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Applied Research on Biomedicine: Linear Ergometer

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Abstract

This article reports a case of success in postgraduate teaching aimed at applied research in the field of biomedicine that resulted in the patent registration of the Linear Ergometer, a device aimed at the recovery, preservation and development of musculoskeletal structures of people in post-surgical recovery, injured or amputated patients, patients with neurological dysfunctions, as well as people with functional deficits. The Linear Ergometer comprises a linear device fixed to an adjustable tray on a shifter whose travel limiter is adjustable and fixed by a simple handle. In the travel limiter are fixed the elements that generate the necessary automatic movements for people that do not spontaneously produce them. The Linear Ergometer was registered with the National Institute of Industrial Property of Brazil under the patent number BR 1020160087503.

Keywords: Linear Ergometer; Applied Research; Biomedicine

Introduction

The Linear Ergometer is the result of the Rehabilitation and Inclusion project: epidemiology and treatment of pressure ulcers in paralympic modalities through the process of building a new product and in the patent registry with the National Institute of Industrial Property (INPI). This device aims to assist in the rehabilitation of people with spinal cord injury, allowing to minimize functional deficits due to pressure ulcer [1], especially in Paralympic athletes, providing independence and presentism in sports practice that results in social inclusion and improvement of quality of life.

The project arose from the observation of the difficulties of the wheelchair users to practice paralympic modalities, resulting in the development of this new product through a multidisciplinary process that involved competences of several areas of knowledge such as Engineering, Physical Education and Physical Therapy in order to provide greater independence for people with disabilities, specifically athletes with spinal cord injuries.

The paraplegias and the tetraplegias are due to functional impairments of spinal cord injuries and present different levels of impairment of mobility and sensitivity, as well as causing psychic disorders such as depression [2], whose symptoms are aggravated by pressure ulcers. In Brazil, the main causes of spinal cord injuries are traffic accidents, followed by gunshot wounds, in a total of approximately 130,000 spinal cord injuries, whose incidence has increased in young males [3].

Sports activities for individuals with spinal cord injury add benefits such as improved oxygen consumption, aerobic capacity gain, reduced risk of cardiovascular diseases, increased life expectancy, favored independence, improved self-esteem and reduced occurrence of psychological disorders. Pressure ulcer is a localized lesion of the skin and underlying tissue, usually on a bony prominence, resulting from the combination of pressure and shear caused by friction. Compression of these areas decreases blood flow facilitating the onset of injury by tissue ischemia and necrosis [4]. The etiology of pressure ulcer is multidimensional and the main factors are immobility and decreased sensory perception, which leads to excess pressure and ischemia, as well as causing tissue damage, causing numerous complications such as infections and worsening of the clinical status of people with restrictions in body mobility, as paralympic athletes with spinal cord injuries [5].

The risk factors involved in the causes of pressure ulcer can be classified as intrinsic and extrinsic [6]. The intrinsic factors that contribute to the development of pressure ulcers are immobility, reduced sensitivity, disease severity, level of consciousness,

previous history of pressure ulcer, vascular and terminal diseases, and malnutrition. External factors such as pressure, friction, shear and moisture of the skin resulting from sports or professional practice affect both the resistance conditions of the tissues under pressure and the related factors. The main parameters used to assess the risks of pressure ulcer development are physical condition, mental state, activity and mobility that are positively influenced by sports practice, as well as skin appearance, such as color, humidity, temperature and texture [7].

Pressure ulcers imply the temporary withdrawal of the athlete and make it difficult to perform their daily activities, impairing their quality of life and contributing to the emergence of depressive symptoms such as sadness, sleep and appetite disorders, fatigue and lack of concentration, as well as multiple physical complaints with no apparent cause that can result in their definitive departure from sports practice. Cyclo-ergometers are stationary devices that allow cyclical movements and are used to perform passive, active and resistive exercises, ie movements similar to those performed on bicycle pedals.

The problems of ergometers, especially linear ones, are focused on portability, hygiene, sterilization, stroke regulation, force performed, reactive force, frequency of movement and speed regulation and electric power supply that can cause electrocution when in contact with the user. The linear ergometer has the advantages of providing the development of passive, active or resistive exercises for patients with different levels of physical limitation including bedridden. Thus, the present invention is indicated for processes of recovery, preservation and development of musculoskeletal structures, since linear movement can be performed with the person in any position (standing, sitting or lying down) and with the ergometer in any position (Horizontal, vertical or with any inclination), according to the medical indications.

The linear ergometer has the advantage of providing safe movements that can be adjusted to the required parameters, preserving muscles, ligaments and bone structures. In case the movements are performed directly by the physiotherapist, there is a requirement of great repetitive physical effort to provide the improvement or recovery of the patient, which may cause work-related musculoskeletal disorders. Therefore, the linear ergometer stands out by providing automatic movements to people who can not perform them, but who require these movements for medical reasons.

Conclusion

The present invention relates to a device used for the recovery, preservation and development of the musculoskeletal structures of post-surgical patients, hospitalized or not, athletes or injured persons, amputees or partially amputees, neurological patients or persons with neurological dysfunctions, patients in the process of rehabilitation, with functional deficit due to the sarcopenia process, who require passive or active movements during a certain period of life or in a systematic way.

The ergometer is a stationary device that allows cyclical movements, being a device for measuring the work performed by a muscle or muscle group. This designation also includes devices that aid in the movement or recovery of sequelae or recovery movements, as well as a means of avoiding aggravation of chronic clinical situations. The linear ergometer comprises a linear device fixed to an adjustable tray, where a shifter is drawn by electromagnetic energy. The travel limiter is fixed via a handle. In the stroke limiter are fixed the elements that generated the automatic movements required when the linear ergometer is applied on people who can not generate spontaneous movements.

The directional element alternates the direction of displacement and is mounted to the adapter of the upper and lower limbs, having controls of strength, speed and number of cycles, allowing the patient to exercise properly. For more information on the linear ergometer, please consult the patent registry number BR 1020160087503 on the website of the National Institute of Industrial Property of Brazil [8].

References

1. Costa, Márcio Paulino (2005) Epidemiologia e tratamento das úlceras de pressão: experiência de 77 casos. Acta Ortopédica Brasileira 13(3).
2. Conceição, Maria Inês Gandolfo (2010) Avaliação da depressão em pacientes com lesão medular. Revista Brasileira de Terapia Comportamental e Cognitiva 12(1-2): 43-59.
3. Gonçalves, Aleksandra Mendes Teixeira (2007) Aspectos epidemiológicos da lesão medular traumática na área de referência do Hospital Estadual Mário Covas. Arquivos Médicos do ABC 32(2).
4. Sanglard DE Souza, Thaí (2010) Estudos clínicos sobre úlcera por pressão. Revista Brasileira de Enfermagem 63(3).
5. Cordeiro, Lívia Maria Cabral (2012) Fatores de Risco para o Desenvolvimentode Úlcera por Pressão em Pacientes na UTI, Salvador.
6. Sousa, Cristina Albuquerque de; SANTOS, Iraci dos; SILVA, Lolita Dopico da. Aplicando recomendações da Escala de Braden (2006) Ee prevenindo úlceras por pressão: evidências do cuidar em enfermagem. Revista Brasileira de Enfermagem 59(3).
7. Gomes, Flávia Sampaio Latini (2011) Avaliação de risco para úlcera por pressão em pacientes críticos. Revista da Escola de Enfermagem da USP 45(2): 313-318.
8. Instituto Nacional de Propriedade Industrial. Disponível em. Acesso em.