The Effect of Wobble Board Training on Postural Sway of Low Back Pain Patient

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ABSTRACT

Background and purpose: The purpose of this study is to investigate the effect of wobble board training on postural sway of low back pain patients. Can proprioception training reduce postural sway in low back pain patients? Subjects: 24 patients with low back pain between the ages of 38 and 50 (mean age 44.2) were recruited. This sample included 10 females (42%) and 14 males (58%). The patients allocated randomly into two groups; either control group (I) or experimental group (II). Both groups received the same program of treatment. A proprioceptive re-education program was added to the experimental group. Methods: equipment used for this study consisted of a balance performance monitor (BPM) (SMS Healthcare, Harlo, Essex, CM19 5TL) with two pressure sensitive footplates. Data collected onto a Toshiba T1900C lap top computer. A standing balance test was done for each subject using the dual force platforms, which were placed 138mm apart. This test took 30 seconds. Following this test the subjects started their treatment according to their group. By the end of the two weeks treatment time for each subject, the standing balance was retested. Results: A paired t-test revealed that before treatment, there was no significant difference between groups in all parameters. There was a significant decrease in postural lateral sway and right sway after treatment (P< 0.05). Left postural sway showed a great decrease in the experimental group but less statistically significant (P< 0.07). As regards to improvement, the control group showed no significant improvement in all parameters whereas the experimental group showed a significant improvement in all parameters (P< 0.05).

Key Words: low back pain, proprioception, wobble board training.

INTRODUCTION

Recently a close relation between various aspects of proprioception and back pain has been suggested. Patients with low-back pain may have persisted impairments in certain aspects of proprioception if not specifically included in the treatment program. It is also known that proprioception deficits have been associated with an increased incidence of low back injuries[5,9,10,16]. Multiple definitions of proprioception exist. Sherrington in 1906 first defined proprioception by describing visual and vestibular input as being important components, as stated by Swinkels[13]. Bardy and Warren[2] however, believed that visual input plays a larger role in braking and acceleration to avoid external objects or to modulate force within a physical activities rather than being an important component in proprioception. Proprioception, in effects, can

be defined as the awareness of body position and movement in space[5]. Or as a specialised variation of the sense of touch that encompasses the sensation of joint movement and position[1].

Basically proprioception is a complex system of nerve endings existing within different structures. It receive different information, and through an internal feedback system allows the brain to make decisions related to the execution of the appropriate movements according to the various information available to it[4,6]. Proprioception contributes to the precision of movement, the muscle reflex, and provides dynamic joint stability by contributing to the motor programming for neuromuscular control[3,8].
Proprioception training is aimed:

- To redevelop the quality after damage to the system, and
- To optimise the movement analysis and help in the reduction of injury.

Several neuro-anatomical studies have identified mechanoreceptors in the back and the spine. Yamashita et al.,[16] conducted their study on rabbits and found that facet joints contained two types of mechanosensitive afferent units. One type was suggested to be a proprioceptor and the other believed to act as a nociceptor[7]. Other neurophysiologic studies suggested a close relation between various aspects of proprioception and back pain. It is known that maintenance of equilibrium requires integration of proprioceptive information[11]. It is also known that proprioception deficits have been associated with an increased incidence of low back injuries[10].

Some researchers suggested that patients who have low-back pain may have persisted impairments in certain aspects of proprioception if it is not specifically addressed[5,12,16]. Nies and Sinnott[9] found that patients with low-back pain demonstrated significantly greater postural sway than normal subjects and were less likely to balance in challenging positions. Based on such information, they developed empiric programs on the basis that patients who have low-back pain experience an alteration in afferent feedback that may lead to poor control of posture and movement.

Parkhurst et al.,[10] suggests that, sense of position may not be the most sensitive measure of proprioception in the low back, based on the assumption that pain may provide a feedback stimulus that might actually enhance performance during tests. Thus, reliable methods for measuring other aspects of proprioception and impairment of the afferent system need to be identified.

Wobble board training, is frequently used by physiotherapists during rehabilitation of a vast spectrum of injuries and diseases which include ataxia, poilyneuropathy, some cases of hemiplegia, cervical problems. It is used as a weight bearing exercise to increase proprioception[13].

Few studies have investigated effects of the wobble board. Those studies that have been published on the use of the wobble board in rehabilitation have used very subjective parameters for their analysis such as the subject's perception of instability. In a study by Wester et al.,[14] volumetric measurements were the parameters used to assess reduction of haematoma and oedema after wobble board training. Subjects had sustained sprains of the lateral ligament complex in the ankle and the results showed no statistically significant differences between trained and no trained groups. No previous studies have investigated the transfer around the center of the base of support in quiet standing.

Management of the balance-related problems is very complex. The

physiotherapists' role in the rehabilitation programme is crucial. Proprioception training must be addressed early on in the treatment and achieving function and balance-specific control are paramount[7].

This study used patients with low back pain to see if wobble board training can decrease their postural sway. Can proprioception training reduce the postural sway in low back pain patients?

METHOD

Recruitment and induction

Twenty four patients with low back pain between the ages of 38 and 50 (mean age 44.2) were recruited. This sample included 10 females (42%) and 14 males (58%). Subjects were not included in the study if they had had any recent lower limb injuries or had suffered from any form of head injury (including concussion). None of the subjects had previously used a wobble board. The patients were allocated randomly into two groups; either group I (control) or group II (experimental). Both groups received the same program of treatment. A proprioceptive re-education program was added to the experimental group.

Control group I

12 patients of low back pain who were treated for 2 weeks with traditional treatment including:

- Interferential therapy.
- Ultrasound therapy Para-vertebral, pulsed.
- Abdominal and back exercise program.

Experimental group II

12 patients of low back pain who were treated for 2 weeks with the same way as the control group with a 5-minute proprioceptive re-education exercise using a wooden wobble board.

Equipment

The equipment used for this study consisted of a Balance Performance Monitor (BPM) (SMS Healthcare, Harlow, Essex, CM19 5TL) with two pressure sensitive footplates. Information taken from this was downloaded onto a Toshiba T1900C lap top computer.

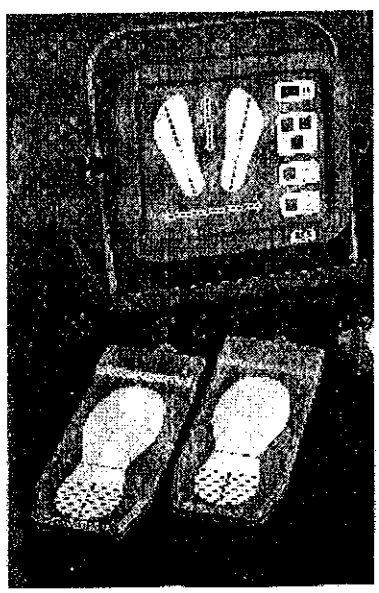

Fig. (1): The Balance Performance Monitor Equipment.

A wooden wobble board with a non-slip cork covering was also used. This was 55cm in diameter with a 13cm diameter ball that was 6.5cm high. Timing was carried out using a quartz timer.

Each subject gave informed consent before participating in the trial. The test was carried out without shoes or socks to avoid any influence of footwear.

Measurement procedure

The subject was first asked to perform a standing balance test using the dual force platforms, which were placed 138mm apart. This test took 30 seconds. Following this test the subjects started their treatment according to the group they were allocated in beforehand. By the end of a two week treatment time for each subject, the standing balance test was then repeated. Measurements taken by the BPM for each subjects were the standard deviations (SD) of the amount of body sway around the center point of the subjects balance (percentage of body weigh shifted to right, left, anterior or posterior) over a 30 second period with weight over both feet. During all three stages the subjects were asked to look ahead and on a point on the wall in front of them.

All the data collected by the BPM over 30 seconds. A figure was given for lateral sway between right and left and then separate figures were given for anterior/posterior sway for the right and left foot. To finally get the results, the pre and post treatment sway values were taken and the difference calculated between each. The final calculation was the mean of the value of differences.

Statistical Analysis:

The mean and standard deviations were calculated for all subjects in each group for each measuring parameter. The student T test was used to compare the value among the group before and after treatment. One-way ANOVA was used to compare the differences among the values between groups. $P<0.05$ was considered statistically significant.

RESULTS

I) Control group: As shown in table 1 and fig. 2, comparing the mean values for postural sway before and after treatment in the control group; there is a no significant increase in lateral sway, left sway and right sway ($P>0.05$).

Table (1): Mean values for postural sway before and after treatment in the control group.

Postural sway	Pretest	Posttest	t	p
Lateral sway	2.67±0.78	2.72±0.86	0.37	0.72
Left sway	2.45±0.84	2.57±1.02	0.42	0.68
Right sway	2.96±0.87	3.17±1.16	1.17	0.26

II) Experimental group:

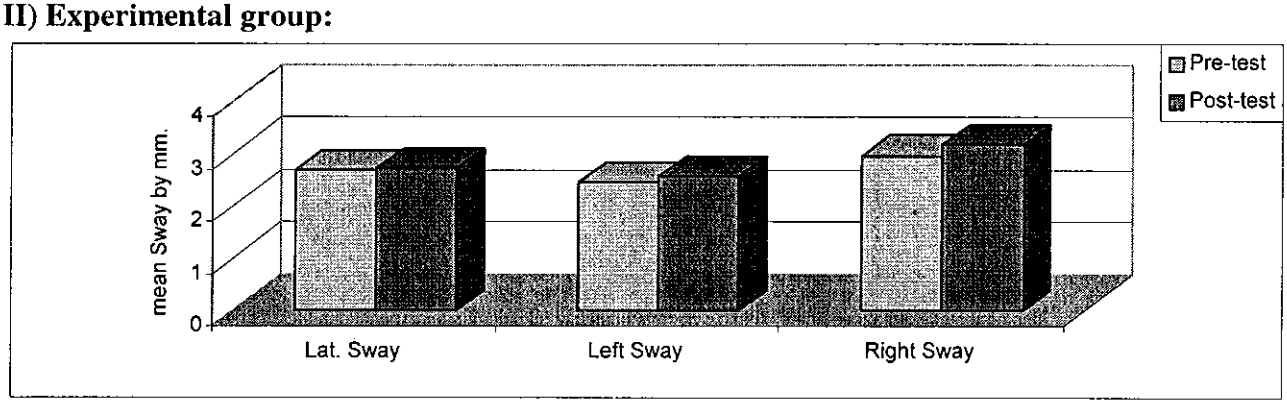

Fig. (2): Mean value for postural sway in the control group.

Table 2 and fig. 3, comparing the mean values for postural sway before and after treatment in the experimental group; there is a significant decrease in the lateral postural sway and right sway (P<0.05). Left postural sway showed also a great decrease in mean±S.D. (3.15±2.32) pretest vs. (1.88±0.61) posttest), but it was not statistically significant (P>0.05).

Table (2): Mean values for postural sway before and after treatment in the experimental group.

Postural sway	Pretest	Posttest	t	p
Lateral sway	2.55±0.73	1.55±0.71	3.75	0.003
Left sway	3.15±2.32	1.88±0.61	1.95	0.076
Right sway	3.01±1.09	1.28±0.82	3.73	0.003

II) Comparing between groups:

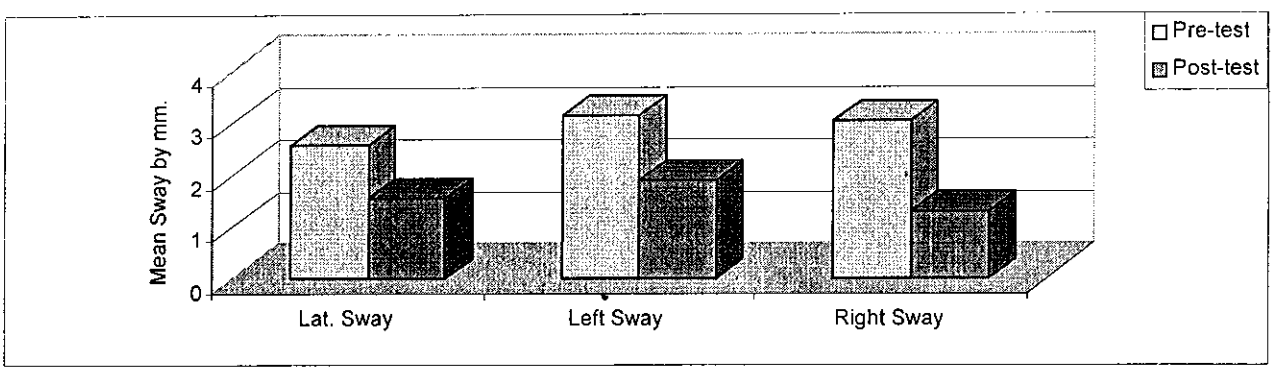

Fig. (3): Mean values for postural sway in experimental group.

Table 3 and fig. 4 showed the treatment group measures before and after treatment and compared the improvement between the control and the experimental groups. It was found that there was no significant difference between groups in all parameters before treatment, but there was a significant decrease in postural lateral sway and right sway after treatment (P<0.05). Left postural sway showed a great decrease in the experimental group but this was not statistically significant (P>0.05). As regard to improvement, the control group showed no improvement in all parameters whereas the experimental group showed a significant improvement in all parameters when compared with the control group (P<0.05).

Table (3): Comparison between groups.

Postural sway	Control group	Experimental group	t	p
1)Pretest				
Lateral sway	2.67±0.78	2.55±0.73	0.35	0.73
Left sway	2.45±0.84	3.15±2.32	0.99	0.34
Right sway	2.96±0.87	3.01±1.09	0.13	0.90
2)Posttest				
Lateral sway	2.72±0.86	1.55±071	3.7	0.004
Left sway	2.57±1.02	1.88±0.61	1.9	0.07
Right sway	3.17±1.16	1.82±0.82	2.9	0.01
3)Improvement				
Lateral sway	-0.04±0.39	1±0.92	4.39	0.001
Left sway	-0.12±0.96	1.28±2.25	2.17	0.05
Right sway	-0.21±0.61	1.19±1.11	4.78	0.001

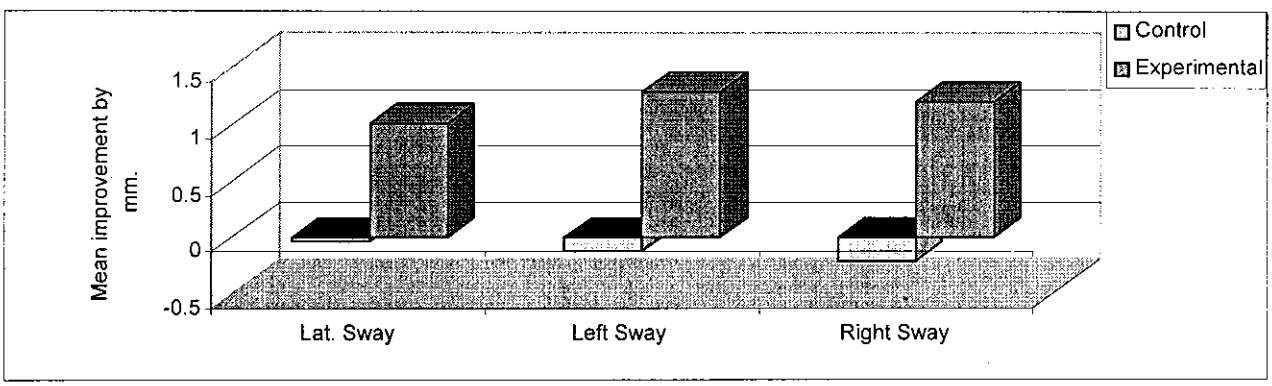

Fig.(3): Comparison between improvements in both groups.

DISCUSSION

The results indicate that postural sway in patients with low back pain is directly affected by wobble board training. A finding that supported the experimental hypothesis. The results contradict with those of Wester et al.,[14] who found no statistically significant differences in their results after comparing subjects with lateral ligament complex sprains in the ankle. Wester's[14] analyzed two groups of subjects completing a rehabilitation programme, while in this study only one of the groups used the wobble board. This design allowed the difference between the two groups more prominent and gave use the opportunity to see the effect of the wobble board training.

In agreement to the results of this study, in a review paper by Edward et al.,[5] stated that wobble board training enhances balance and joint proprioception following injury despite the fact that they cited no evidence to support this statement. While the results of this study supported by the degree of significance found statistically, but research on the use of the wobble board in rehabilitation remains inconclusive.

In support to our results Nies and Sinnott[9] found that patients with low-back pain demonstrated significantly greater postural sway than normal subjects and were less likely to balance in challenging positions. Based on such information, they developed empiric programs on the bases that patients who have low-back pain experience an alteration in afferent feedback that may lead to poor control of posture and movement. It was found that the use of wobble board training was more effective than their suggested program.

The results of this study showed that the proprioception re-education has a significant rule in treating patients with low back pain, despite it did not support Saal et al.,[12] suggestion that patients who have low-back pain experience an alteration in afferent feedback that may lead to poor control of posture and movement, as the study did not examine the relation between low back pain and the affection of proprioception. It seams that back pain affecting soft tissues of the back might inhibit the action of proprioception receptors and hindering it function, this affection reduces the since of poison and causes at least partially increase in the manifestation of pack pain.

CONCLUSION

In conclusion, wobble board training, as a method of proprioception re-education training, is an effective method for the treatment of patients with low-back pain if they demonstrated greater postural sway than normal. It can be recommended that the treatment of patients with low back pain should include proprioception re-education.

It is also concluded that further researches are needed in the effect of proprioception re-education training in different back problems as well as the contribution of proprioception affection on the back manifestation.

REFERENCES

1- Allegrucci, M., Whitney, S.L. and Lephart, S.M.: Shoulder kinesthesia in healthy unilateral athletes participating in upper extremity sports. J. Orthop. Sports Phys. Ther.21(4): 220-226, 1995.

2- Bardy, B.G. and Warren, W.H.: Visual control of braking in goal-directed action and sport. J. of Sports Sciences, 15: 607-620, 1997.

3- Beard, D.J., Dodd, C.A.F., Trundle, H.R. and Simpson, A.H.R.W.: Proprioception enhancement for anterior cruciate ligament deficiency. J.B.J.S. 4: 654-658, 1994.

4- Bullock-Saxton, J.E., Janda, V. and Bullock, M.I.: Reflex activation of gluteal muscles in walking: an approach to restoration of muscle function for patients with low-back pain. Spine, 18(6): 704-708, 1993.

5- Edward, R., Laskowski, M.D., Karen Newcomer-Aney, M.D. and Jay Smith, M.D.: Refining rehabilitation with proprioception training: Expediting return to play. The Physician and Sportsmedicine. 25(10): 282-293, 1997.

6- Hoffman, M. and Payne, V.G.: The effects of proprioceptive ankle disk training on healthy subjects. J. Orthop. Sports Phys. Ther.21(2): 90-93, 1995.

7- Lephart, S.M., Pincivero, D.M., Giraldo, J.L. and Fu, F.H.: The role of proprioception in the management and rehabilitation of athletic injuries. Am. J. Sports Med. 1: 130-137, 1997.

8- MacDonald, P.B., Hedden, D. and Pacin, O.: Proprioception in anterior cruciate ligament-deficient and reconstructed knees. Am. J. Sports Med. 24(6): 774-778, 1996.

9- Nies, N. and Sinnott, P.L.: Variations in balance and body sway in middle-aged adults: subjects with healthy backs compared with subjects with low-back dysfunction. Spine, 16(3): 325-330, 1991.

10- Parkhurst, T.M. and Burnett, C.N.: Injury and proprioception in the lower back. J. Orthop. Sports Phys. Ther. 19(5): 282-295, 1994.
11- Perrin, P.P., Bene, M.C., Perrin, C.A. and Durupt, D.: Ankle trauma significantly impairs posture control- a study in basketball players and controls. Int. J. Sports Med. 18: 387-392, 1997.
12- Saal, J.A. and Saal, J.S.: Initial stage management of lumbar spine problems. Phys. Med. Rehabil. Clin. North Am. 2: 187-203, 1991.
13- Swinkels, A., Ward, C.D. and Bagust, J.: Bed-rest and plaster of paris leg cylinders-do they alter knee joint proprioception? Physiotherapy, 10: 626-631, 1995.
14- Wester, J.U., Jesperson, S.M., Nielson, K.D. and Neumann, L.: Wobble board training after partial sprains of the lateral ligaments of the ankle: A prospective randomised study. J.O.S.P.T. 5: 332-336, 1996.
15- Wyke, B.: Articular neurology: a review. Physiotherapy, 58(3): 94-99, 1972.
16- Yamashita, T., Cavanaugh, J.M. and El-Bohy, A.A.: Mechanosensitive afferent units in the lumbar facet joint. J. Bone Joint Surg. (Am). 72(6): 865-870, 1990.

الملخص العربي

تأثير التدريب على لوحة الاتزان على تأرجح القوام عند مرضى آلام أسفل الظهر

الهدف من الدراسة: أجريت هذه الدراسة لبحث تأثير لوحة الاتزان ضمن برنامج العلاج الطبيعي لمرضى آلام أسفل الظهر و مدى كيفية الاستفادة منه في إنقاص تأرجح القوام.
أفراد العينة: ٢٤ مريضاً بآلام في أسفل الظهر يتراوح أعمارهم بين ٣٨ و ٥٠ سنة، متوسط العمر ٤٤,٢ سنة. تتكون العينة من ١٠ سيدات و ١٤ رجل و قد قسموا إلى مجموعتين:
المجموعة الأولى: و تشمل ١٢ مريضاً بآلام أسفل الظهر و قد تم علاجهم بالوسائل التقليدية للعلاج الطبيعي لمدة أسبوعين في صورة موجات فوق صوتية و تيارات متداخلة و تمرينات علاجية .
المجموعة الثانية (التجريبية): و تشمل ١٢ مريضاً بآلام أسفل الظهر وقد تم علاجهم بالوسائل التقليدية للعلاج الطبيعي لمدة أسبوعين كما هو الحال في المجموعة الأولى مضافاً إليه التدريب على لوحة الاتزان لمدة خمس دقائق ضمن برنامج العلاج الطبيعي.
الطرق و الوسائل: تم استخدام جهاز لقياس التوازن عن طريق وحدة قياس لحساسية التوازن تحت القدمين قبل وبعد أسبوعين من العلاج. تم عمل الجلسات للمجموعتين لمدة أسبوعين مضافاً إليها تمارين التوازن في المجموعة الثانية (التجريبية).
النتائج: بعد نهاية أسبوعين من العلاج لكلتا المجموعتين، أسفرت النتائج إحصائياً عن الآتي : عدم وجود أي فروق إحصائية بين أفراد العينة لكل المقاييس في المجموعتين قبل بدء العلاج ، أما بعد العلاج فقد كان هناك نقصان ذو دلالة إحصائية في معدل التأرجح الجانبي للقوام و كذلك التأرجح جهة اليمين لصالح المجموعة الثانية (التجريبية) مما يدل على تحسن التوازن في هذه المجموعة عنه في المجموعة الأولى (الضابطة). كذلك أسفرت النتائج عن نقصان في التأرجح جهة اليسار لصالح المجموعة الثانية و لكنه ليس ذو دلالة إحصائية. أما المجموعة الأولى فلم تشر النتائج إلى وجود أي تحسن في التوازن بعد العلاج عنه قبل العلاج.
المضمون: مما سبق يستدل على أن آلام أسفل الظهر تحدث خللاً في التوازن لدى المرضى ، لذا يوصى بإدراج تمرينات التوازن ضمن برنامج العلاج الطبيعي لمرضى آلام أسفل الظهر .