The Solo ACL Technique: Using an Articulated Arm Holder for ACL Reconstruction Without a Surgical Assistant

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Abstract

Background: Anterior cruciate ligament (ACL) surgery is challenging to perform without an assistant. During arthroscopy the leg must be manipulated simultaneously while performing surgery. This usually requires multiple hands and can be physically demanding. Throughout orthopaedic training, most trainees learn to perform ACL surgery with an assistant. However, once in practice, early career surgeons may find it difficult to obtain an experienced ACL surgical assistant.

Obtaining surgical assistance is becoming increasingly challenging in today's healthcare environment. A principal contributing factor is the Federal No Surprises Act which helps minimize surprise out-of-network billing to patients by prohibiting hiring independent third-party surgical assistants.

Additionally, many early career orthopaedic surgeons do not have access to physician assistants (PAs) until they meet productivity thresholds. Non-academic surgeons and junior attendings also may not have as readily access to fellows, residents, and medical students. Additionally, COVID-19 decreased healthcare personnel in the elective surgery realm, making it difficult for surgeons to have two arthroscopy-experienced scrub technicians. This can be challenging for an early career surgeon to increase productivity without appropriate surgical assistance.

This abstract will describe using an articulated arm holder adapted to hold and manipulate a leg during ACL surgery without an assistant and using a self-retractor to aid in quadriceps tendon graft harvest and repair when performing a solo quadriceps tendon autograft ACL reconstruction.

Technique: Orient the patient in the supine position, place the lateral leg post at the level of the tourniquet, and secure the articulated arm holder to the bed anterior to the lateral leg post. Place the articulated arm holder posterior to the lateral post to address medial pathology more effectively. Prep and drape the leg in sterile fashion, drape the articulated arm holder and corresponding hockey puck connector, and place a stocking-net from the lower leg to the knee. Place the corresponding articulated arm holder arm foam piece on the leg above the stocking net ensuring the outside metal piece connector is lateral and in line with the fibula. Rest the plantar arch on the foam connector's cylindrical piece. Fold excess stocking net over the foam proximally to maximally expose the tibia. Apply self-adherent wrap distal to proximal to secure the foam piece to the leg while ensuring the metal connector piece stays lateral. Connect the hockey-puck connector on the articulated arm holder to its corresponding blue foam holder connector. Verify uninterrupted range of motion of the arm holder and ensure the leg can be placed in ninety degrees of flexion and in hyperflexion. Perform timeout and use an Esmarch to exsanguinate the leg if tourniquet use is desired. Arthroscopy or graft harvest can proceed depending on the pathology or surgeon's preference. To address medial pathology, apply valgus stress using the lateral post and the articulated arm holder. If needed, the surgeon can use his/her body for additional valgus force onto the knee. The holder also frees the surgeon's feet for pedal control. To address lateral pathology, remove the leg from the holder and orient it in the figure of four position. Ensure the "male" part of the lateral connector does not rest on the patient's contralateral leg during this portion. Alternatively, one can leave the leg in the leg holder and place the leg in figure of four. Use a proprietary clear plastic self-retractor for quadriceps tendon graft harvest for ACL reconstruction. Repair the quadriceps tendon using the proprietary clear plastic self-retractor for retraction, the dry arthroscope and a self-retrieving arthroscopic suture passing device. Scrub technician and/or assistant can prepare graft while the surgeon closes the quadriceps defect. Proceed with ACL surgery after graft preparation. The articulated arm holder stabilizes the knee in hyper-flexion during anteromedial portal drilling and stabilizes the leg during tibial tunnel drilling. The leg can also be stably held with the desired amount of extension while performing final graft tensioning.

Conclusion: The use of the articulated arm holder adapted as a leg holder with the proprietary clear plastic self-retractor allows a surgeon to safely perform ACL surgery with a quadriceps tendon autograft without an assist.

The articulated arm holder has many advantages over other knee arthroscopy set-ups. First, the articulated arm holder stabilizes the leg in any direction for an indefinite amount of time, allowing ACL surgery to be more easily performed on a leg of any size by any surgeon regardless of height. The articulated arm holder also allows for both pedal and hand

control on arthroscopic instruments. Additionally, the leg can be more elevated than usual when in the figure of four position, allowing assistants to retrieve needles from the posterolateral knee during inside out meniscus repairs. This system can be implemented with any type of allograft or autograft (hamstring, quadriceps tendon, bone-patellar-tendon-bone).

Another advantage of this set-up for quadriceps tendon autografts, is that if an assistant is available, the scrub technicians can help assistants prepare the graft while surgeons close the quadriceps defect without requiring tissue retraction assistance. Disadvantages to this system are cost and resource availability.