Case Report

Rehabilitation program in type I floating knee: A case report

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Type I floating knee is characterized by fracture of the femur and tibia shafts leading to a discontinuity of the knee joint. Despite the evidence in the literature about surgical treatment for these fractures, we found a lack of findings focusing the rehabilitation process. Thus, the aim of this study was to describe a specific rehabilitation program for a patient in postoperative type I floating knee. Case Description: This case is a young patient victim of automobile accident resulting in type I floating knee treated surgically with blocked intra-medullar nail of the femur and tibia. She was submitted to a rehabilitation program based on specific strengthening exercises, body conscience, and biomechanical correction, ending the physical therapy treatment after 7 months. Outcomes: After the rehabilitation period, the patient returned to her daily activities without pain complaints, 69 points in the lower extremities functional scale (LEFS), 20% muscle strength deficits for knee and hip extensors, 30% for knee flexors, 15% for hip abductors, 7% for hip adductors, and 20% for hip internal rotators. Hip flexors and lateral rotators, as well as dorsi-flexors and plantar-flexors strength were the same than the contra-lateral limb. Discussion: The patient came to physical therapy sector using a wheelchair, pain complaints and significant musculature activation deficit. The rehabilitation focused strengthening specific muscles, lumbo-pelvic stabilization, and biomechanical correction. Based on these clinical results, our rehabilitation protocol was satisfactory in a patient with type I floating knee.

Key words: Floating knee, fracture, rehabilitation, physiotherapy, surgery

INTRODUCTION

Floating knee is characterized by knee joint discontinuity as a result of fractures of the ipsilateral femur and tibia shafts, and may be associated with soft tissue injury (Rethnam et al., 2007). This fracture is usually caused by car accidents, accompanied in most cases by head, thorax and abdomen traumas, showing high incidence of morbidity / mortality (5-15%) (Rethnam et al., 2007), especially when associated with complications such as infection, fat embolism, weight bearing deficits and bone healing deficits (delayed consolidation or non-union) (Hung et al., 2007).

There is a poor prognostic for this fracture due to difficulties during the surgical procedure, mainly because of associated injuries. It is important to highlight the high incidence of concomitant vascular damage as a result of these injuries, which may lead to amputation (Hung et al., 2007; Yokoyama et al., 2002). Ligament injuries are also common and range between 30-45%. The anterior cruciate ligament is the most affected and it can be associated with other ligament structures (Szalay et al. 1990, Van Raay et al. 2002).

According to Blake and McBryde (Blake and McBryde, 1975), there are 2 types of floating knee: type I and II (Figure 1). Type I is the true floating knee because the knee joint is not directly involved, with involves only fractures of the femur and tibia shafts. In type II-A, there is knee joint involvement as well as shaft fractures. Type II-B is characterized by associated hip or ankle joint...
fractures. When selecting surgical treatment, there is a consensus in the literature that the best option is fixation by intramedullar nails in both fractures (Theodoratos et al., 2001). It is believed that better functional results can be achieved with this stabilization because it allows knee and ankle movement, early return to pre-injury activities, and accelerated bone healing (Dwyer et al., 2005). There are reports in the literature of fracture stabilization procedures; however, few studies or case reports were observed that focus on rehabilitation programs and their influence on returning to prior functional status.

CASE REPORT

A 15-year-old female patient had presented right femur and tibia shaft fractures due to a motorcycle accident in May 2009. According to Blake and McBryde, this fracture was classified as type I floating knee (Figure 2). One day after the fracture, she was submitted to external fixation (Figure 3) and after 3 days she was submitted to stabilization with retrogrades DFN (distal femur nail), and anterogrades ETN (expert tibial nail). Both nails were blocked (Figure 4). During the hospital period (between surgeries), physical therapy was initiated based on hip and ankle active-assisted mobilization. The focus of the physical therapy was on flexion and extension, patellar mobilization, active exercises for the ankle, and orientations regarding limb positioning. After the second surgery, the physical therapy was performed utilizing the aforementioned exercises, including gait training with proprioceptive weight bearing with regular crutches. We also applied some analgesic procedures by neural-electrical stimulation. Thus, the patient finished the hospital physical therapy period and on the 6th day after surgery began ambulatory physical therapy.

Four days after leaving the hospital, the patient was admitted to the Rehabilitation Service while seated in a wheelchair and maintaining the limb in full extension. Clinical examination showed moderate knee edema, quadriceps activation deficit, and range of motion (ROM) around 30° for knee flexion, 25° for plantarflexion and 10° for dorsiflexion, as well as pain complaints in the injured limb (Visual Analogue Scale = 7) (Jensen et al., 1986). Muscle strength measurement and ligament tests were not conducted at this time due to the pain presented by the patient. However, after approximately 1 month, these measurements were obtained and demonstrated a significant weakness of the quadriceps, hip abductors and lateral rotator muscles (Powers, 2003).

The rehabilitation process lasted approximately 7 months and was divided into 5 phases, as described in Table 1. The frequency of sessions varied according to the specific rehabilitation phase, i.e. 3 weekly sessions in the first 2 phases and 2 weekly sessions in the other phases.

Knee ROM increased approximately 10 degrees per week, being that the initial evaluation (first week postoperative) showed 30 degrees and the 12 weeks evaluation showed approximately 140 degrees of flexion. Ankle ROM reached normal values (20 degrees of dorsiflexion and 45 degrees of plantar-flexion) in the fifth week rehabilitation.

Therefore, after this 7-month period, the patient returned to regular daily activities without pain complaints and with “satisfactory” function (scoring 69 points in the LEFS)
Figure 2: Pre-operative anterior-posterior X-rays of floating knee – A) Femur shaft fracture and B) Tibia and fibula shaft fracture (May/09)

Figure 3: X-rays immediately after surgery for external fixation - A) Femur fixation; B) Tibia fixation (May/09)

(Binkley et al., 1999). The post-operative clinical outcome was also considered "good" according to the criteria described by Karlström and Olerud (Karlstrom and Olerud, 1977).

The muscular strength measurement in the final evaluation was performed by a hand-held dynamometer (Lafayette Instrument, Co) (Bohannon, 1990). Despite this functional improvement, a certain strength deficit remains after therapy for knee and hip extensors (20%), knee flexors (30%), hip abductors, adductors and internal rotators (between 5-20%) in comparison to the contra-lateral limb. The muscle strength of the hip flexors and external rotators, as well as the ankle dorsi-flexors and plantar-flexors presented the same values when compared to the contra-lateral limb after the applied protocol.

DISCUSSION

This is a case description of a victim of a motorcycle accident with a diagnosis of type I floating knee that had been treated in the Rehabilitation Service of the Irmandade da Santa Casa de Misericórdia – São Paulo, Brazil. The patient was submitted initially to external fixation of both fractures, and subsequent internal fixation with retrograde intra-medullar nail for the femoral fracture, and anterograde intra-medullar nail for the tibial
Figure 4: X-rays immediately after surgery for open reduction internal fixation using intra-medullar nails – A) DFN; B) ETN (May/09).

Table 1. Rehabilitation program

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<tr>
<th>Phase I – 1 to 4 weeks</th>
<th>Objective</th>
<th>Interventions</th>
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|                        | -Quadriiceps activation;  
                        | -Hip muscles strength;  
                        | -Hip, knee and ankle ROM gain;  
                        | -Lumbo-pelvic stabilization;  
                        | -Proprioceptive (non-weight bearing) gait;  
                        | -Analgesy | -Quadriiceps NMES;  
                        | -Hip active exercises;  
                        | -Knee and ankle articular mobilization;  
                        | -Knee and ankle active movement (without pain complaints);  
                        | -Transverse abdomen and multifidus activation;  
                        | -Non weight bearing gait train with crutches bilaterally;  
                        | -Cryotherapy |
| Phase II – 5 to 8 weeks | -Knee and ankle ROM gain;  
                        | -Hip, knee and ankle muscular strength;  
                        | -Gait functional improvement | -Stationary bike;  
                        | -Articular mobilization (Maitland grade 3 and 4) and muscle energy skills in the knee and ankle;  
                        | -Quadriiceps NMES (médium frequency stim);  
                        | -Hip active exercises;  
                        | -Hip abductors and lateral rotators strengthening correcting dynamic valgus;  
                        | -Extensor machine for quadriiceps (progressive load);  
                        | -Dorsiflexors and plantar flexors strengthening (progressive non weight bearing);  
                        | -Gait train with 30% weight bearing increasing to total weight bearing at the end phase; |
| Phase III – 9 to 12 weeks | Same objectives | Aforementioned exercises increasing weights;  
                        | -Gait without crutches;  
                        | -Sensorio-motor reeducation | Bipodal sensorio-motor train in stable surface evolving to unstable surface |
| Phase IV – 13 to 20 weeks | Same objectives | Aforementioned exercises increasing weights;  
                        | -Gait without crutches;  
                        | -Sensorio-motor reeducation | Increasing strength exercises with and without weight bearing;  
                        | -Correcting single leg dynamic valgus in front of a mirror;  
                        | -Single leg sensorio-motor trainning evolving to advanced proprioception |
| Phase V – 21 weeks to the end of treatment | Return to function | Jogging  
                        | -Plyometric exercises |
have been raised, such as deficiencies in neuromuscular control, causing imbalance in the actions of static and dynamic stabilizers of the lower limb joints (Cowan et al., 2002). Thus, in the applied protocol, we conducted hip abductor and lateral rotator muscle strengthening, as well as sensory-motor training based on the dynamic valgus correction. Initially, we applied postural conscience exercises, progressing to functional activities such as climbing-down stairs, squatting, plyometric exercises, etc. Despite few detailed descriptions about floating knee rehabilitation, there are reports of a return to regular daily activities in around 7 months (Hung et al., 2007; Dwyer et al., 2005) as occurred in the present case study. Due to the case report limitations, the scientific potential of this study is confined to the description of the rehabilitation protocol after floating knee injury. The anatomical, surgical, biomechanical, and bone consolidation knowledge should also be taken into consideration.

This patient presented a satisfactory outcome according to the functional scales, muscle strength measurements, and ROM. We would like to emphasize the key role of rehabilitation in patients with lower limbs fractures, specifically floating knee.

Additional information

We declare that there was no financial support, or any conflict of interest in the accomplishment of this study.

REFERENCES


