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ABDOMINAL DRAWING IN MANEUVER: EFFECT ON GAIT PARAMETERS AND PAIN REDUCTION IN PATIENTS WITH CHRONIC LOW BACK PAIN

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ABSTRACT

Background: Back pain is the common musculoskeletal condition with a high prevalence of up to 80% among the general and work force population at some times in their lives. Muscular injury, fatigue, or facet or disc degeneration can compromise the stabilizing effects resulting in shearing forces that cause pain. Abdominal drawing in maneuver is used to facilitate the re-education of neuromuscular control mechanisms provided by local stabilizing muscles. Objective of the study is to measure the gait parameters and pain control before and after abdominal drawing in maneuver in patient with chronic mechanical low back pain.

Methods: Total number of 30 consecutive patients and they were divided into two groups by purposive sampling. Group A is subjects with low back pain and Group B is subjects without low back pain. Outcome measures were average step cycle, average step length, coefficient of variation, time on each foot, Ambulation index measured with Biodex gait trainer. Pain is measured with Revised-Oswestry low back pain questionnaire.

Results: Significant difference between gait parameters were observed in both low back pain group and the group without low back pain group with abdominal drawing in maneuver and the changes without abdominal drawing in maneuver was minimal. There was no significant difference found between both groups with or without abdominal drawing in maneuver.

Conclusion: Gait parameters and Pain control can be improved by training with abdominal drawing in maneuver thereby it reduces pain and improves gait symmetry in subjects with low back pain.

Keywords: Low back pain, Abdominal drawing in maneuver, Gait parameters, Biodex gait trainer 2, Transverse Abdominis.

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INTRODUCTION

Backpain is the common musculoskeletal condition with a high prevalence of up to 80% among the general and work force population at some times in their lives. A common general classification in clinical settings is mechanical back pain, which includes patients without an identifiable patho-anatomic cause [1]. The operational definition of mechanical back pain most frequently requires that the pain be exacerbated by motion.² Chronic low back pain is defined as pain which persisting for at least 12 weeks. Mechanical low back pain is mainly due to deconditioned low back musculature and weak core stabilizers. People with back pain have reduced endurance of their lumbar stabilizing muscles and also slower reaction time in activating the muscles along with impaired thorax-pelvis co-ordination which may undermine functional walking compared to healthy individuals [2].

Walkers with back pain may adopt a strategy whereby they modify their pattern of muscular activity in an attempt to reduce the sensation of pain, thus they exhibiting abnormal gait pattern, characterized by shorter stride length, greater step width. Thus they adopt a 'protective guarding' or 'splinting' strategy by restricting movements of the spine and also they exhibit poorer motor control, and suffer from reduced proprioception, which limits their ability to adapt their gait pattern to changing circumstances. As a result, the walkers compensate for their poorer motor control by deliberately adopting a slower and less flexible gait [3].

The abdominal drawing-in maneuver has been described as the best way to activate the Transverse abdominis and is often a fundamental exercise in a traditional stabilization program for Low back pain [4]. The Abdominal drawing in maneuver is an inward movement of the lower abdominal wall in which the patient is instructed to draw the umbilicus toward the spine while maintaining a normal lumbar lordotic curve along with relaxation of the more superficial musculature. It was found to be associated with an unconscious co-contraction of the lower lumbar multifidi. This co-contraction of the Transverse abdominis and the Multifidi increased stability of the lumbar spine. The abdominal drawing in maneuver is often used to facilitate the re-education of neuromuscular control mechanisms provided by the local stabilizing muscles [5]. The transverse abdominis muscle is an important unconscious motor activity to provide a stabilizing force which increases intra-abdominal pressure and, through its insertion into the thoracolumbar fascia, resulted in increased stiffness of the lumbar spine [6]. This training of the transverse abdominis has been shown to improve pain and the lower extremity function in patients with chronic low back pain by improving stability of the spine [8]. Aim of the study is to know the effect of abdominal drawing in maneuver on gait parameters and pain reduction in patients with chronic low back pain.

METHODOLOGY

Thirty patients were collected from departments of Physical medicine and Rehabilitation at Al Ahsa Hospital, a ter-

tiary referral hospital in eastern area of Saudi Arabia, from January 2015 to January 2016. All patients were clinically suspected to have Mechanical low back pain. Study design is pretest and posttest experimental design with purposive sampling with 15 subjects in a group with chronic low back pain (Group A) and total of 15 subjects without low back pain (Group B). The subjects with low back pain more than 12 weeks, revised Oswestry low back pain questionnaire >20% and basing on clinical prediction rule with minimum of 3 components were included in the study. Subjects with surgery to the spine and lower extremities, unstable cardiac or pulmonary problems and neuromuscular diseases were excluded from the study. Group B subjects collected from those who are coming for routine check-up at Physiatrist clinics. Complete medical history, clinical examination, and routine examinations were performed to all controls.

The study was approved from hospital ethical committee and a written informed consent was taken from all individuals agreed to contribute in the study with full information about the study and procedures may request to do.

PROCEDURE

Low back pain patients who met the inclusion criteria are selected for group-A and the same number of subjects with same age group without low back pain is selected for group-B. For all the patients two base line measurements of gait parameters with and without abdominal drawing in maneuver are assessed with the help of Biodex gait trainer. Auditory biofeedback device is used to maintain the abdominal drawing in maneuver while measuring the abdominal drawing in maneuver procedure. The base line pain measurements for Group A subjects are ascertained by administering the Revised Oswestry low back pain questionnaire. After documenting the base line measurements of all the subjects, the abdominal drawing in maneuver is demonstrated as the subjects are asked to lie in the supine crook-lying position on the treatment table with their knees bent to 90°, feet flat on the table, and arms besides the trunk. The participants were then instructed to perform an abdominal drawing in, then push through the heels to lift their hips into the air while maintaining straight alignment of the knees, hips, and shoulders and maintain this for 10 seconds and then to lower their hips back. Further instructed them to continue this for 10 times. Subjects performed this exercise for 10 times 3 sets per day for four weeks.

After four weeks the post test measurements were taken. The parameters assessed were average step cycle (cycles/sec), average step length (cm), co-efficient of variance (%), Time on each foot (%), and ambulation index (%). For evaluation of the gait parameters, each patient was asked to walk over the gait trainer without visual feedback. The treadbelt will run at a speed of 2 kilometers / hour. Once the patient was comfortable the data recording was started. Each patient was allowed to walk continuously for three minutes then the evaluation session was finished and the tread belt slowed gradually until it stopped. The results

then can be displayed on the display. The post test pain percentage levels are assessed using Revised Oswestry low back pain questionnaire.



Figure 1: Gait assessment-with abdominal drawing maneuver statistical analysis

This study was done to evaluate the effect of abdominal drawing in maneuver on gait parameters in subjects with and without low back pain and also to evaluate the percentage of pain reduction in patients with chronic low back ache. In this study statistics is used to compare group A and group B by means of independent “t” test and paired “t” test. Data were collected and tabulated using Microsoft excel version 7(Microsoft Cooperation. NY, USA) and analyzed using SPSS for windows (Statistical Package for the Social Science, version II, SPSS, Inc., Chicago, IL, USA).

RESULTS

Within group comparison of results in group A:

The analysis of pretest and posttest values of pain and gait parameters with abdominal drawing in maneuver in back pain group (group A) reveled significant change in pain, step length on both sides, time on each foot on both sides and ambulation index. There was no significant change found in step cycle and coefficient of variance on both sides (table: 1).

The analysis of pretest and posttest values of pain and gait parameters without abdominal drawing in maneuver in back pain group (group A) reveled significant change in pain, step length on both sides, time on each foot on both sides and ambulation index. There was no significant change found in step cycle and coefficient of variance on both sides (table: 2).

Within group comparison of results in group B:

The analysis of pretest and posttest values of pain and gait parameters with abdominal drawing in maneuver in no-back pain group (group B) reveled significant change in pain, step length on both sides, time on each foot on both sides, coefficient of variance on both sides and ambulation index. There was no significant change found in step cycle (table: 3).

The analysis of pretest and posttest values of pain and gait parameters without abdominal drawing in maneuver in no-back pain group (group B) reveled significant change in pain, step length on left sides, time on each foot on

both sides and ambulation index. There was no significant change found in step cycle, step length on right sides and coefficient of variance on both sides (table: 4).

Between group comparison of results:

The analysis of results between back pain group and no-back pain group found no significant difference between all the parameters with or without abdominal drawing in maneuver.

Group	Parameters In percentage	Pre-test Mean values	Post-test Mean values	Paired - 't' value	Table - 't' value
Group - A	Coefficient of variance (left)	14.8933	11.2667	2.696	2.145
Group - A	Coefficient of variance (right)	11.0867	9.6933	1.392	
Group - A	Time on each foot (left)	46.3267	49.4667	3.500	
Group - A	Time on each foot (right)	49.3600	51.2000	2.161	
Group - A	Ambulation index	87.8267	90.3067	3.223	

Table 1: Result of Low Back Pain Group (Group-A) with Abdominal Drawing in Maneuver

Group	Parameters in percentage	Pre-test Mean values	Post-test Mean values	Paired - 't' value	Table - 't' value
Group -A	Coefficient of variance (left)	12.7200	12.7467	0.022	2.145
Group -A	Coefficient of variance (right)	10.6667	9.7600	0.822	
Group -A	Time on each foot (left)	46.5333	48.3667	2.674	
Group -A	Time on each foot (right)	52.7400	49.9867	2.206	
Group -A	Ambulation index	86.8400	88.9867	2.529	

Table 2: Result of Low Back Pain Group (Group-A) With Abdominal Drawing in Maneuver

Group	Parameters in Percentage	Pre-test Mean values	Post-test Mean values	Paired - 't' value	Table - 't' value
Group - B	Coefficient of variance (left)	13.6733	9.7267	4.732	2.145
Group - B	Coefficient of variance (right)	11.0667	8.6100	2.429	
Group - B	Time on each foot (left)	43.3200	48.6867	3.867	
Group - B	Time on each foot (right)	49.6933	50.6000	2.509	
Group - B	Ambulation index	88.9820	91.7133	3.562	

Table 3: Result of Control Group (Group-B) with Abdominal Drawing in Maneuver

Group	Parameters in Percentage	Pre-test Mean value	Post-test Mean value	Paired - 't' value	Table - 't' value
Group-B	Coefficient of variance (left)	11.7200	11.4807	0.283	2.145
Group-B	Coefficient of variance (right)	9.5800	8.7267	1.283	
Group-B	Time on each foot (left)	47.7600	49.0933	3.533	
Group-B	Time on each foot (right)	51.9813	50.5267	3.198	
Group-B	Ambulation index	87.2480	89.1200	2.672	

Table 4: Result of Control Group (Group-B) without Abdominal Drawing in Maneuver

DISCUSSION

Core Stability is the optimal status of lumbar motion segments, which is maintained by the unique interplay between the segments. The stable core would accelerate the lower segments of the body in a more symmetrical pattern, thereby minimizing the energy expenditure and maintaining the proper balance and co-ordinated activity of lower limb. The transverse abdominis muscle acts as a stabilizer of low back and it is one of the global core stabilizing muscles of the lumbar spine. A weak transverse abdominis muscle is often indicated in low back pain and shows an increased alteration in these systems and results in asymmetrical gait patterns.

Hodges et al., 1999 oposed that the transverse abdominis contracts prior to the limb movement in healthy individuals, while the pre-activation of the transverse abdominis is poor in those with low back pain. The active Abdominal drawing in maneuver prepare the core for the further activity of the spine and lower limb movement. Further the activity would bring the pelvic into neutral positions which fetch the length-tension relationship of the pelvic girdle muscles, which would facilitate the optimal strength and co-ordinated activity of the muscles, which might cause symmetry of the gait parameters. The study state of the core muscle reduces the shear movements in the spine (i.e) facet joints might reduce the pain caused by the segmental instability. The facilitated segmental stability by the active abdominal drawing in maneuver is a very effective strategy to reduce the mechanical low back pain and also improves the symmetry of the gait [2,7].

The primary findings in this study was that the abdominal drawing in maneuver had significantly improved the gait parameters from pre-intervention to the post-intervention when compared with the low back pain group and the control groups. This study shows that the abdominal drawing in maneuver had significantly reduced the pain from pre-intervention to the post-intervention in the low back pain group. Peter O' Sullivan et al., 1998 says that the abdominal drawing in maneuver activates specifically the deep abdominal muscles like transverse abdominis and also with minimal activation of the rectus abdominis muscle. This study found that there is a significant reduction

in Pain because the Abdominal drawing in maneuver activates the transverse abdominis and it produces an unconscious motor activity to provide a stabilizing force which increased intra-abdominal pressure and, through its inserting into the thoracolumbar fascia, resulted in increased stiffness of the lumbar spine [13]. In addition, voluntary transverse abdominis contraction, while maintaining a normal lumbar lordotic curve or neutral spine was found to be associated with an unconscious co-contraction of the lower lumbar multifidi. This co-contraction of the transverse abdominis and the multifidus increased stability of the lumbar spine, decreases the low back pain and reduce the risk of subsequent low back injury [9,10].

Seung-Chul Chon et al., 2010 says that the use of the Abdominal drawing in maneuver, in particular, is far more effective than the use of general core stabilization techniques in improving the Transverse abdominis muscle activation. Thus, core stabilization techniques that incorporate the selective motor recruitment of the central core stabilizer, such as the Transverse abdominis muscle activation is activation are necessary for effective management of low back pain[12].

Susan A. Saliba et al., 2010 says that the transverse abdominis muscle stabilize the spine during movements that involve the arms and legs and the weak abdominal muscles tilts the pelvis forward and increases the lordosis in the spine [14]. John D. willson et al., 2005 says the chronic low back pain patients lower level of gait performance and altered and altered physical activity which is mainly due to the abdominal and back muscle weakness, and also due to the pain-avoidance behavior. The Gait variables measured in this study were, step length, step cycle, co-efficient of variance, time on each foot and the Ambulation index [8].

Step Length is the distance of one foot moves in front of the other (i.e) the heel strike of one extremity to the heel strike of the opposite extremity. The comparison of the right and left step length determines the gait symmetry. The variability in step Length is at a minimum with patient preferred walking speed. Step Cycle is the sum of movements made during locomotion by a limb from the time it leaves the ground until it leaves the ground on next occasion. Co-efficient of variance indicates the amount of variation between footfalls. The higher the coefficient of variance, the poorer the reproduction of a consistent foot all pattern. Thus reduction in the variation between step lengths helps to provide a biomechanically efficient gait pattern. Time distribution on each foot is mainly based on the pain during the movement and the poor muscular strength due to the immobility of the spine. Ambulation index is a composite score relative to 100 and is based on foot-to-foot time distribution and average step cycle. The goal is to achieve 100 and it is calculated using the following equation:

David Newell et al., 2010 studied the influence of gait parameters on low back pain and control subjects and low back pain patients has a smaller step length, slower walking velocity when compared to control subjects. Thus low back pain patients represent asymmetry of gait [11]. This

study shows that there is a significant improvement in all the step length, time on each foot, step cycle, co-efficient of variance and the ambulation index. As all these parameters are interconnected during abdominal drawing in maneuver it activates the transverse abdominis and by stimulating the multifidus it maintains the normal lordotic curve or the neutral spine, thereby it reduces the low back pain. The reduction in pain reduces the immobility and improves the individual's performance level. When the muscular performance is improved, it influences on the gait cycles. When the step length is increased, the number of movements taken place in a particular time interval is reduced (step cycle) and thereby the time taken on each foot is increased to maintain the symmetry, which in turn reduces the energy expenditure and improve core stability with better ambulation of participants in the study.

CONCLUSION

This study concludes that there is a statistically significant symmetry of gait in the mechanical low back pain patients and control group who performed abdominal drawing maneuver. Therefore, it is recommended that abdominal drawing in maneuver exercises can be included in the regular conventional practice to improve the gait performance, reduce the pain and to reduce the risk of subsequent low back injury.

REFERENCES

- [1] Fritz, J.M., Cleland, J.A. & Childs, J.D. Subgrouping patients with low back pain: evolution of a classification approach to physical therapy. *J Ortho Sports Phys Ther*, 2007, 37(6): 290-302.
- [2] Robert H. Gringmuth, Chris Jackson Therapeutic exercise for Spinal Segmental Stabilization in Low Back Pain: Scientific Basis and Clinical Approach. *J Can Chiropr Assoc*. 2000 Jun; 44(2): 125.
- [3] McGill, S. *Low Back Disorders: Evidence-Based Prevention and Rehabilitation*. Champaign, IL: Human Kinetics, 2002.74-110.
- [4] Deydre S. Teyhen, Chad E. Miltenberger, Henry M. Deiters, Yadira M. Del Toro, Jennifer N. Pulliam, John D. Childs, Robert E. Boyles, Timothy W. Flynn. The Use of Ultrasound Imaging of the Abdominal Drawing-in Maneuver in Subjects With Low Back Pain. *J Orthop Sports Phys Ther*. 2005 Jun;35(6):346-55.
- [5] L. Vogt, K. Pfeifer, W. Banzer. Neuromuscular control of walking with chronic low-back pain. *Man Ther*. 2003 Feb;8(1):21-8.
- [6] Malik Slosberg. Core Stabilization Strategies: Abdominal Hollowing vs. Bracing. *Dynamic Chiropractic*. 2009; 27(21):1-5.
- [7] P. W. Hodges. Is there a role for transversus abdominis in lumbo-pelvic stability? *Man Ther*. 1999 May;4(2):74-86.
- [8] John D. Willson, Christopher P. Dougherty, Mary Lloyd Ireland, and Irene McClay Davis. Core Stability and Its Relationship to Lower Extremity Function and Injury. *J Am Acad Orthop Surg*. 2005;13(5):316-325.
- [9] Hodges, P.W., Richardson, C.A. Inefficient muscular stabilization of the lumbar spine associated with low back pain. A motor control evaluation of transversus abdominis. *Spine*. 1996;21:2640-2650.
- [10] Peter J Beek. Effects of attention on the control of locomotion in individuals with chronic low back pain. *J Neuroeng Rehabil*. 2008 Apr 25;5:13.
- [11] David Newell, mariska van der laan. Measures of complexity during walking in chronic non-specific low back pain patients. 2010;13(1):8-14
- [12] Seung-Chul Chona, Ki-Yeon Changa, Joshua (Sung) H. You. Effect of the abdominal draw-in manoeuvre in combination with ankle dorsiflexion in strengthening the transverse abdominal muscle in healthy young adults: A preliminary, randomised, controlled study. *Physiotherapy*. 2010; 96(2):130-136.
- [13] Peter B. O'Sullivan, Dip Physio, Grad Dip Manip Physio' Lance Twomey, Garry T. Allison. Altered Abdominal Muscle Recruitment in Patients With Chronic Back Pain Following a - Specific Exercise intervention. *J Orthop Sports Phys Ther*. 1998 Feb;27(2):114-24.
- [14] Susan A. Saliba, Ted Croy, Rebecca Guthrie, Dustin Grooms, Arthur Weltman, Terry L. Grindstaff. Differences in transverse abdominis activation with stable and unstable bridging exercises in individuals with low back pain. *N Am J Sports Phys Ther*. 2010 Jun; 5(2): 63-73.

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