

Knee's Radiographic Exam on Spinal Cord Injury Patients

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Abstract

Objective: The proposed study aims to assess the knee of the injured spinal cord through radiographic examination, in relation to possible joint damage and the efficiency of neuromuscular electrical stimulation. Methods: The sample consisted of 21 spinal cord (11 controls and 10 NMES group) aged between 20 and 55 years. Radiographic knee of patients with spinal cord injury were analyzed (in the anteroposterior and lateral). The variables analyzed were: bone thinning, calcification, degenerative changes such as changes in joint space, subchondral sclerosis and osteophytes graduated from classification osteoarthritis - Keelgren and Lawrence. The patellar height measured by the method Caton-Deschamps. Results: There was no statistically significant difference between the groups. This study suggests that structural changes in the knee of the injured spinal cord are not relevant. An important factor is the bone mass loss that begins in the 2nd month of injury and did not differ with the treatment performed (muscle strengthening, stretching, hydrotherapy or NMES) after 1 year of injury.

Keywords: knee, radiographic exam, spinal cord injury.

Introduction

Spinal cord injury (SCI) is a cause of clinical, social and economic problems. The estimated incidence is 20 to 50 cases per million in habitants per year.

The SCI may lead to several changes, orthostatic hypotension [2,3,4] spasticity, autonomic dysreflexia, contractures [2], bladder and bowel dysfunction, heterotopic ossification (OH) [1] respiratory complications, heart disease, psychological disorders, decreased of resistance to perform activities of daily living and inability to walk.

Regarding the osteoarticular system is evidenced the osteoporosis [4], the potential risk of fracture and OH [1]. Most part of the bone mass loss occurs during the first four to six months after the injury and stabilizes between the twelfth and sixteenth month, when the density of bone mass may reach 2 / 3 of the original, with about 1 / 3 of bone mass is lost over the first three to four months. This loss occurs initially in the whole skeleton, restricting, later to the paralyzed segments. Neuromuscular electrical stimulation

(NMES) is a treatment used to restore movement, prevent complications arising from physical injury [5], promote the standing position, gait, to activate the pattern generator for locomotion and to improve the cardiorespiratory function [4]. Despite that the radiology exam is not indicated for the early diagnosis of joint involvement common after spinal cord injury, it has lower cost compared to other imaging tests [11].

Material and Methods

Laboratory Biomechanics and Rehabilitation at the University Hospital offers a training program with neuromuscular stimulation. It is utilized 4-channel NMES bilaterally.

This study assess 21 knee radiographs (Figure 1) with spinal cord injuries, which 10 perform NMES and 11 perform physical therapy with muscle strengthening and stretching, but do not perform any electrical muscle work (control group).

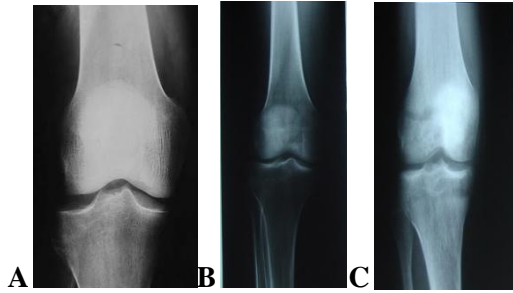


Figure 1. Radiographic images of the knee (AP). A. Regular individual. B. SCI patient control. C. SCI patient that accomplishes NMES.

The radiographic images were analyzed in the anteroposterior (AP) and lateral views. The variables analyzed were: bone thinning, calcification, degenerative changes such as changes in joint space, subchondral sclerosis and osteophytes graduated from classification osteoarthritis - Keelgren and Lawrence:

- Grade 1: doubtful narrowing of joint space and possible osteophyte lipping
- Grade 2: definite osteophytes, definite narrowing of joint space
- Grade 3: moderate multiple osteophytes, definite narrowing of joints space, some sclerosis and possible deformity of bone contour
- Grade 4: large osteophytes, marked narrowing of joint space, severe sclerosis and definite deformity of bone contour.

The patellar height was measured by the method Caton- Deschamps [10]. This method is calculated from the relationship between the distance from the lowest point of the articular surface of the patella to the anterosuperior edge of the tibial plateau and length of the articular surface of the patella.

The Mann-Whitney test was used to analyze differences between the groups, considering $p \leq 0,05$ as statistically significant.

Results

Individuals in the control group presented a mean age of $31 (\pm 7, 4)$ years old, mass of $80, 3 (\pm 12, 7)$ kilograms and height of $1, 77 (\pm 1, 6)$ meters. For the NMES group the

mean age was $34 (\pm 10, 4)$ years old, mass $75, 8 (\pm 15, 8)$ kilograms and height of $1, 73 (\pm 0, 06)$ meters.

Analysis of patellar height is in Figure 2. The ratio can vary from 0.6 to 1.2. The patella is considered low if the index is less than 0.6 and high if the index is above 1.2. There was no statistically significant difference ($p=0,14$).

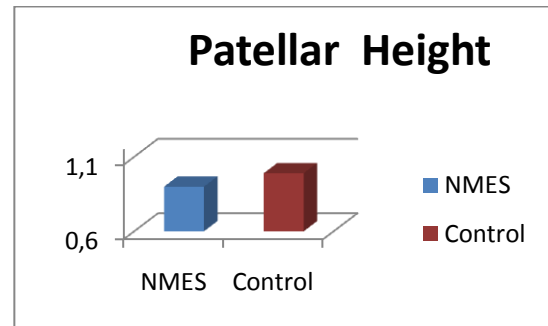


Figure 2. NMES (0,95) and Control (0,99)

Figure 3 comprehends the evaluation of the classification osteoarthritis Keelgren and Lawrence. There was no statistically significant difference between groups ($p=0,20$).

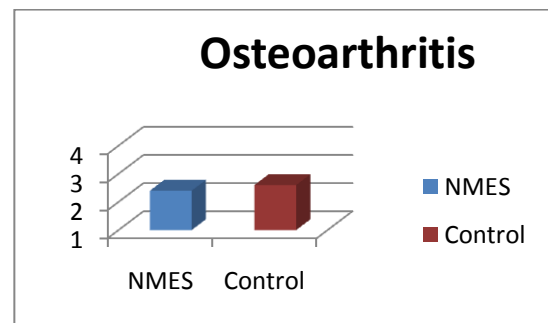


Figure 3. NMES (2,6) and Control (2,81)

The bone thinning was measured in a qualitative manner: mild, moderate and severe. It was observed in the control group 1 mild, 7 moderate and 3 severe and on the NMES group 1 mild, 8 moderate and 1 severe.

Discussion

It is observed a large loss of bone mass in spinal cord injured, both paraplegics and

tetraplegics subjects [6, 7]. Mechanisms that involve bone loss are not entirely clear but the loss of mechanical stress on bone is certainly a factor.

In the analysis of patellar height, classification of osteoarthritis and bone rarefaction, the patients showed no statistically significant difference. It was not found cases of (OH) due to several factors: first the joint most commonly affected are the hips, the NMES promotes reduction of OH and volunteers in the control group were young (31 years old) A study shows that several non-pharmacological treatments that can lead to increased osteogenesis, including the mechanical load that causes bone micro-deformations, stimulating osteoblastic cells and thus promoting changes in the bones, often related to a lower bone reabsorption and a increase of bone formation due to as the local pulsed ultrasound of low intensity, electrical stimulation and laser application [3].

We observed a large loss of bone mass, however, the x-ray is not the most frequently used test to observe this characteristic, it is important to perform bone densitometry.

Studies with MRI showed significant thinning of the cartilage of the knee in the absence of loading and mobilization of patients with spinal cord injury [8] and imbalance between bone reabsorption and formation in the group in question and formation in the group in question soon after the injury.

Despite the great loss of bone mass between the groups, it is known that the radiographic exam is not the most frequently used test to observe this characteristic, it is important to perform bone densitometry.

Conclusion

This study showed that structural changes in the knee of the injured spinal cord are not relevant.

The important factor is the bone mass loss that begins in the 2nd month of injury and did not differ due to the treatment performed (muscle strengthening, stretching,

hydrotherapy or NMES) after 1 year of injury.

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