REVIEW ARTICLE

ANTERIOR CRUCIATE LIGAMENT REHABILITATION: A SYSTEMIC REVIEW

Amit Chaitanya[1], Pawan Kumar[2]

[1]Senior Resident, Physical Medicine and Rehabilitation, [2]Senior Resident, Orthopaedics, IGIMS, Patna

ABSTRACT:
Modern medicinal therapy in today's medical world aims for establishing a better quality of life in patients in different stages of disorders. It is a well - known fact that anterior cruciate ligament (ACL) reconstruction needs to be combined with post-treatment rehabilitation programme in order for patients to return to their pre-injury activity levels and this rehabilitation is almost as important as the surgical part. Over the past two decades, there have been drastic changes in the pattern, and aggressiveness of ACL rehabilitation protocols. Therefore, this review highlights the protocol in ACL rehabilitation and insight on its upcoming scenario.
Key Words: Anterior cruciate ligament, Range of Motion, Rehabiliation

Corresponding author: Dr. Pawan Kumar, Orthopaedics, IGIMS, Patna, E mail: reachpawankumar@gmail.com

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INTRODUCTION

Anterior cruciate ligament (ACL) reconstructions aim to restore the patient's pre-injury activity state. Therefore, it has to be combined with detailed postoperative rehabilitation protocol. Structural restoration of ligament is achieved by reconstruction whereas post operative rehabilitation protects the graft in early phase and maintains the tone and strength of surrounding muscles as well as the joint mobility. Rehabilitation is also important for the improvement of patient psychology and in turn improves the self confidence of patient on operated joint. Literature quotes data that tried to determine the earliest optimal time to start rehabilitation and how long it should take, considering all parameters of the rehabilitation process.[1]

Modern medicine therapy aims to commence a better quality of life in patients at different stages of disorders which are possibly achieved through knowledge about multiple aspects of etiopathogeny and pathology. Patients suffering from severe chronic disabilities targets to improve their quality of life (QOL). The loss of mobility in the joints makes patient more dependent on others which affects their quality of life.[2]

Therefore, this review aims to highlight the most common modalities in ACL rehabilitation, such as postoperative bracing, neuromuscular electrical stimulation (NMES) and various other modalities related to it.

POST OPERATIVE BRACE USE

Post operative bracing allows guided and predetermined ROM and thus protects the newly reconstructed ACL from undue stress. Postoperative brace mainly causes restriction and development of the Range of motion (ROM) of the knee, producing knee stability thereby protecting knees from injuries. But, the role it plays in ACL is still under controversy.[1] According to McDevitt *et al,* there is no definite evidence of improvements in results from re-injuries associated with the use of a brace in postoperative ACL reconstruction.[3] Wright *et al* indicated in a systematic review that wearing of a knee brace had no additional treatment value after ACL reconstruction.[4] Mayr *et al* compared the clinical outcomes of postoperative ACL rehabilitation. They found that the hard brace group had significantly more extension deficits and no significant difference was reported between the groups on knee ROM, knee laxity and thigh atrophy parameters.[5] following the above studies, we can conclude that value of early ROM recovery in postoperative ACL rehabilitation is quite

obvious. However it is still uncertain when to start ROM exercises in the early postoperative period.[6]

CRITERIA FOR PROGRESSION INTO THE RETURN-TO-SPORT PHASE

Return-to-sport neuromuscular training incorporates a channel of certain criteria specifically designed to provide structure and objective standardization to late-phase rehabilitation following ACL reconstruction.[7] Prior to initiation of return-to-sport training, the athlete should demonstrate sufficient strength to improve potential for success.[9] The absence of sufficient strength may result in an inability to initiate dynamic movements, to attenuate ground reaction forces, or to achieve high levels of performance during dynamic tasks.[8,9]

ANIMAL INVESTIGATIONS

Various literature data on animal experimentation have correctly discerned that the results of animal reconstructions and their post-operative care cannot be readily transferred to humans. It is quite obvious that the cooperation necessary to complete a post-operative rehabilitation program is not manifest in any animal model. However, it is not practically possible to perform destructive studies of ACL reconstructions in a human model. Therefore, investigations and results that have evaluated these results from the reconstruction of animal ACLs are of great value. At the time of experimentation in animal models, sacrificing varying from three to 24 months following ACL reconstruction, the ultimate failure loads of patellar tendon autografts are all well below the control ACL values. Return of ultimate strength of the graft in experimentation has ranged as high as 55% in primates, 40% in goats, 30% in canines, and only 12% in rabbits.[10]

FULL PASSIVE KNEE EXTENSION

The most common post surgical complication of ACL reconstruction is loss of range of motion, in particular is the loss of full knee extension.[11-13] The inability to fully extend the knee results in abnormal joint arthrokinematics,[14-16] scar tissue formation in the anterior aspect of the knee, and subsequent increases in patellofemoral/ tibiofemoral joint contact pressure.[17] Therefore, we aim to achieve some degree of hyperextension during the first few days after surgery and eventually to work to restore symmetrical motion.

Specific exercises include PROM exercises performed by the rehabilitation specialist, supine hamstring stretches and gastrocnemius stretches. The patient lied in the supine position while the low-load, long-duration stretch is applied for 12 to 15 minutes 4 times per day, with the total low-load, long-duration stretch time per day equalling at least 60 minutes.[18] this technique is utilized immediately following surgery to maintain and improve knee extension and prevent a flexion contracture.

The amount of hyperextension attempted to restore is invariably dependent on the uninjured knee. During the first week following surgery, for patients who exhibit 10° or more of hyperextension on the uninjured knee, e approximately 7° of hyperextension is restored on the surgical side. The remaining hyperextension is gradually restored once joint inflammation is reduced and muscular control is restored over the following several weeks.[19]

ROM RESTORATION

Many researchers favour the fact that priority goal of postoperative ACL rehabilitation should be restoration of the full ROM.[20-23] Rubinstein *et al* reported that in the post operative period, full knee extension in patients that underwent autogenous bone-patellar-tendon ACL reconstruction did not damage the graft or joint stability. Graft protection is important for both the patient and the surgeon who performed the surgical procedure. Orthopedic surgeons generally refer their patients to mostly those sports medicine clinics with whom they are convinced that they will perform a rehabilitation modality that will not adversely affect the graft recovery process. Patient compliance with the rehabilitation protocol will improve when patients will trust the orthopedist and physicians responsible for the rehabilitation program.[20,21]

PROGRESS TO SPORT-SPECIFIC TRAINING

The last step involved in ACL rehabilitation involves the restoration of function through sport-specific training for athletes returning to competition. Most of the previous mentioned drills in the literature, such as cone drills, lunges with sport cords, plyometric drills, and the running and agility progression, can be modified for the specific functional movement patterns associated with the patient's unique sport. The specific movement patterns learned throughout the rehabilitation program are integrated to provide challenges in a controlled setting.[19]

NEUROMUSCULAR ELECTRICAL STIMULATION (NMES)

During the early phase of treatment, normal gait should be restored by controlling and

synchronizing the quadriceps with the antagonist hamstring. Many studies have proven that electrical stimulation (ES) protects from muscle atrophy.[24-27] Snyder-Mackler *et al* showed that high intensity ES either alone or in combination with low intensity ES increased recovery of the opposite limb quadriceps strength.[28] Although most of the literature studies stressed the benefit of ES, Wright *et al* in a systematic review quoted that the quality of these studies varied; many did not address randomization or were not blinded and their results were not evaluated by independent observers. In the light of above data, authors highlighted that NMES helped the development of the quadriceps, but one could not conclude that NMES was certainly required for successful ACL rehabilitation.[29]

IN - VIVO BIOMECHANICAL INVESTIGATIONS

Instability of the knee after injury to the anterior cruciate ligament are treated by funvtional braces. They are also used to prevent intra-articular injury and protect healing ACL grafts; however, the limit of the effect of these braces is still unclear. In the present scenario, the main aim of current rehabilitation protocols advocated are not based on truly validated research data. Before the safety of such protocols be evaluated, one must keep in mind about the lack of randomized clinical trials evaluating the ultimate outcome of rapid and aggressive rehabilitation compared to more conservative and lengthy rehabilitation must occur.[10]

LIMITATIONS AND PRACTICAL APPLICATIONS OF SUCH PROTOCOLS

Future research work is required to evaluate the clinical relevance, reliability, validity, and long-term consequences of such approach to the return-to-sport phase of rehabilitation. Evaluation of criteria for transition to each subsequent stage in the return-to-sport phase requires the utilization of equipment that may not be available in the majority of sports medicine clinics. Further studies might provide insight as to whether or not less equipment-intensive return-to-sport algorithms are reliable.[7]

CONCLUSION

All of the surveys and literature data have important impact for individual patient care and preventive interventions relating to orthopaedic emergencies and complications. The main approach in ACL rehabilitation is to ensure almost complete rehabilitation and return of the person to sports activities at the 5-6 month postoperatively. However, studies in the present state aims to shorten this period of rehabilitation. Since, all these researches require a lot of financial support and effort, it is going to take time develop the necessary investigations to determine what is the ideal ACL rehabilitation program.

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