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Original Article

The effect of lumbar-pelvic alignment and abdominal muscle thickness on primary dysmenorrhea

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Abstract. [Purpose] The purpose of this study was to identify effects of malalignment of the lumbar pelvis, as a passive element, and the thicknesses of abdominal muscles, as active elements, on primary dysmenorrhea. [Subjects and Methods] The subjects were divided into a primary dysmenorrhea group and normal group according to Visual Analogue Scale, and ultimately there were 28 subjects in the dysmenorrhea group and 22 subjects in the normal group. Alignment of the lumbar pelvis was measured by using a Formetric 4D analysis system, and the thicknesses of abdominal muscles were measured by using ultrasound imaging. [Result] Scoliosis was 6.7 ± 4.3° in the primary dysmenorrhea group and 3.8 ± 2.0° in the normal group, and the lordotic angles of the two groups were 0.6 ± 0.5° and 0.1 ± 0.3°, respectively. The thickness of the internal oblique was 3.8 ± 1.3 mm in the primary dysmenorrhea group and 6.0 ± 1.9 mm in the thicknesses of the transverse abdominis in the two groups were 2.6 ± 6.8 mm and 3.5 ± 6.1 mm, respectively. Furthermore, the thickness of the normal group, and the external oblique was 4.0 ± 0.8 mm in the primary dysmenorrhea group and 5.4 ± 1.4 mm in the normal group. [Conclusion] This study showed significant differences between the primary dysmenorrhea group and the normal group in lumbar-pelvic alignment and thicknesses of abdominal muscles.

Key words: Lumbar-pelvic alignment, Primary dysmenorrhea, Abdominal muscles

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INTRODUCTION

Dysmenorrhea occurs in 20–90% of childbearing women, 40–50% of which suffer from unknown primary dysmenorrhea. Their common symptoms include pelvic circumference pain and low back pain[1)], and 15% of cases experience problems in daily life due to extremely severe pain that may result in absence of school or office[2)]. A study on dysmenorrhea has been done in relation to drug therapy to inhibit excessive secretion of prostaglandin[3)], and treatment of dysmenorrhea depends on drugs even though these drug therapies can result in several adverse events such as indigestion and headache[4)] and focus only on transient reduction of the pain. Meanwhile, Denise et al. supposed that primary dysmenorrhea might be caused by spinal misalignment and reported that dysmenorrhea was reduced by applying manual therapy to 16 women with dysmenorrhea[5)]. Blakey et al. supposed that primary dysmenorrhea might be caused by incompatibility between muscles of the pelvic circumference and soft tissue[6)]. However, few studies have been performed on the relationship between primary dysmenorrhea and the musculoskeletal system, and concrete and reliable studies considering the stability of the pelvic cavity circumference are also remarkably lacking. The stability within the pelvic cavity is associated with passive elements such as bones and ligaments and active elements such as muscles and tendons, which allow smooth movement structurally and functionally[7)].

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It was surmised that the musculoskeletal incompatibility would cause structural and functional changes of the body and a change in location of the uterus, increasing dysmenorrhea. Therefore, the aim of the present study was to identify effects of the alignment of the lumbar pelvis, as a passive element, and the thicknesses of abdominal muscles, as active elements on primary dysmenorrhea.

SUBJECTS AND METHODS

This study recruited women who were between 20 and 45 year of age, residing in Busan, Republic of Korea, and without any uterine diseases or musculoskeletal disorders such as low back pain. Among them, 30 women with a VAS score of at least 8 and 30 women with a VAS score of less than 8 were assigned to the primary dysmenorrhea group and normal group, respectively. Two women in the primary dysmenorrhea group and 8 women in the normal group dropped out of the study, and ultimately 28 persons in the dysmenorrhea group and 22 persons in the normal group participated in the study. All experimental procedures and methods were approved by the research ethics committee of the Catholic University of Pusan, and the subjects were provided with a sufficient description of the study aim and procedures and provided informed consent. In this study, pelvic tilt, pelvic torsion, slice rotation, scoliosis, and lordotic angle were measured by using a DIERS Formetric 4D analysis system (DIERS International GmbH, Schlangenbad, Germany) to study passive elements, and the thicknesses of the TrA, IO, and EO were measured by using a LOGIQ Book XP ultrasound machine (GE Healthcare Products, Milwaukee, WI, USA) with an 8 MHz linear transducer to study active elements. The DIERS Formetric 4D measurments were conducted by modifying the methods of previous studies[8)], and the measurements were conducted after marking the PSIS and C7 regions through accurate palpation.

With the transducer placed 2.5 cm distal from the center line at the midpoint, between the iliac crest and the rib, the thicknesses of abdominal muscles were measured. Differences between the primary dysmenorrhea group and the normal group and their general characteristics were analyzed with the independent samples t-test. For data analysis, IBM SPSS Statistics 19.0 was used, and a p-value of 0.05 was set as the level of significance.

RESULTS

General features of the primary dysmenorrhea group and normal group are shown in Table 1, and there were no statistically significant differences. For the passive elements, there was significant difference in scoliosis and the lordotic angle. Scoliosis was 6.7 ± 4.3° in the primary dysmenorrhea group and 3.8 ± 2.0° in the normal group ($p<0.05$). The lordotic angle, was found to be 0.6 ± 0.5° in the primary dysmenorrhea group and 0.1 ± 0.3° in the normal group ($p<0.05$). For pelvic tilt, pelvic torsion, and slice rotation, there were no significant differences, with the values being 3.9 ± 3.4 mm, 1.9 ± 1.5°, and 3.4° ± 2.3° in the primary dysmenorrhea group and 2.6 ± 2.5 mm, 2.2° ± 1.2°, and 2.8° ± 1.8° in the normal group. In addition, both groups showed significant differences in the thicknesses of abdominal muscles, an active elements. In particular, the thickness of the IO was 3.8 ± 1.3 mm in the primary dysmenorrhea group and 6.0 ± 1.9 mm in the normal group, and the thicknesses of the TrA in the two groups were 2.6 ± 6.8 mm and 3.5 ± 6.1 mm ($p<0.05$), respectively. Furthermore, the thickness of the EO was 4.0 ± 0.8 mm in the primary dysmenorrhea group and 5.4 ± 1.4 mm in the normal group ($p<0.05$) (Table 2).

DISCUSSION

The aim of this study was to study effects of lumbar pelvis alignment and abdominal muscle thickness on primary dysmenorrhea. Among the passive elements of stability, it was found that the lordotic angle was 0.6 ± 0.5° within 33–47° of normal range and the scoliosis was 6.7 ± 4.3° within 0–4° of normal range ($p<0.05$) in the primary dysmenorrhea group, showing

Table 1. Characteristics of the subjects (N=50)

	Group I (N=28)	Group II (N=22)
Age (years)	30.0 ± 5.8	31.0 ± 5.6
Height (cm)	163.0 ± 5.0	164.0 ± 4.1
Weight (kg)	50.1 ± 6.0	54.8 ± 6.4
BMI (Kg/m^2)	21.0 ± 2.4	20.6 ± 2.1

Group I: primary dysmenorrhea group; Group II: normal group

Table 2. Comparison of trunk alignment and abdominal muscle thickness between groups

	Group I (N=28)	Group II (N=22)
Pelvic tilt (mm)	3.9 ± 3.4	2.6 ± 2.5
Pelvic torsion (°)	1.9 ± 1.5	2.2 ± 1.2
Slice rotation (°)	3.4 ± 2.3	2.8 ± 1.8
Scoliosis (°)	6.7 ± 4.3*	3.8 ± 2.0
Lodotic angle (°)	0.6 ± 0.5*	0.1 ± 0.3
TrA (mm)	2.6 ± 6.8*	3.5 ± 6.1
IO (mm)	3.8 ± 1.3*	6.0 ± 1.9
EO (mm)	4.0 ± 0.8*	5.4 ± 1.4

Values are shown as the mean ± SD, *p<0.05.
Group I: primary dysmenorrhea group; Group II: normal group

significant difference. It was considered that spinal misalignment resulted in changes in the lumbar pelvis in the sagittal plane, which induced locational change of the uterus, an organ within the pelvic cavity. It was considered that the dysmenorrhea was increased by increasing tension of soft tissue including ligaments, tendons and muscles resulting from anterior and posterior locational change of the uterus. This hypothesis was consistent with the hypothesis asserted by gender, who assumed that dysmenorrhea was reduced by correcting the movement of the lumbar pelvis and sacroiliac joint and softening the surrounding muscles[9)]. In addition, Kokjohn et al. reported that corrective spinal alignment by manual therapy reduced primary dysmenorrhea[10)]. Regarding the thicknesses of abdominal muscles, active elements of stability, it was shown that all of the abdominal muscles showed differences between the primary dysmenorrhea group and the normal group, especially the IO and TrA, which showed 1.5 times greater differences compared with the EO. Bergmark[11)] classified the stability muscles into local muscle and global muscles systems and reported that the main role of the local muscle system was to maintain stability of the body and that the TrA and IO were involved in the local muscles system. Thus in this study, it was considered that the differences between the groups in TrA and IO were related to a weakened local muscle system, resulting in instability and dysmenorrhea. Lim et al.[12)] reduced the pain experienced by 11 patients with dysmenorrhea by applying Kinesio taping to the abdominal area, which was considered to provide a massage effect and to improve the balance of the abdominal muscles. In addition, based on the study by Sara et al., it was reported that isometric exercise reduced primary dysmenorrhea in 68 patients by reinforcing muscles surrounding the pelvis to provide stability[13)]. Furthermore it was reported by Hassan et al. that application of lumbar stabilizing exercise to 20 women with primary dysmenorrhea resulted in mitigation of pain[14)]. The present study presented data regarding the relationship the between muscular stability in the pelvic cavity and primary dysmenorrhea. However, the study has several limitations. First, daily habits of the subjects including smoking, alcohol consumption, medication, and amount of exercise were not controlled. Second, the ages of the subjects varied, ranging from the 20s to 40s, but the distribution of age was not even. Third, the primary dysmenorrhea group was restricted to subjects with a VAS score of over 8. Finally, the sample size was small. Consideration of these points in the future studies should improve the reliability and validity of the studies.

In conclusion, this study showed significant differences between the primary dysmenorrhea group and the normal group in scoliosis, lordotic angle, and thicknesses of the TrA, IO, and EO, and it is considered that misalignment of the lumbar pelvis and the differences in deep abdominal muscle thickness are associated with primary dysmenorrhea.

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