

Advancements in Arthroscopic Surgery Techniques for Anterior Cruciate Ligament (ACL) Reconstruction

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Abstract : Anterior Cruciate Ligament (ACL) injuries are common among athletes and individuals participating in sports with sudden stops, pivots, and changes in direction. Arthroscopic surgery is the gold standard for ACL reconstruction, aiming to restore knee stability and function. Recent years have witnessed significant advancements in arthroscopic surgery techniques, graft materials, and technological innovations, revolutionizing the field of ACL reconstruction. This presentation delves into the latest advancements in arthroscopic surgery techniques for ACL reconstruction and their potential impact on patient outcomes. Traditionally, autografts from the patellar tendon, hamstring tendon, or quadriceps tendon have been commonly used for ACL reconstruction. However, recent studies have explored the use of allografts, synthetic scaffolds, and tissue-engineered grafts as viable alternatives. This abstract evaluates the benefits and potential drawbacks of each graft type, considering factors such as graft incorporation, strength, and risk of graft failure. Moreover, the application of augmented reality (AR) and virtual reality (VR) technologies in surgical planning and intraoperative navigation has gained traction. AR and VR platforms provide surgeons with detailed 3D anatomical reconstructions of the knee joint, enhancing preoperative visualization and aiding in graft tunnel placement during surgery. We discuss the integration of AR and VR in arthroscopic ACL reconstruction procedures, evaluating their accuracy, cost-effectiveness, and overall impact on surgical outcomes. Beyond graft selection and surgical navigation, patient-specific planning has gained attention in recent research. Advanced imaging techniques, such as MRI-based personalized planning, enable surgeons to tailor ACL reconstruction procedures to each patient's unique anatomy. By accounting for individual variations in the femoral and tibial insertion sites, this personalized approach aims to optimize graft placement and potentially improve postoperative knee kinematics and stability. Furthermore, rehabilitation and postoperative care play a crucial role in the success of ACL reconstruction. This abstract explores novel rehabilitation protocols, emphasizing early mobilization, neuromuscular training, and accelerated recovery strategies. Integrating technology, such as wearable sensors and mobile applications, into postoperative care can facilitate remote monitoring and timely intervention, contributing to enhanced rehabilitation outcomes. In conclusion, this presentation provides an overview of the cutting-edge advancements in arthroscopic surgery techniques for ACL reconstruction. By embracing innovative graft materials, augmented reality, patient-specific planning, and technology-driven rehabilitation, orthopedic surgeons and sports medicine specialists can achieve superior outcomes in ACL injury management. These developments hold great promise for improving the functional outcomes and long-term success rates of ACL reconstruction, benefitting athletes and patients alike.

Keywords : arthroscopic surgery, ACL, autograft, allograft, graft materials, ACL reconstruction, synthetic scaffolds, tissue-engineered graft, virtual reality, augmented reality, surgical planning, intra-operative navigation

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