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RESEARCH ARTICLE

EFFECT OF SEGMENTAL CONTROL TRAINING ON LUMBOPELVIC SAGITTAL ALIGNMENT IN ASYMPTOMATIC SUBJECTS

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ABSTRACT

Background: Core stability training has become a popular fitness practice that is already being used in rehabilitation and sports medicine programs. Core stability training is the basic and fundamental component of many comprehensive functional rehabilitation programs. In the late 1990s, core stability training was created based upon findings from large number of studies which demonstrated the significance of trunk control in neuromuscular reorganization in managing back pain. Core stability training programs are designed to help an individual to gain functional strength, neuromuscular control and the endurance of core muscles. Although most previous studies about core stability training were conducted to evaluate pain and function and only a few studies are considering pelvic parameters changes. **Aim of the study:** The purpose of the study was to investigate lumbopelvic sagittal alignment in asymptomatic subjects after the segmental lumbopelvic training exercises. **Subjects and Methods:** 13 asymptomatic subjects (8 males and 5 females) aged 20-30 years and body mass index ranged from 18.5-25 kg/cm^2 were recruited for this experimental study. The pelvic parameters examined in this study were lumber lordosis angle (LL) and pelvic tilt angle (PT), pelvic incidence angle (PI) and sacral slope (SS) measured by X-ray imaging radiography from sagittal. T-test was used to detect differences in the mean values of pelvic parameters before and after exercise training. **Results:** T-test Statistical analysis was used to detect differences in in mean value of lumber lordosis angle, pelvic tilt angle, pelvic incidence angle and sacral slope angle before and after segmental lumpopelvic training exercise. There were no significant differences between lumber lordosis angle ($t = -1.12$, $p = 0.13$), pelvic tilt angle ($t= -1.16$, $p = 0.12$), pelvic incidence angle ($t = -0.33$, $p = 0.37$) and sacral slope angle ($t = 0.22$, $p = 0.41$) before and after segmental lumpopelvic training exercise. **Conclusion:** there was no significance difference in the mean value of pelvic parameters before and after segmental lumbopelvic exercise training.

INTRODUCTION

Low back pain is a prevalent ailment that limits movement and daily activities, and the decline in physical activity has exacerbated low back pain (Fritz *et al*., 2008). Despite the great number of pathological disorders that can cause back pain, nonspecific low back pain affects 85 percent of LBP patients treated in primary care and the vast majority of LBP patients seen by physical therapists (Wand, 2008). A common cause of nonspecific low back pain is instability of the lumbar spine (Demoulin, 2007). Regardless of the cause of persistent LBP, the most effective treatment technique, according to current evidence-based guidelines, is to combine exercise and education (Berglund, 2016).

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To address the functional rehabilitation of these distinct trunk muscular groups, specific training programs have been designed (Grenier, 2007). Bone, discs, ligaments, and muscle control stabilize the spine; this stabilization system keeps the spine in a neutral zone under the physiological threshold to prevent functional instability.[6] The ability of the lumbopelvic skeleton to be steady and maintain balance following disturbance or movement is known as spinal stability (Haussler, 1999). The muscle dynamic function contributes significantly to this stability. Static materials such as bone and other soft tissue also play a role in spinal stability, to varying degrees. Proprioception and nociception are two crucial neurologic functions that are protected by the bony skeleton (Stokes *et al*., 2008; Willson *et al*., 2005). Muscle-building programs that are active have been found to be relatively effective. Despite this, no research that quantified evidence of physiological or anatomical alterations in the back muscles has been conducted (Mannion, 2001).

Understanding lumbopelvic biomechanics requires a thorough examination of sagittal balance (Chanplakorn *et al*., 2011). In the examination of pathological diseases associated with anomalous angular parameter values, physiological spinal sagittal balance should be used as a baseline. The correlations between angular parameters may also be beneficial in determining the corrections to be obtained during treatment before a patient with spinal sagittal imbalance is treated (Vialle *et al*., 2005).

MATERIALS AND METHODS

The aim of the study is to investigate the sagittal alignment and pelvic parameter change in asymptomatic subjects after the segmental lumbopelvic training exercises. The pelvic parameters examined in this current study were lumber lordosis angle (LL) and pelvic tilt angle (PT), pelvic incidence angle (PI) and sacral slope (SS) in asymptomatic subjects. Thirteen subjects (8 males and 5 females) were assigned into one group with mean age of 25.67 (± 2.17) years, mean weight of 70.71(±7.73) kg, and mean height of 172.75(±6.02) cm participated in this study. X-ray imaging radiography from sagittal view was done for all subjects before and after training program .data processing and angle measurements done by Corel draw software 2019.

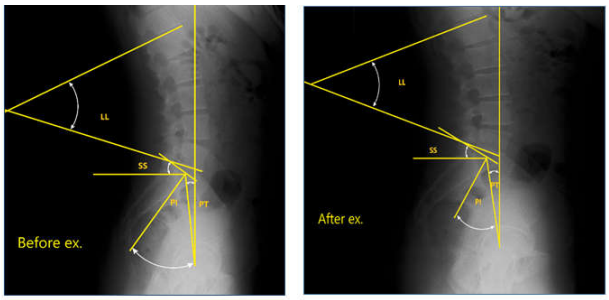

Figure 1. Spinopelvic angles before and after exercises. (LL = Lumbar Lordosis, SS = Sacral Slope, PT = Pelvic Tilt, PI = Pelvic Incidence)

Figure 2. Segmental control (open chain and closed chain) program

The segmental approach developed by Richardson was used through three stages of segmental control, increasing challenges to the patient joint protection mechanisms (Richardson, 2004). These stages are; Stage 1: local segmental control, Stage 2: closed chain segmental controland Stage 3: open chain segmental control and progression into function.

Statistical analysis using T-test was used to detect differences in the mean values of pelvic parameters (lumbar lordosis angle, pelvic tilt angle, pelvic incidence angle and sacral slope angle) before and after segmental lumpopelvic training exercise. There were no significant differences between lumber lordosis angle ($t = -1.12$, $p = 0.13$), pelvic tilt angle ($t = -1.16$, $p = 0.12$), pelvic incidence angle ($t = -0.33$, $p = 0.37$) and sacral slope angle ($t = 0.22$, $p = 0.41$) before and after segmental lumpopelvic training exercise.

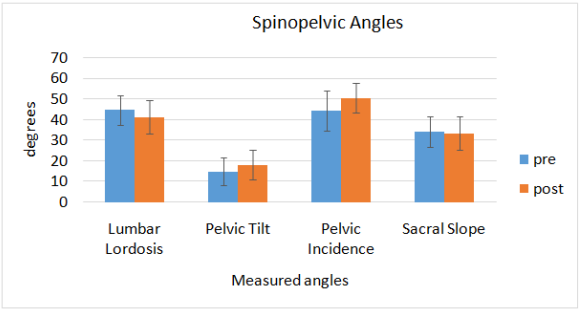

Figure 3. Different spinopelvic angles measured before and after exercise program

DISCUSSION

Core stability exercise is more beneficial than general exercise in reducing pain and improving physical function in persons with chronic LBP in the short term. However, there were no significant long-term differences in pain severity between patients who did core stability training and those who did general exercise (Wang *et al*., 2012). In all factors, segmental stability outperforms superficial strengthening. TrA activation capacity is not improved by superficial strengthening (França, 2010). Findings revealed that there was Most of studies about core stability training evaluate pain and function and only a few studies are considering pelvic parameters and angle changes. Our results showed that there was no significant difference in all mean dependent variables (LL, PT, PI and SS angles) before and after segmental lumpopelvic training. This results was supported by (Imai *et al*., 2019) who cleared that Sagittal spinal balance and standing posture are affected by pelvic morphology (Imai *et al*., 2019). In comparison to the general population, some investigations found no significant variations in pelvic incidence in spine disorders (Golbakhsh, 2012). Normative values for anatomic parameters of sagittal pelvic alignment do not exist, according to another study (Vrtovec, 2012b), because the variability of the measured values is relatively high even in normal subjects, but they can be predictive for spinal alignment and specific spinopelvic pathologies

Conclusion

From the obtained results of this study, it can be concluded that there was no significance difference in the mean value of pelvic parameters measured from sagittal view using x-ray radiography imaging before and after exercise training. These results appear to be related to anatomical and structural differences among individuals. These effects should be considered when clinicians manage their patients on basis of pelvic parameters

Conflict of interest: There is no conflict of interest.

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