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ORIGINAL RESEARCH

Effect of sacroiliac manipulation on postural sway in quiet standing: a randomized controlled trial

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KEYWORDS
Postural sway;
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Abstract
Background: Sacroiliac joint manipulation can alter joint and muscle control mechanisms through local and remote effects. Postural balance is controlled by supraspinal (rambling) and spinal–peripheral (trembling) mechanisms. A manipulation may interfere with postural control in quiet standing.
Objectives: To evaluate the immediate effects of sacroiliac joint manipulation on postural control in patients with (1) sacroiliac dysfunction and (2) to determine whether rambling and trembling are affected by sacroiliac joint manipulation.
Methods: 32 patients aged between 20 and 50 years old were selected by convenience after confirmation of sacroiliac joint dysfunction by clinical examination. These patients were randomly allocated either to manipulation or sham manipulation group. Displacement, velocity and frequency of the center of pressure, rambling and trembling in the anterior–posterior and medial–lateral directions were our primary outcomes and analyzed immediately before and after the intervention in quiet standing. The physical therapists who performed the physical, biomechanical and statistical examinations, were all blinded to the patients' grouping.
Results: No differences were found between the two groups but trembling velocity (0.14 and −0.11 for intervention and sham group, respectively) and frequency (0.17 and 0.11 for intervention and sham group respectively) increased after intervention in the treatment group in the anterior–posterior direction.

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Conclusion: Generally, sacroiliac joint manipulation had no superiority than sham treatment regarding postural control as measured by rambling–trembling analysis of center of pressure. Manipulation may increase muscle activation in the treatment group due to increased trembling parameters.

Trial number: IRCT2014072715932N8 – http://www.irct.ir/searchresult.php?keyword=%D8%B3%D9%88%DB%8C%D9%87&id=15932&field=&number=8&prt=13&total=10&m=1.

Introduction

Sacroiliac (SI) joint dysfunction is considered one of the possible sources of chronic mechanical low back pain.[1] Stability of the SI joint is provided by the surrounding muscles, ligaments and the unique shape of the joint.[2] The SI joints play an important role in force transmission between the trunk and lower extremities, so any dysfunction in these joints may alter weight distribution at the feet.[3] Anker et al.[4] showed that greater weight-bearing asymmetry may lead to increased postural instability. Baruah et al.[5] showed that patients with SI joint dysfunction had deficits in balance and postural control. It has been reported that SI joint manipulation can decrease pain, redistribute peak pressure between the feet,[3] and improve disability[6] and gait symmetry[7] in patients with SI dysfunction.

The effects of SI manipulation have been proposed to be related to spinal and supraspinal mechanisms.[8] Research published to date, however, is controversial regarding the spinal mechanisms of SI manipulation. In some studies, SI manipulation increased muscle activity[9–11] whereas in others, it decreased alpha motor neuron activity[12] or had no effect at all.[13] Few studies have evaluated supraspinal and cortical mechanisms in spinal manipulation. Alterations in excitability and metabolism after spinal manipulation have been reported in corticospinal tracts, limbic, cerebellar and sensorimotor areas.[12,14,15]

In patients with low back pain, center of pressure (CoP) parameters have been used conventionally to evaluate postural control.[16,17] Rambling (Rm) and trembling (Tr) have been shown to be more sensitive parameters for analyzing postural control during quiet standing.[18,19] According to the main hypothesis of the rambling–trembling process, the higher spinal centers control the CoP at instant equilibrium points. The net effect of external torques acting on the body is equal to zero at these points, and the CoP coincides with the gravity line extending from the body's center of mass. Rambling component is composed of interpolation of these points. If the body loses the equilibrium state, restoring forces try to return it to an upright stance.[20] Trembling is therefore viewed as oscillation of the CoP around the equilibrium points, which can be calculated as the differences between CoP and rambling.[21,22] Therefore, any modulation in muscle responses or spinal reflexes may change trembling.

It has been claimed that rambling represents supraspinal processes whereas trembling reflects spinal reflexes and mechanical properties of the muscles and joints.[23,24] Research into rambling and trembling can distinguish different spinal and supraspinal mechanisms behind postural control,[25] as shown in a number of studies. Freitas et al.[26] evaluated the effect of joint immobilization on postural control, and found increased anterior–posterior (AP) and decreased medial–lateral (ML) trembling displacement and velocity in quiet standing with various lower extremity constraints. They proposed that body sway was controlled by two distinct neuromuscular mechanisms involving ankle and hip strategies.[26] Solnik et al.[27] evaluated postural sway in different pointing tasks and found that rambling and trembling components of postural sway involved different neurophysiological mechanisms. VanderHill et al.[28] evaluated the flexibility of the central nervous system in performing different dual task activities, and found that a suprapostural task altered velocities of rambling, trembling and CoP in both AP and ML directions. Rambling and trembling can also reveal adaptive changes in the sensory system over time. For example, whole body vibration has been found to change Rm-Tr paths of body sway in long-term evaluations.[18] Another study by Sarabon et al.[29] showed that aging had a strong effect on rambling parameters. These studies showed that the evaluation of postural control by studying rambling and trembling could shed light on new aspects of postural balance that conventional analysis of CoP was unable to detect.

Although research to date has evaluated different neurophysiological aspects of SI joint manipulation, there is no evidence to date of a definite effect of spinal manipulation on postural control by supraspinal and spinal mechanisms. The aim of this clinical trial was to evaluate the effect of SI joint manipulation on balance in patients with SI joint dysfunction. Based on previous studies, our first hypothesis was that SI joint manipulation would change balance parameters in quiet standing. Our second hypothesis was that SI joint manipulation would have a stronger effect on trembling than on rambling.

Methods

Participants

For this 2-arm double blinded randomized clinical trial, 78 male and female patients (age range: 20–50 years old) were initially recruited. The patients had lower back pain of 3 months' duration, and were recruited from rehabilitation

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