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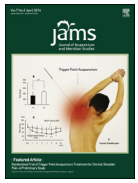

RESEARCH ARTICLE

Effects of Intermittent Traction Therapy in an Experimental Spinal Column Model

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Abstract
Traction therapy, which is known to be a treatment method for scoliosis, one of many muscles disease, has been used since Hippocrates introduced it. However, the effects of traction therapy are still not clear. In addition, the meridian sinew theory, which is related to muscle treatment and is mentioned in the book on meridian sinews in the Miraculous Pivot of Huangdi's Internal Classic, has not been the subject of much study. For these reasons, experimental spinal models were made for this study to observe and analyze the lengths of vertebral interspaces after intermittent traction therapy, which is known to be excellent among muscle treatment methods, with various tensile forces. The results showed that the effects of intermittent traction therapy were unclear and that it might be harmful, especially when the pain was induced by muscle weakness. Because the results of this study on intermittent traction therapy were different from those expected from osteopathy or craniosacral theory, better studies of the subject are necessary.

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1. Introduction

The meridian sinew theory was introduced to address the locations of meridian sinews, as well as the causes, mechanisms, and treatments of the diseases discussed in the chapter on meridian sinew in Miraculous Pivot, Huangdi's Internal Classic [1]. A meridian sinew, which was mentioned in meridian sinew theory, was not understood as a certain single muscle, but as the following: a muscle and its functions, as well as the relationships between the functions of the muscles and the symptoms of diseases [1]; as a single muscle including the ligaments and tendons that are connected to the bone and control the movement of the muscle, so that movement of the muscle sinew controls the action of the muscle [1,2]; as simply a single muscle or many muscles [3]; and as the system and organization of body muscles consisting of muscles, ligaments, tendons, fascia, etc. [1–4]. This understanding of the meridian sinew recognizes the importance of muscle function or movement for treatment in traditional Oriental medicine. Some recognition of the importance of muscles for the treatment of diseases was present in ancient European medicine, and traction therapy, which is thought to have been introduced by Hippocrates [circa 460–350 before common era (BC)], has been used to treat scoliosis [5].

Traction therapy aims to remove pain and to reduce pressure in nerve roots by increasing negative pressure in the spinal column using mechanical forces in the body to stretch muscles and to reduce the pressure caused in the spinal column by gravity [6]. Factors that are known to influence the effects of traction therapy are the traction force, traction time, traction angle, treatment time, posture of the patient during treatment, etc. [7]. Intermittent traction therapy (ITT) is a method in which the traction force and time are changed to make the therapy more effective [8]. Intermittent traction helps to relieve pain by improving the circulation to the tissues and by reducing the swelling of tissues. Gentle alternation of stretching and relaxation of the spinal column's soft tissue structures prevents the formation of adhesions of the dural sleeve [9].

The effects of traction therapy in treating diseases are unclear in many studies [10], but Clarke et al [11] asserted that this was because in clinical cases, the effects of traction were difficult to determine scientifically due to: (1) difficulties in setting up a control group; (2) difficulties in conducting blind tests with a mechanical traction stress; (3) different education levels of the patients; (4) different understandings of the mechanisms of diseases; and (5) different causes possibly having the same symptoms, as well as different symptoms possibly having the same cause. Therefore, this study was designed to determine the effects of traction therapy, especially ITT because it is expected to be more effective in treating diseases, in an experimental spinal model. The traction lengths were compared and analyzed with different traction forces. The results should be used as fundamental data to improve the traction methods and to develop the method for meridian sinew treatment.

2. Materials and methods

Each of the vertebrae was made of lumber with dimensions of 68 mm × 88 mm × 38 mm. The rubber bands (Hyupsin Co. Ltd., Kwangju, Korea) were used after testing under a tensile force of 250 g when pulling a distance of 15 cm. Four of the vertebrae and the rubber bands were used to make an articulated spine model with three spinal joints. The spinal ligament of the model was made by using 120-cm horizontal and vertical beams to prevent deflections in unwanted directions. The anchoring site and the tensioning site of the model were designated, and the joints were named the first, second, and third joints, depending on their distance from the anchoring site, with the first joint being nearest the anchoring site (Fig. 1).

The normal articulated spine model has two types. The first is normal type 1 (NT 1), in which the three spinal joints are equally relaxed (VB1–VB2–VB3–VB4; VB1–4 indicate the first–fourth vertebral bodies, respectively; – indicates one rubber band). The other is normal type 2 (NT 2), in which the three spinal joints were equally tensioned (VB1=VB2=VB3=VB4; = indicates two rubber bands). Because the forces on the spine are different, depending on the patient, Model 1 is used for patients whose spines are relaxed and who have no pain, and Model 2 is used for patients whose spines are tensioned. Model 1 used one rubber band for a relaxed condition, and Model 2 used two rubber bands for a tensioned condition. Based on the hypothesis that muscle shortening of a certain joint region causes scoliosis with pain, we set the second spinal joint of the abnormal type (AT) 1 model under tension by using two rubber bands (VB1–VB2=VB3–VB4) and the second spinal joint of the AT 2 model under relaxation by using one rubber band (VB1=VB2–VB3=VB4).

New rubber bands, which had the same tensile force, replaced the old rubber bands after completion of the NT 1, NT 2, AT 1, and AT 2 experiments. The tractions were completed three times by stretching for 2 minutes each with forces of 400 g (600 g) and 200 g (400 g). Note that the forces are given in terms of the masses used to exert the forces; thus, the force in SI units of Newtons is the product of the mass in kg and the acceleration due to gravity in m/s^2. The distances between vertebrae were measured by using burner calipers (Fuji, Japan; Fig. 2).

2.1. Statistical treatment

All experiments were repeated three times, and the data are presented as designated by means ± standard deviations. Origin 6.0 software was used for the statistical

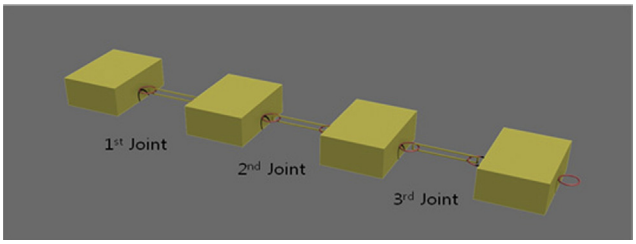

Figure 1 The multijoint model of the spinal column.