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The effect of complex training on the children with all of the deformities including forward head, rounded shoulder posture, and lumbar lordosis

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The purpose of this study is to investigate the effect of complex training on children with the deformities including forward head, rounded shoulder posture, and lumbar lordosis. The complex training program was performed for 6 month three times per week. The complex training improved posture as measured by forward head angle (FHA), forward shoulder angle (FSA), and angle between anterior superior iliac spine and posterior superior iliac spine (APA). In the present results, complex training might overcome vertebral deformity through decreasing forward head, rounded shoulder posture, and lumbar lordosis and increasing flexibility in the children.

Keywords: Complex training, Forward head posture, Rounded shoulder posture, Lumbar lordosis

INTRODUCTION

School environment plays an important role in the sitting position (Koo and Lee, 2014; Syazwan et al., 2011). Children often sit with poor posture having their neck, shoulders, and back fixed for long periods during classroom lessons, and physical inactivity, repetitive static dynamic loading of the spine constitutes as a risk factor (Lee and Olga, 2013; van Gent et al., 2003). For this reason, neck pain was reported by 22% of girls and 11% of boys among adolescents (Grimmer et al., 2006). Recently, Clément et al. (2013) reported that degree of lumbar lordosis increases in adolescents (Clément et al., 2013). Furthermore, sitting lumbopelvic posture can alter activation of the deep cervical flexors, thus possibly influence deformity of neck and shoulders such as forward head and rounded shoulder postures (Falla et al., 2007).

The forward head posture of cervical musculoskeletal abnormalities is associated with the shortening of the posterior neck extensor muscles and tightening of the anterior neck muscles (Fernández-de-las-Peñas et al., 2006). This forward head posture leads to forward inclination of the head with cervical spine hyperextension by shortening of the upper trapezius, the splenuis and semispinalis capitis and cervicis, the cervical erector spinae and the levator scapulae musculature. Thus, forward head posture might be a consequence of neck and shoulder pain (Fernández-de-las-Penas et al., 2006).

Neck musculoskeletal disorder and cervical dysfunction are related to thoracic kyphosis and rounded shoulder posture (Quek et al., 2013). Irregular lower trapezius condition and serratus anterior positions by abnormal scapular tilt can lead to rounded shoulder posture in children and adults.

Also, the weakness of abdominal muscle permits an anterior pelvic tilt and a lordotic posture (Youdas et al., 1996). Many studies reported that lumbar lordosis and abdominal muscle function are related to each other (Polly et al., 1996; Youdas et al., 1996).

In this study, we investigated the effect of complex training on children with the deformities including forward head, rounded shoulder posture, and lumbar lordosis.

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MATERIALS AND METHODS

Subjects

Forty children from KINESS growth and health center were participated in this study. Subjects were divided into an exercise group (complex training) (boys = 10, girls = 10) and control group (boys = 10, girls = 10). The characteristics of the subjects for each group are presented in Table 1.

Postural analysis

Participants underwent postural screening to identify forward head, rounded shoulder, and lumbar lordosis. Posture was assessed using a digital camera (Ainfo USB Camera, SONIX, Seoul, Korea) and posture measurement program Cento (KEPC, Seoul, Korea). Forward head angle (FHA) measured from the vertical arterially to a line connecting the tragus and the seventh cervical vertebra (C7) marker. Forward shoulder angle (FSA) for rounded shoulder measured from the vertical posteriorly to a line connecting the C7 marker and the acrominal marker (Charles, 2010). Lumbar lordosis (ASA) measured from angle between the anterior superior iliac spine (ASIS) and the posterior superior iliac spine (PSIS).

Complex training program

The complex training program was performed for 6 month three times per week. The training program is presented in Table 2.

Data analysis

SPSS for Windows software (version 12.0, SPSS Inc., Chicago, IL, USA) was used for all statistical analysis. Two-way repeated ANOVA was used to examine interactions between time and group and differences between groups. In the case of significant time by group interactions, paired t-test was used to evaluate differences between pre and post. Significance was set as $P < 0.05$.

Table 1. The characteristics of the subjects

	Age (yr)	Height (cm)	Mass (kg)	BMI (kg/m^2)
EG (n = 20)	13.55 ± 2.21	155.01 ± 12.71	45.02 ± 11.02	19.41 ± 2.33
CG (n = 20)	13.75 ± 1.80	154.48 ± 8.10	49.39 ± 9.36	20.60 ± 3.51

EG, exercise group; CG, control group.

RESULTS

Forward head angle

The result of FHA changes is presented in Table 3. Two-way repeated ANOVA revealed that there was a significant effect of training ($F = 10.53$, $P < 0.01$) with significant interaction between time and group ($F = 32.89$, $P < 0.001$). The present results showed that the complex training group was remarkably decreased the FHA levels.

Forward shoulder angel

The result of FSA changes is presented in Table 4. Two-way repeated ANOVA revealed that there was a significant effect of training ($F = 4.39$, $P < 0.05$) with significant interaction between time and group ($F = 23.44$, $P < 0.001$). The present results showed that the complex training group was remarkably decreased the FSA levels.

Angle between anterior superior iliac spine and posterior superior iliac spine (APA)

The result of APA changes is presented in Table 5. Two-way re-

Table 2. The complex training program

	Items	Sec (reps) × sets
Stretching	Neck stretching	10 sec × 3
	Rounded shoulder stretching	10 reps × 3
	Press your back in a supine position	10 sec × 3
Strengthening	Isometric neck pulling	6 sec × 5
	Push ups	15 reps × 3
	Sit ups	30 reps × 3
	Leg raising	15 reps × 3
	Extension after bending your back with a band	10 reps × 3

Table 3. Difference of between groups on FHA (°)

Groups	n	FHA		F	P
		Pre	Post		
EG	20	41.60 ± 3.33	32.86 ± 5.02	43.11	0.000
CG	20	42.16 ± 4.76	41.57 ± 6.56		
Time × Group				32.89	0.000
Group				10.53	0.002

Values are means ± SD. EG, exercise group; CG, control group; FHA, forward head angle.

Table 4. Difference of between groups on FSA (°)

Groups	n	FHA		F	*P*
		Pre	Post		
EG	20	42.83±5.56	35.81±4.62	37.71	0.000
CG	20	42.46±4.10	41.63±3.84		
Time×Group				23.44	0.000
Group				4.39	0.043

Values are means±SD. EG, exercise group; CG, control group; FSA, forward shoulder angle.

Table 5. Difference of between groups on APA (°)

Groups	n	FHA		F	*P*
		Pre	Post		
EG	20	16.46±3.25	10.51±2.12	14.86	0.000
CG	20	16.57±3.45	16.15±3.45		
Time×Group				11.12	0.002
Group				9.09	0.005

Values are means±SD. EG, exercise group; CG, control group; APA, angle between the anterior superior iliac spine.

Table 6. Difference of between groups on flexibility (cm)

Groups	n	FHA		F	*P*
		Pre	Post		
EG	20	5.31±8.66	12.20±7.04	7.73	0.018
CG	20	5.73±6.54	5.61±6.21		
Time×Group				8.29	0.007
Group				2.59	0.116

Values are means±SD. EG, exercise group; CG, control group.

peated ANOVA revealed that there was a significant effect of training ($F=9.09$, $P<0.01$) with significant interaction between time and group ($F=11.12$, $P<0.01$). The present results showed that the complex training group was remarkably decreased the APA levels.

Flexibility

The result of flexibility changes is presented in Table 6. Two-way repeated ANOVA revealed that there was no significant effect of training ($F=2.59$, $P=0.116$) with significant interaction between time and group ($F=8.29$, $P<0.01$). The present results showed that the complex training group was remarkably decreased the flexibility.

DISCUSSION

Postural change occurs continuously throughout the entire time of ontogenesis, with critical periods at school age and puberty (Dolphens et al., 2012). Exercise used to improve weak musculature and stretching tight, forward head and rounded shoulder posture and lumbar lordosis. Several studies have shown that stretching exercise decreases the forward head, rounded shoulder posture, and lumbar lordosis through stretching. Charles et al. (2010) reported that the ideal posture showed lower levels of FHA and FSA. In this study, complex training decreased FHA, FSA levels. These results suggest that complex training ameliorated postural deviations, indicating that changes postural deviations can influence profoundly posture correction.

Lumbar spine problems are associated with low back or lower limb poor muscle development and hip or knee joint deformities (Glard et al., 2005). Pelvic tilt (APA) was measured using the angle between the horizontal and a line connecting the ASIS and the PSIS. This angle is influenced by the balance of muscular and ligamentous forces acting between the pelvis and adjacent segments (Preece et al., 2008). Previous studies reported that increased lumbar lordosis and diminished abdominal muscle force increased the risk of low back pain (Kim et al., 2006; Polly et al., 1996). In this study, complex training decreased the angle between right ASIS and PSIS, indicating recovery of neutral pelvis position.

The flexibility exercises were often used to improve lumbar lor-

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dosis caused by tightness in the levator scapulae, the sternocleidomastoid and the pectoralis muscle group. In this study, the complex training increased flexibility. These results suggest that complex training improve range of movement.

Based on the present results, complex training might overcome vertebral deformity through decreasing forward head, rounded shoulder posture, and lumbar lordosis and increasing flexibility in the children.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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