MD	*Mean difference*
MOOSE	*Meta-analysis Of Observational Studies in Epidemiology*
MRI	*Magnetic Resonance Imaging*
PCL	*Posterior cruciate ligament*
PDGF	*Platelet Derived Growth Factor*
PE	*Polyethylene*
PRISMA	*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*
PROMS	*Patient related outcome scores*
PRP	*Platelet rich plasma*
RCTs	*Randomized controlled trials*
RR	*Relative risk*
SD	*Standard deviation*
SMD	*Standardized mean difference*
TGF	*Transforming Growth Factor*
VEGF	Vascular Endothelial Growth Factor

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ABSTRACT

Background: Initially, authors reported deterioration in the outcomes of ACL open primary repair. Consequently, authors considered ACL reconstruction surgery as the gold standard approach in treating ACL injuries. Recently, with the introduction of modern-day technology such as MRIs and arthroscopic repair, emerging reports gained interest in reevaluating the outcomes of primary repair.

Aim of the work: We aim to evaluate to evaluate the results of different techniques regarding ACL repair, and determine the ideal candidates for this procedure

Patients and Methods: We conducted an electronic search via PubMed, SCOPUS, Web of Science, Cochrane Central Register of Controlled Trials (CENTRAL), and Google Scholar from their inception till August 2020. We included randomized, nonrandomized trials, prospective or retrospective cohort and case control studies that were published in English with full text available. We restricted our search to patients diagnosed with acute ACL tear whom underwent open or arthroscopic ACL repair. Outcomes of interest were Functional outcomes (Lysholm, Bivot and Lachman scores), complications and failure rates.

Results: From a total 2089 screened citations, 24 studies met our inclusion criteria. Eleven studies evaluated primary ACL suture repair of the (1 study used a biologic scaffold in the ACL repair, 4 used microfracturing techniques, and 5 used some form of mechanical augmentation). The remaining 11 studies used dynamic intraligamentary stabilization (DIS). There was male predominance across the studies, with patients aged between 6 to 43.3 years and patients were follow-up to 16 years. There was a wide range of ACL repair survivorship between 60 % and 100% with reoperation rate ranged between 0 % and 51.5%. Re-rupture of the ACL, revision ACLR procedures, and implant removal were as high as 18.2%, 20%, and 100%, respectively. However, results were improved when ACL repair was combined with biological enhancers e.g. microfracturing and scaffolding. In the four comparative studies (primary repair vs. ACLR), there was no significant difference between both approaches regarding; IKDC, Lysholm,Tegner and Lachman, scores.but ACLR was slightly superior in certain outcomes e,g, failure rates and proper positioning.

Conclusion: We found that still ACL reconstruction is superior to ACL primary repair however, with strict selection criteria mainly; proximal ACL rupture and excellent tissue quality, primary ACL repair could be reconsidered as an effective treatment especially when combined with microfracturing and scaffolding.

Keywords: Primary Repair, Anterior Cruciate Ligament Tear

INTRODUCTION

Ligamentous injury in the athlete is a major cause of morbidity and time away from sport. Ligamentous repair remains an ongoing aspiration in the treatment of athletic patients in order to try and facilitate a rapid and complete return to high level sporting activity. Knee ligament injuries can have devastating consequences on the sporting career of athletes. In particular, we will focus on the anterior cruciate ligament (ACL) ligament injury and ligamentous repair techniques [(1)].

Anterior cruciate ligament injury:

Account for anywhere between 25 and 50% of ligamentous knee injuries and pose unique clinic problems because of its poor capacity to undergo biological healing due to the local intra-articular conditions. A potential theory to explain this is that the synovial fluid and intra-articular movement prevents formation of a stable fibrin-platelet scaffold. Without this scaffold, no primary healing can take place. This poor capacity of the ACL to heal is one of the main reasons why the current gold standard surgical treatment for an ACL injury in an athletic patient is ACL reconstruction [(2)]. The results of ACL reconstruction are good but current techniques do pose their own challenges and potential issues as, donor site morbidity, loss of proprioception or incomplete return to high-risk sports [(3)].

There is also significant evidence to suggest that ACL reconstruction does not prevent future osteoarthritis [(4)].

So, two major motivators for developing a new treatment for ACL injuries because of the recently reported high rates of osteoarthritis, after conventional ACL reconstruction, and the problem of how to safely treat skeletally immature patients.

Injury of the anterior cruciate ligament (ACL) was considered to be rare in the pediatric and adolescent population in the twentieth century. However, with the increase in sports participation of this patient population, and the greater clinical awareness along with modern diagnostic imaging, the incidence of ACL injuries has increased over the last decades in this population [(5)].

Although reconstruction transphyseal grafts is currently the gold standard still believed to be a risk factor for limb length and angular deformities in skeletally immature patients with risk of iatrogenic damage of the distal femoral or the proximal tibial growth plate, and subsequent growth disturbance and angular deformity in adolescents. Specially such injuries of ACL has been steadily rising for skeletally immature patients [(6)].

However, the prepubescent population could benefit greatly from a regenerative treatment, which does not require violation of the physes, and, as has been shown recently, this

group of patients may have the potential to respond most strongly to the biological stimuli used in current enhanced repair techniques. A repair procedure which does not involve transphyseal drilling, therefore, has a lower risk profile of physeal complications [(7)].

Regeneration of the ACL, rather than replacement with a similar type of tissue, has the potential to preserve the proprioceptive nerve fibers and the complex architecture of the ligament insertion side, features that are usually not reproduced by tendon grafts. This could potentially lead to more normal biomechanics of the knee if adequate regeneration is achieved [(8)].

Primary repair, if successful, can theoretically lead to a significant improvement in the treatment of ACL injuries in the athlete. In particular, the improvements in retention of proprioception and native kinematics could be a significant advancement. Novel techniques for primary ACL repair have developed considerably in recent years and now employ the full gambit of advanced techniques currently available [(9)].

Multiple growth factors have been evaluated in vitro and in vivo for ACL healing. Transforming Growth Factor Beta 1 , Fibroblast Growth Factor 2 (FGF-2), Growth and Differentiation Factor (GDF) 5 and GDF-7 have been shown to stimulate type I collagen production in ACL-derived cells in vitro, whereas Insulin-like Growth Factor I did not result in substantial increases. In vivo studies by Kobayashi et al. showed that FGF-