

THE EFFECTS OF TACTILE STIMULUS ON BIPEDAL POSTURAL SWAY IN EARLY ADOLESCENTS

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INTRODUCTION

Human bipedal upright stance is a basic ability of postural control and it is a product of dynamic feedback mechanisms controlled by the Central Nervous System (CNS) (1). The primary sensory information required for this dynamic feedback are visual, vestibular and proprioceptive (1). Basically the motor performance arises from complex neural interactions between the environment and the body (2). Skin is the boundary between the environment and our body and it is functioning as a sensory information resource about the peripersonal space around human body (3). The tactile sensations and the plasticity of the sensorimotor cortex are being investigated for a long time by neuroscientists (4). Stimulating a spesific region of skin can even produce functional alternations in somatosensoric cortex (5). The purpose of this study was to investigate the effects of painfull and indolent tactile stimulus which was applied through the skin of calf area over bipedal postural sway in early adolescents.

METHODS

156 adolescents volunteered in the study ($n_{\text{female}}=82$, $n_{\text{male}}=74$). They have been devided randomly into 3 groups as Painful Stimulus (Fig. 1) Group (PS) ($n=47$), Indolent Stimulus (Fig. 2) Group (IS) ($n=55$) and the Control Group (C) ($n=54$). GYKO was used for bipedal postural sway measurements (Table 1). The data considered from sway measurements of GYKO were Elliptical Area (EA), Length (L), Mean Distance (MD), Velocity (V) on Medio-Lateral (ML) and Antero-Posterior (AP) directions. PS and IS groups were respectively asked for bipedal postural sway measurement, prone position for 1 minute bilateral calf stimulus and bipedal postural sway measurement again. C group distinctly just lied down for 1 minute without stimulation between the tests. One way ANOVA test was used for statistical analyses for comparing the results between groups. For comparing the results of the pre and post tests of the same group the Paired Sample T-Test was used. The signifiicance level was set at 0.05.

Table 1. Caharcteristics of the subjects

	PS (n=47)	IS (n=55)	C (n=54)
Age (year)	12.6±0.0	12.5±1.0	12.6±1.1
Body height (cm)	152.4±9.7	151.9±9.3	150.3±7.6
Body weight (kg)	45.4±11.3	45.7±10.2	46.4±10.8
Gyko height (cm)	124.9±8.9	123.6±8.3	123.0±7.9

PS: Painful stimulus, IS: Indolent stimulus, C: Control group.



Fig.1: Indolent Stimulus application.

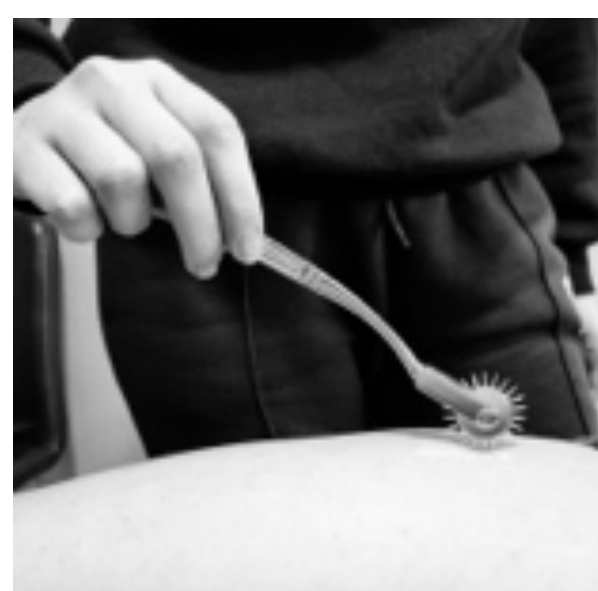


Fig.2: Painful Stimulus application

RESULTS

All three groups showed statistically significant difference between two tests in V, AP-L, AP-V. In addition the PS group showed statistically signifiicant difference in L, ML-L and ML-V. Although there were significant differences on some values these were trivial or small by the effect size (Table 2). The reaction of the female and males were unlike each other.

Table 2. Pre- and post-test comparison of all participants

		PS (n=47)		IS (n=55)		C (n=54)	
		mean±SD	p	mean±SD	p	mean±SD	p
Elips area (cm ²)	Pe	15.0±11.2		16.9±13.3		18.2±13.9	
	Pst	16.2±11.9	.715	16.5±11.9	.719	16.7±13.1	.206
Length (cm)	Pre	56.5±20.8	.003	55.9±14.7		57.9±21.4	.046
	Pst	60.2±21.3	[ES .175]	57.9±21.4	.096	61.2±21.4	[ES .154]
Mean distance (cm)	Pre	.551±.228		.590±.229		.650±.229	
	Pst	.638±.444	.295	.624±.258	.299	.576±.253	.052
Velocity (cm.sec ⁻¹)	Pre	1.88±.69	.008	1.84±0.53	.030	1.93±.71	.045
	Post	1.99±0.75	[ES .144]	1.93±.48	[ES .185]	2.04±.71	[ES .152]
ML length (cm)	Pre	29.6±12.1	.018	29.1±9.4		29.2±11.6	
	Post	31.1±12.1	[ES .124]	28.9±9.1	.823	29.9±12.9	.443
ML mean distance (cm)	Pre	.549±.263		.555±.226		.603±.275	
	Post	.603±.291	.184	.522±.224	.199	.593±.279	.785
ML velocity (cm.sec ⁻¹)	Pre	.99±.40	.017	.97±.31		.97±.39	
	Post	1.04±.40	[ES .132]	.97±.30	.827	.99±.43	.462
AP length (cm)	Pre	41.7±15.1	.006	41.3±10.2	.025	43.5±16.2	.011
	Post	44.7±15.3	[ES .198]	43.8±10.4	[ES .243]	46.6±15.4	[ES .196]
AP mean distance (cm)	Pre	.955±.497	.688	1.049±.550	.142	1.131±.503	
	Post	.957±.394		1.150±.585		1.009±.450	.137
AP velocity (cm.sec ⁻¹)	Pre	1.39±.50	.007	1.37±.34	.022	1.45±.54	.012
	Post	1.49±.51	[ES .197]	1.46±.35	[ES .249]	1.55±.51	[ES .195]

Note: PS: Painful stimulus, IS: Indolent stimulus, C: Control group, ES: effect size, $p<.05$. There is no statistical significance for intergroup comparison in pre- and post-tests.

CONCLUSION

There are many levels of sensorimotor integration in human nervous system and each input has another pathway to the CNS (6). There is a slight statistical significance but further studies should investigate the types of tactile inputs, the body part input is applied and the age and sex differences. If we can prove any motor actions of the body can be performed better with the help of the tactile inputs than we can provide some applicable training programme additions for better outcomes.

REFERENCES

- 1- Peterka R. J. Sensorimotor Integration in Human Postural Control. Journal of Neurophysiology. 2002;88(3):1097-1118.
- 2- Wallwork S. B., Bellan V., Catley M. J., Moseley L. Neural representations and the cortical body matrix: Implications for sports medicine and future directions. British Journal of Sports Medicine. 2015;0:1-8.
- 3- Vignemont F., Serino A., Wong H. Y., Farne A. The World at Our Fingertips: A Multidisciplinary Exploration of Peripersonal Space. Oxford University Press. 2020.
- 4- Lesemann P. H. F., Ruter E. M., Godde B. Tactile stimulation interventions: Influence of stimulation parameters on sensorimotor behavior and neurophysiological correlates in healthy and clinical samples. Neuroscience and Biobehavioral Reviews. 2015;51:126-137.
- 5- Reed, Catherine L. Tactile perception. In V.S. Ramachandran (ed.), Encyclopedia of the Human Brain (pp. 545-556). San Diego, CA: Academic Press. (2002)
- 6- Guyton A.C., Hall J.E. : Textbook of Medical Physiology. 13th Ed. Philedelpia, PA:Elsevier,2016.