

Locomotor training in tetraplegic patients: an orthopedic assessment upon its effects on the osteoarticular system

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Abstract

This study has been evaluating tetraplegic patients who have been walking for several months with the aid of a system that involves neuromuscular stimulation, treadmill and a harness support device[20-23]. Clinical and radiological evolution of two patients who have taken part in the training programme were assessed. Improvement on the severity of the heterotopic ossification has been noticed in both hip joints of the first patient. On the other patient, despite knee instability and an intense programme routine, no knee injury was observed, suggesting that the training programme is safe for this joint.

these patients mandatory in order to analyse positive effects and to promptly recognize suggestive signs of possible complications secondary to the treatment because of the presence of a number of potential risks of neuropathic arthropathy, such as microtraumata, articular instability and absence of nociception, proprioception and joint protecting reflexes. [7, 8, 14, 15]

Our objective is to study the impact of the gait on the SCI's complications in tetraplegic patients undergoing locomotor training, mainly heterotopic ossification, and the possible supervening complications, as well as correlating clinical and radiological findings of these patients.

1. INTRODUCTION

The classical passive rehabilitation protocol used below the level of the lesion in tetraplegic patients underwent several changes during the last decades because a “cure” for SCI commenced to be possible in a foreseeable future [1-4, 20-23] due to the increasing number of incomplete lesions, the rising life expectancy in SCI patients and the promising therapeutical modalities brought by the fast technological and medical development [3,10,11-13]. This change made necessary the development of therapeutical means to maintain the neuromuscular system conditioned below the level of the lesion, keeping it able to respond soundly to the challenge to be brought by the new interventions, namely the locomotor training of tetraplegic patients with harness support, treadmill apparatus and neuromuscular electrical stimulation (NMES). [4, 15-19]

Nonetheless, some concerns arise at the moment of the mobilization of such patients [2] making a careful orthopedic surveillance on

1.1. Our experience

The Biomechanics and Rehabilitation of the Locomotor System Laboratory of the University Hospital of Unicamp (State University of Campinas) practices a gait training programme with neuromuscular stimulation whose primary goal is the reversal of osteoporosis and neural bipedal gait facilitation. It consists on sessions in which the patients' trunk is stabilized by harness support [9], and then the steps are taken with the help of a device that alternately contracts both quadriceps muscle groups, followed by a withdraw reflex that is achieved through the electrical stimulation of the peroneal nerve. This kind of training programme lacks on studies that can measure its risks for the patients' joints, bones and muscles. Into the 21st century, it is to be expected that patients with incomplete or even complete spinal injuries might regain their once lost functions. Therefore, it is necessary to investigate the dangers in innovative rehabilitation programmes and try to protect the patients,

keeping their bodies intact until definitive therapies become available.

1.2. Objectives

This preliminary paper intends to (1) survey the tetraplegic patients undergoing locomotor training to study the impact of the gait on the SCI's complications, mainly heterotopic ossification, and the possible supervening complications inherent to the treatment, which would be the case of neuropathic arthropathy [5,6,8], (2) as well as correlating clinical and radiological findings of these patients.

2. METHODS

Two patients were investigated. The first one was searched for abnormal findings in the knee joint. The second one, in the hip joint.

Patient number one is 35 years old, was lesioned in 2002 at the level of C5, weighs 67kgf and is 1,81m tall. He was investigated with a traditional physical exam, magnetic resonance imaging and radiographs. The exams were taken in September 2004 and March 2005. The patient took part in the treadmill with harness support and NMES training programme since March 2004, two sessions a week, twenty minutes per session.

Patient number two is 39 years old, was lesioned in 1999 at the level of C6, weighs 73 kgf and is 1,78 m tall . He was investigated with a series of three radiographs spaced out by 7 months and then 14 months. This patient could not walk in the harness support system. However, he took regular sessions of quadriceps electrical stimulation, twice a week, 20 minutes per session, for 3 years.

3. RESULTS

Patient number one: 1st radiograph: heterotopic ossification in left hip, typically in the abductor muscle group and front-lateral and front-medial regions, grade III of Brooker. 2nd radiograph: improvement in the radiological aspect, with reduction in the volume of ossification. 3rd radiograph: the ossification changed from grade III to grade II of Brooker (figure 1).

Patient number two: this patient's knee remained free of injury despite its instability in the clinical exam. Magnetic resonance imaging has shown no evidence of joint degeneration, neither before nor after the training period (figure 2).

4. DISCUSSION AND CONCLUSIONS

At the present time, our research shows that the training programme is safe for the joints of tetraplegic patients. Furthermore, joint movement seems to be able to reverse the process of heterotopic ossification, making an almost immobile joint regain its functionality.

Individual case studies are usually insufficient to provide definite conclusions. That is why at this very moment data towards this research are being gathered on a group of fifteen patients. With more data and varied outcomes, it will probably be possible to obtain more consistent information on how the paralysed body reacts to physical exercise after some time in idleness. It is expected that these patients may only profit from similar programmes.

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Fig.1: Reversal of heterotopic ossification with the use of NMES as seen on Lauenstein's view of the left hip. 21 months apart.

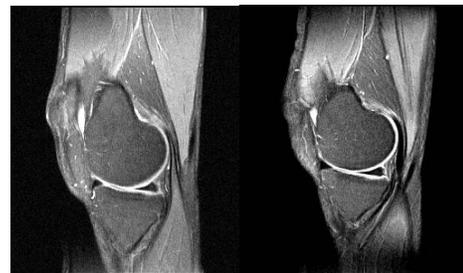


Fig. 2.: Preservation of knee architecture after harness support + NMES gait training, particularly medial meniscus, as seen on a MRI in a sagittal view. 6 months apart.

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