



## TREATING POSTERIOR CRUCIATE LIGAMENT INJURY

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**ABSTRACT** The main objective of this study was to provide a clear overview of the methods of treating the injury of posterior cruciate ligament. The following data bases were used to collect the data: PubMed, Ovid, Web of Science and SciVerse Scopus, concluded on 6th of August 2018. All the papers were listed according to the references, and they all included those with the aim of operative and nonoperative treatment of the posterior cruciate ligament injury. After a systematic review of the case, it can be said that there are different responses to this question, as the subjective attitudes of experts and that many studies are needed to be done to better understand the mechanism of the injury itself, which will contribute to the treatment and rehabilitation of recovery treatments.

**KEYWORDS :** PCL, PCL injury, posterior cruciate ligament, rehabilitation, non-operative, treatment, kinesitherapy.

### 1. INTRODUCTION

Nowadays, most common knee injuries include meniscus, ligament, tendon and cartilage damage. In this paper, there is a concise summary of the treatment of injury of the posterior cruciate ligament, as well as the effects of these treatments. In fact, injuries of PCL (i.e., posterior cruciate ligament) count for only 3% of total knee ligament injuries in the general population (according to Harrer & Hoher, 1998), therefore the number of PCL injury investigations is much smaller than the other. Thus, speaking of the PCL injury of athletes, one of the main problem relates to the question: "How to treat the injury and how to get back to the routine as soon as possible?" Naturally, these injuries do not only occur to professional athletes but also to other population, i.e. people recreationally involved in sport. In recent years, there is an apparent increase in the incidence of PCL injuries, possibly because of an increase in the number of road traffic accidents, increased participation in recreational and competitive sports, and improved awareness and clinical diagnostic skills (Patel, Allen, Warren, Wickiewicz & Simonian, 2007). If injury is diagnosed, immediate treatment is required.

### 2. TREATING POSTERIOR CRUCIATE LIGAMENT INJURY

The treatment of the posterior cruciate ligament injuries could be conservative and operative. Certainly, the conservative method should be applied even if the treatment is planned to be operational. In the majority of cases, functional treatment is recommended. However, in some cases, notably when there is pain or instability, surgical treatment can be proposed (Wajsfisz, Christel & Dijan, 2010). The choice of the treatment depends on the type of the injury (isolated or combined with other knee structures), the level and type of physical activity and the patient's preferences. Recovery, regardless of the character of the treatment, should take 2-12 weeks. The ultimate goal of treatment is to achieve a normal walking pattern and return to everyday activities (sport, recreation, etc.).

### 3. NONOPERATIVE TREATMENT OF PCL INJURY

It is understood that in injury such this is, a person is temporarily unable to deal with everyday bodily activities and that physical activity needs to be adjusted. Therefore, repairing the injury itself is a necessity. There are cases when the patient can not remember the injury and is able to walk normally, and the effects begin to feel only 2 to 3 weeks after the trauma. In higher grade injuries (associated with ligament, meniscus and cartilage injury), the patient usually asks for medical help immediately. Then, magnetic resonance imaging is used to assess intraarticular pathology. In conservative rehabilitation (most commonly with isolated injuries), the main goal is to reduce the inflammatory phase and restore the wrist movement to muscle function in the shortest possible time. Thus, one of the main principles of nonoperative treatment includes a priori rest, ice, compression of joint and elevation of the lower leg. In the first phase of nonoperative treatment (up to 7 days after the injury), the above-mentioned RICE method is applied. The elements of this method are combined several

times a day with simultaneous treatments of muscle and ultrasound electrostimulation. After the calming of the initial edema and the inflammation, a patient should begin with the exercises of strengthening back thigh and quadriceps. Isometric exercise of strengthening the quadriceps and muscles of hip flexors (raising legs with flexion, adduction, abduction) are recommended. It is also necessary to exclude the open kinetic chain exercises when strengthening the back thigh for the possibility of a posterior displacement of the tibia. One of the methods of initial brace treatment is the use of a specifically designed "PCL-Jack" dynamic brace (according to Jacobi, Reischl, Wahl, Gautier & Jakob, 2010). This brace is mainly used in higher-level injuries, where injuries of other structures are associated.

Only patients with grade III injuries should continue to wear a brace (0-60°) until at least the third week therapy (Peterson & Young, 2017). Furthermore, the acute phase rehabilitation of week 2 and 3 includes exercises that are performed with slight increase in resistance. Bicycle ergometers and isometric exercises, as well as exercises in the water, are used to increase the range of movement and muscle strength. Closed kinetic chain exercises are used during the week 3-6 (low-grade exercise with light resistance, lowering to incomplete squat). At a phase of 8-12 week after the injury, light jogging with the aforementioned strength training exercises with increased resistance has to be included. Keller, Shelbourne, Mc Carroll & Rettig (1993) state that patients with isolated PCL injury suffer from continuous knee deterioration based on radiological, subjective and functional assessment. Deterioration begins and can be detected in less than 5 years after the injury and will not slow down if the quadriceps strength continues to remain at an enviable level. Patients can continue with their sports activities, but often notice significant symptoms. Also, the authors state that patients with such an injury can maintain sufficient muscle strength to remain active but are usually unable to return to the level of activity prior to the injury itself and continue to show objective and subjective signs of knee deterioration. In a second study (Shelbourne, Davis, Patel, 1999), scientists conclude that, regardless of the amount of laxity, half of the patients have returned to the same sport at the same or higher level, one-third returned to the same sport at a lower level, and one-sixth did not return to the same sport. Edson, Fanelli & Beck (2010) concluded that patients who attended conservative method use a similar training for quadriceps and for proprioception as which is applied postoperatively, and that the program avoids knee flexion over 70° and also isolated rigging exercises.

### 4. OPERATIVE TREATMENT OF PCL INJURY

In the case of a PCL reconstruction procedure, the treatment is performed gradually, using the same as after injury elements of the RICE method in the first stage. Depending on the severity of the procedure, depending on whether there is isolated or combined injury, further therapy is applied. Attention should be paid to the mobilization of the knee, especially the patella, so as to avoid fracture of the fibrous

tissue around the joint structures. It is also of particular importance to protect the graft during this period, as this phase is the most sensitive.

Peterson & Young found in their research (2017) that operational rehabilitation lasts from 2 to 12 weeks. During this period, the patient should gradually improve the range of motion (0-130°). It is necessary to use passive stretching for re-mobility, and to be sure that the load increases according to the tolerance of the patient. Strengthening exercises, and those of the closed kinetic chain (CKC), are being used. Likewise, during the later part of this phase, water resistance training is introduced. In their work, Reinold, Carter & Wilk (2001) found that rehabilitation goals after reconstruction include restoring entire joint movement, preventing joint cartilage wear, gradually increasing stress on the transplant itself, and improving dynamic knee muscle stabilization. The program implemented by the mentioned authors consists of five phases foreseen for gradual advancement of the patient to unlimited activities 6-7 months after the operation. Immediately after the surgery, the knee is fed with compression bandages and continuous cryotherapy. The patient uses a full-length denture and two walking aids, which relies on approximately 50% of the weight. The orthosis can be flexible as the patient sits or while exercising. Complete passive extension should be achieved in a short period of time after the surgery to prevent the development of arthrofibrosis of the joint. Range of motion (ROM) exercises and mobilization of the patelles are carried out four to five times throughout the day to gain the scope of the movement. Exercises include strengthening of the quadriceps, slow leg flexion, abduction and adduction. Electrical muscle stimulation is applied in conjunction with these exercises to facilitate quadriceps contraction (Reinold et al., Ericksson & Haggmark, 1979; Morrissey et al., 1985; Snyder, Mackler, Delitto, Bailey & Stralka, 1995). Isolated exercises to strengthen the posterior thigh are contraindicated in the first 8 weeks due to the large force of the hamstring that is generated by contraction of itself. Cryotherapy is usually used 15 minutes before and after the treatment, and for reducing pain and edema. In the period from week 2 to 6, the ROM gradually increases (from 0 to 90° during the week 1, up to 105° to the end of week 2, to 115° to the end of week 4 and to 125° to the end of the week 5, respectively week 6). The patient between the 2nd and the 3rd week begins to walk with one rat. Activity to strengthen the quadriceps gradually increases, including knee extension in OKC (open kinetic chain) of 0-60° and leg press exercise of 60-0° C during the week 2. Mini-squats from 0-45°, including Biodex Stability System, are also being performed to increase proprioception. Stressing stability training is becoming increasingly commonplace. Bicycle ergometer can be used to strengthen the quadriceps, to stimulate the ROM and to maintain cardiovascular training whenever this allows the range of motion. Also, at this point, a water therapy program is started, consisting of swimming in the pool and exercises of the lower extremities. Swimming is allowed between the week 6 and 7, with the emphasis on knocking on a flat foot due to the possible hyperextension of the wrist. All CKC exercises are allowed from 6-8 week, including side and front steps, climbing along the escalator, etc. At the point of week 8, the back loop contraction (0-60°) is performed with resistance. Swimming in the pool begins to be practiced at the week 12 to help the athlete prepare to run on a dry ground. Returning to lightweight sports activities starts at the phase of 3rd to 4<sup>th</sup> months after the surgery. The emphasis is on a strength training, neuromuscular control and slow-moving sport-specific movements. Pliometric exercises are used to increase dynamic wedge stabilization and neuromuscular control. Within time, it progresses from leg-press machines and leaps on a flat surface, up to leaps to elevation and one leg jumps. Athletes usually get back to a noncontact sports between 5.5 and 6 months postsurgery, and to contact sports between 6-7 months. It is necessary to be more cautious with skiers because of the highly dynamic nature of the sport, generally permitting skiing at 8- 9 months postsurgery (according to Reinold & al., 2001). Fanelli (2008) has presented his specific rehabilitation program in which the knee is locked in the orthosis in full extension from the week 3-6, using the walkout without relieving the weight on the leg. The orthosis is unlocked during the postoperative period of 4 to 6 weeks. The range of motion starts to increase during the week 4. The 7th week starts with a 25% weight gain on the leg and lasts progressively until the week 10, when the wraps are lifted. Exercises for quadriceps of the open kinetic chain (45-0°) are started in week 11 and are run up to a closed kinetic chain (0-45°). Flexion exercises of OKC are avoided for a period of 6 months postoperatively. Getting back to an usual sports activities is to be expected in a period of 6 to 9 months after the operation, when sufficient strength and ROM have been achieved. Bianchi (1983) concludes that, despite a relatively low percentage of good results obtained by an objective assessment of patients, in most

cases, patients expressed satisfaction for the simple reason that they could return to a normal life, including the activities they were practicing before the injury.

## 5. CONCLUSION

After a systematic review of the posterior cruciate ligament injury cases, it can be said that there are still different answers to this question and also the subjective views of the experts. As the choice of treatment depends not only on the type of the injury, but also on the level and type of physical activity and the patient's preferences, accordingly decisions are to be made on the type of a treatment. In many studies, it was concluded that a portion of the patients treated only by the conservative treatment method was unable to return to the level of activity before the injury itself, while part of it was at the same or near level. On the other side, speaking of the operational method, in most cases the athletes returned to their activities between 5.5 and 9 months postoperatively, depending on the requirement of the sport itself.

To conclude, both in science and in practice, this issue remains underdeveloped and there is certainly a need for further research related to this issue.

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