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Comparison of body movement characteristics between EAAT and walking in children with cerebral palsy

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Purpose

Equine-associated activities and therapy (EAAT) are known to be one of exercise interventions to improve postural control in children with cerebral palsy (CP). However, there is little research on the mechanism of action to improve postural control. The purpose of this study was to compare of the body movement characteristics between EAAT and walking in children with CP using tri-axial accelerometer,

Subjects and Method

Twelve children (age, 8.3±2.0; height, 128.5±7.3; weight, 27.7±4.6) with CP (Gross Motor Function Classification System level Ⅰ-Ⅲ) participated in this study. Tri-axial body movements were measured with ActiGraph model GT3X accelerometer (Health One Technology, Fort Walton Beach, FL) on the waist during EAAT and walking. Changes of heart rate were also measured with Polar heart rate monitor (Polar Inc., Oulu, Finland) on the chest during EAAT and walking. The 40-minute EAAT programs were offered, which included stretching, strengthening, dynamic balance, postural control, and basic riding skills while walking and trotting. Times for mounting and unmounting activities were excluded in the analysis. Six minute walk tests (6MWT) were performed at least two days apart from the measurement during EAAT. Children received the same verbal instructions to assist in the pace of walking. Tri-axial raw acceleration data (counts per minute) obtained were analyzed with ActiLife 6.0 software (Health One Technology, FL, USA). Then the coefficients of variation (CV, ratio of the standard deviation to the mean) of tri-axial raw acceleration were calculated. The metabolic equivalent rate (MET) of each child was calculated using Freedson equations for children (2005); 2.757 + (0.0015 * Counts per minute) – (0.08957 * Age) – (0.000038 *Counts per minute * Age).

Results

Tri-axial raw acceleration (anteroposterior, mediolateral and vertical) were all significantly lower during EAAT than walking ($p<.01$). However, the coefficients of variation in all tri-axis were significantly higher in EAAT than walking ($p<.01$). The highest acceleration was noted in the vertical axis during walking, anteroposterior axis during EAAT, respectively. MET and HR was significantly lower during EAAT than walking ($p<.01$). However, the coefficients of variation in MET was significantly higher in EAAT than walking ($p<.01$).

Conclusion

Body movements in all tri-axis were decreased in spite of continuous postural challenge. However, contents of the EAAT program seem more complex and variable than those of walking (higher CV). This implies automatism has not been completed during EAAT. Then these results support EAAT is a context focused therapy to improve postural control in children with CP.

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Table 1. The value of tri-accelerometry, MET and HR during EAAT and walking

Value	Walking(6min)	EAAT(30min)	p
Vertical Axis (counts/min)	3247.41±1307.79	558.35±231.57	.002*
Mediolateral Axis (counts/min)	2270.49±790.52	654.77±258.72	.002*
Anteroposterior Axis (counts/min)	2324.15±629.95	1036.44±462.79	.002*
MET	5.81±1.31	2.54±.35	.002*
Heart Rate (beats/min)	143.15±14.16	105.66±10.17	.002*

NOTE. MET, Metabolic Equivalent rate; EAAT, Equine-associated activities and therapy; * significantly difference between walking and EAAT (p<.01).

Table 1. The value of tri-accelerometry, MET and HR during EAAT and walking

Table 2. The Coefficient of variation of tri-accelerometry, MET and HR during EAAT and walking

Coefficient of variation	Walking(6min)	EAAT(30min)	p
Vertical Axis (counts/min)	.140±.117	.906±.227	.002*
Mediolateral Axis (counts/min)	.129±.099	.586±.144	.002*
Anteroposterior Axis (counts/min)	.140±.142	.571±.141	.002*
MET	.162±.071	.309±.063	.002*
Heart Rate (beats/min)	.098±.056	.069±.025	.117

NOTE. MET, Metabolic Equivalent rate; EAAT, Equine-associated activities and therapy; * significantly difference between walking and EAAT (p<.01).

Table 2. The coefficient of variation of tri-accelerometry, MET and HR during EAAT and walking