Posture and Balance: Study Case

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Abstract

Most of the postural problems are detected mostly as symptoms of muscular imbalance influenced by a variety of risk factors which can be internal or external factors. Through this study, we investigate how important a good posture is for a better balance stability by evaluating the impact of posture corrective exercises over the equilibrium parameter. Our study was conducted over randomly selected 67 children aged 10-11 years. Over randomly selected 34 children we used an Intervention Program (the isometric and stretching exercises) while the rest followed the routine of physical education class program. For the review we used Jab Ref, Pub Med, Medline, and Research Gate. To evaluate the postural shape of children we used "Posture Screen Mobile®-PSM (iPod) and Postural Analysis Grid Chart" and the Leonardo Mechanograph® GRFP for the equilibrium parameters. To analyze the data, we applied the SPSS 20.0 applying the Paired-Sample Test (T-test) and the Multifunctional Linear Regression. The results showed an efficacy of the postural corrective exercises on the posture alignment improvement and the equilibrium parameters too. In the end, we underline the importance of these kind of exercises to be implemented on the physical education program in order to insure a better posture and equilibrium too.

Keywords: posture, balance, children, postural deviations, intervention program

1. Introduction

Nowadays, poor posture among children became one of the most critical health issues analyzed and studied by different researchers of various scientific fields. This is why there are different definitions of posture as a concept, for example, atomists and the scientists of Kinesiology defined the "Normal Posture" as " the human body's ability to maintain a static and dynamic balance in relation to the force of gravity" (Loots, 1999; Kendall, Mccreary, Provance, Rodgers & Romani, 2005). There are others who defined the Normal Posture as an important indicator of the mechanical efficiency of the kinetic condition and muscle balance or neuromuscular coordination (Latalski et al., 2013) and others as a mechanically performed behavior which can easily be

modified and affected by various actions or habits. (Kratěnová, Žejglicová, Malý & Filipová., 2007)

Despite these different definitions of Normal Posture as a concept, it is important for our study to underline the fact that the new generation of modern society is increasingly facing postural problems. Unfortunately, the technological evolution has negatively affected our child's posture shape causing poor posture (Motow-Czyż, Orczyk& Marek Orczyk, 2014; Brianezi L, Cajazeiro & Maifrino, 2011). Postural deviations are considered one of the most critical health issues recently because the incidents of poor posture among children unfortunately has increased. It is known that the human body change throughout life, but the greatest challenges regarding posture shape is during school age when posture is more fragile and sensible from different risk factors such as: using electronic games for hours, staying in class for hours in a seating position, holding heavy school bags and inaccurate way, using urban transport reducing physical activity level, unhealthy food, wearing uncomfortable shoes (Tremblay & Willms, 2000; Banfield, 2000; Kratenova et al., 2007; Misra, Nigam & Alagesan, 2012).

Despite these risk factors, studies underline that most postural deviation incidents are caused by the "lack of information" about posture (Brianezi et al., 2011). This is the reason why being aware of the "poor posture's risk factors" and "how to keep upright our body", is so important. If you are able to diagnose the existence of poor posture as soon as possible before that skeletal growth process finishes, you should know that postural misalignment can be easily corrected via physical exercises establishing muscle balance (Brianezi et al., 2011; Latalski et al., 2013; Gordeiro, Duarte, Collucci & Frade, 2014; Cosma et al, 2015). The necessity of intervention program implementation to correct poor posture in children during Physical Education Class is studied by many researchers emphasizing its positive impact on this prevalent physical condition. These studies highlighted that to correct poor posture it is important to use the "strengthening and stretching exercises" focusing on muscle balance development.

Furthermore, evidence showed that these physical exercises (strengthening and stretching) can significantly improve not only the poor posture, which is also the reason why these intervention programs were designed to be used for but even to improve balance stability (Cordeiro et al.,2014; Deutschmann et al., 2014). After a detailed analysis of how other studies could improve the detected postural deviations among children, we decided to implement an intervention program even among Albanian children using a combination of isometric and stretching exercises. It is important to emphasize that the isometric exercises chosen from us are based on the fact that they are characterized by an unchangeable motor scheme, making them more understandable for kids and easily executed by them (Bomba&Haff, 2009, Markola, Bardhyl, Markola&Quka, 2016). Educating a good posture shape or correcting children's poor posture shape is very important for their wellbeing

because the back pain caused by poor posture can be uncomfortable, affecting even their daily movement execution quality (Stroebel, 2002).

2. Research Methods

To build up an essential theoretical background regarding our study issues, we reviewed especially the contemporary scientific research articles collected by various research sectors such as JabRef research, PubMed, Google Scholar, Inspire, Medline, Sports Discuss act. We were focused more on those research articles that investigated more about the correlation between posture and balance stability. In our study participated 67 children aged 10 -11 years who were randomly selected and divided into two groups, from two public schools of Tirana. They were examined for their postural shape and balance ability twice, before and after the intervention program because of which we decided to divide them into two groups:a) the experimental group (N = 34, 16 boys & 18 girls), who participated regularly in the intervention program for 12 weeks, 2 times/week, b) the control group (N = 33, 16 boys & 17 girls) were not part of this experiment but they continued their daily routine.

The intervention program consisted of strengthening and stretching postural muscles using 6 isometric exercises (some of them for both sides, and legs), 20 seconds each, 3 repetitions, 1:1, and 6 stretching exercises, 20 seconds each. This intervention program was applied during physical education classes starting with different upright games focusing on keeping the body upright. Both of two (2) groups of our study underwent twice the postural and balance tests, exactly before and after 12-weeks of the experimental period. To analyze the postural shape of children, we took four (4) photos for each of 67 of them in anterior/ posterior and lateral views (left and right side). Participants were told to stand up in a relaxed way for several seconds, near to the Postural Analysis Grid Chart. After that, all taken photos were analyzed via Posture Screen Mobile® (PSM), software which has been recently and widely applied by researchers. (Figure 1)

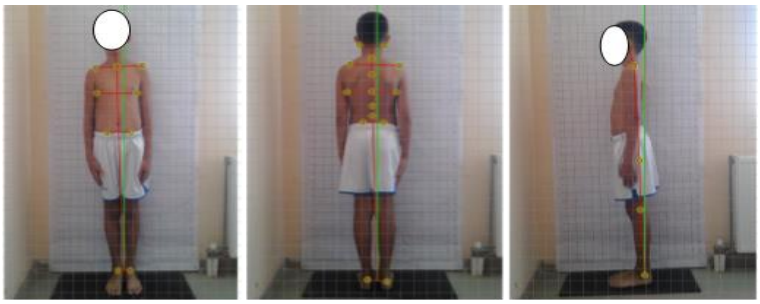

Figure 1. Anterior, Posterior & Lateral Posture Analyse View.

To analyze balance stability we used Leonardo Mechanography® (GRFP), performing balance test in four (4) different positions, with eyes open and eyes closed, so in 8 variants and respectively in Romberg Test (eyes open, eyes closed –Rom EO/EC) Semi Tandem Test (eyes open, eyes closed- Sem Tan EO/EC), Tandem Test (eyes open, eyes

closed-Tan EO/EC) and 1 leg Test (eyes open, closed eyes-1L_EC/EO). (Figure 2, 3, 4 &5)

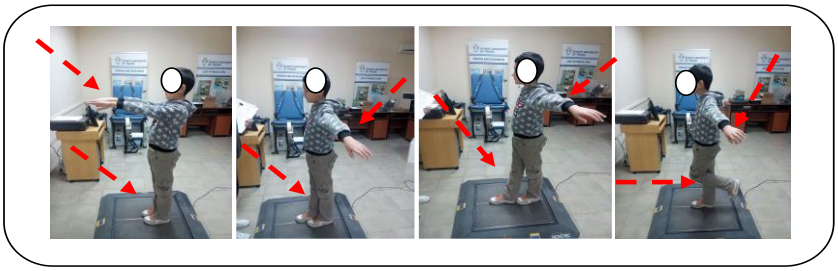

Fig 2. *Romberg* **Fig 3.** *Semi Tandem* **Fig 4.** *Tandem* **Fig 5.** *1 Leg.*

The collected data were analyzed via SPSS 20.0 by using Paired Simple Test & Multifunctional Linear Regression. In order to determine the impact of the intervention program in posture shape and balance stability, we analyzed several variables such as:

EQ- Equilibrium, obtained from 8 variants of Balance Test

The angle of posture displacement (in total), in Anterior & Posterior View

Averaged Lateral Angle of "shoulder" and "hip-pelvis" displacement, in left & right side.

Results

In order to analyze and determine what really happened with the postural subject's shapes between two tests, pre-post intervention programs, for the experimental and control groups we used Paired Simple Test (T-Test).

Tables 1, 2, and 3 showed a difference of mean values between two measures (T1-T2) for the control group but not significant for $p<0.05$, while for the experimental group this difference seems to be significant in the Anterior, Posterior and Lateral View.

These results showed that postural habits improved significantly as a result of the intervention program used. In addition, these results showed quantitative changes in the postural shape of the control group but compare to the experimental group they resulted not statistically significant for $p<0.05$.

TABLE 1 ***Paired Simple Test*** ***(Anterior/Posterior View)***						
	Paired Differences				t	*Sig.(2-tailed)*
Posture Displacement (In total)	Mean	Std.	St. Error	95%		

		Deviation	Mean	Lower	Upper		
CONTROL GROUP							
Anterior *(M1 –M2)*	5.22	2.84	0.76	1.15	9.53	3.21	*.226**
Posterior *(M1 - M2)*	16.18	4.27	1.67	2.97	26.34	4.53	*.159**
EXPERIMENTAL GROUP							
Anterior *(M1 –M2)*	3.72	1.08	0.48	0.15	7.36	6.72	*.002**
Posterior *(M1 - M2)*	12.28	3.69	1.12	2.61	18.26	7.88	*.001**
***p<0.05**							

TABLE 2 (Lateral View)	**Paired Simple Test**						
	Paired Differences					**t**	**Sig.(2-tailed)**
Lateral Plan	**Mean**	**Std.**	**St. Error**	**95%**			
		Deviation	**Mean**	**Lower**	**Upper**		
Control group							
Shoulder shift (M1 –M2)	**4.77**	**0.85**	**0.079**	**-3.22**	**13.39**	**4.12**	**.108***
Experimental group							
Shoulder shift (M1 –M2)	**3.47**	**0.72**	**0.046**	**-2.66**	**10.58**	**8.80**	**.001***
***p<0.05**							

TABLE 3 *(Lateral View)*	***Paired Simple Test***						
	Paired Differences					t	*Sig.(2-tailed)*
Lateral Plan	Mean	Std.	St. Error	95%			
		Deviation	Mean	Lower	Upper		

Control group							
Hip/Pelvis Displacement *(M1 – M2)*	3.81	0.87	0.068	-14.49	4.61	3.63	*.254**
Experimental group							
Hip/Pelvis Displacement *(M1 – M2)*	3.58	0.84	0.061	-14.31	3.56	5.13	*.002**
***p<0.05**							

Multifunctional Linear Regression is a statistical technique that can analyze several variables at the same time and in our study, we used it to analyze exactly the posture displacement (in total) from anterior, posterior, and lateral view and one of balance stability parameters such as EQ-Equilibrium variable at 8 variants of Balance tests.

The results of Tables 4 & 5 show that the correlation between Balance (1 Leg, Romberg, Semi Tandem, Tandem) and Posture in total (anterior/posterior/lateral) are significant for all 67 subjects referred p <0.05, so every qualitative or quantitative postural change result to be well reflected at balance stability. The correlation between "Posture and Balance" is statistically significant meaning that poor posture reflects even at reduced balance stability and that our intervention program can improve not only posture but also balance stability.

Table 4. Multifunctional Linear Regression Subjects (n=67)	**P**	**Coefficient**
Age 10		
1LegTest / Posture	<0.01	0.487
RombergTest/ posture	<0.05	0.218
Age 11		
1Leg Test / Posture	<0.01	0.469
Romberg Test/ posture	<0.05	0.216

Table 4. *Multifunctional correlation between 1 Leg and Romberg test with Posture in total*

Table 5. Multifunctional Linear Regression Subjects (n=67)	**P**	**Coefficient**
Age 10		
SemiTanTest / Posture	<0.01	0.288
TanTest / Posture	<0.01	0.487

Age 11		
SemiTan Test / Posture	<0.01	0.282
Tan Test / Posture	<0.01	0.459

Table 5. *Multifunctional correlation between Semi Tandem and Tandem test with Posture in total*

Discusion and Conclusion

Our intervention program that took place in children aged 10-11 years during Physical Education Class, except isometric and stretching exercises were combined also with a variety of games educating good posture behaviors. Through these exercises, we aimed to restore muscle balance by "strengthening and stretching" postural muscles. This is supported by another author emphasizing the importance of strengthening postural muscles on having a good posture and helping to cope successfully with everyday life activity by reducing the possibility to be injured. (Grissaffi, 2007)

Our study showed significant improvement of postural behaviors and better ability to keep balance on those who were part of the 12 weeks intervention program. These postural changes that manifested in the children's balance stability showed the relation between posture shape and balance.

From the results of Paired Sample Test, it is shown that the angle of postural displacement (in total) and the angle of averaged lateral shoulders or hip-pelvis displacement have changed in both groups (control and experimental groups) but it resulted significantly only for the experimental group. ($p < 0.05$)

These results clearly showed the impact of the intervention program on postural deviations correction because a significant improvement was detected on all four postural parameters that we analyzed. These results go alongside the literature which stated that physical exercises are important for postural deviations correction. (Cordeiro et al., 2014; Deutschmann et al., 2014; Misra et al., 2012; Annamaria et al., 2014; Oliver et al 2010; Byun et al, 2014; Cosma et al., 2015)

Multifunctional Linear Regression was used to identify the correlation between 8 variants of Balance Test performing (EQ -Equilibrium variable) and Posture in total (Anterior/Posterior and Lateral). By using this statistical analysis, we realized that every change in postural parameters (in total) was evidently reflected on balance ability. The results showed that these correlations are significant at $p<0.05$ and respectively $p<0.01$ between Posture Test-1 Leg, SemiTandem, and Tandem Tests and $p < 0.05$ between Posture –Romberg Test. These results are detected even at other foreign scientific studies, where it is clearly emphasized "the importance of postural correction exercises in poor posture and balance improvement". (Cordeiro et al., 2014)

Our study showed also that strength and stretching exercises are essential for a better posture shape and to maintain balance as long as you can with ought forcing yourself.

Based on these conclusions we recommend that:

Physical Education Teachers should pay more attention to the education of good posture during school time especially to children in order to provide a beneficial education for a good-looking and healthy child.

For a better life for our child, strengthening and stretching exercises should be included as soon as possible at the Physical Education Program particularly because of its two positive impacts such as Good Posture and Balance stability.

References

[1] Annamaria S., Lazáry Á., Feszthammer A., Darabosné I.T., Steinhausz V.T., Boja S., Szilágyi Á., Varga P. (2014). Application of special exercises in physical education to develop, automatize and maintain the biomechanically correct posture. Clinic Neuroscience. 92:11-19.

[2] Banfield M.A. (2000). The posture theory: some additional considerations. 11thed. Modbury, Australia: Pg.1004.

[3] Brianezi L., Cajazeiro D.C., Maifrino L.B.M. (2011). Prevalence of postural deviations in the school of education and professional practice of physical education. Journal of Morphol.Sci.Vol.28, No.1, Pg.35-36.

[4] Bomba T.O., Haff G.G. (2009). Human Kinetics.5 th edition. Periodization. Theory and Methodology of training. ISBN 13: 9780736074834. Pg. 269.

[5] Byun S., Changkyoo A., Minho K., Han D.(2014). The Effects of an Exercise Program Consisting of Taekwondo Basic Movements on Posture Correction.J. Phys. Ther. Sci.26: 1585–1588.

[6] Cosma G., Ilinca I., Rusu L., Nanu C., Burileanu A. (2015). Physical exercise and its role in a corecct postural alignment. Physical Education, Sport and Kinetotherapy Journal. Vol. 9 No. 1. Pg. 39.

[7] Dickson R.A. (2004). Spinal deformity - basic principles. Current Orthopaedics.18:411-425.

[8] Deutschmann M., Parfant H., Holzer M., Ebner G., Ivanic M., Svehlik A., Weiglein. (2014). New media supported child-oriented Pilates as the intervention to stabilize posture and to correct postural defects on pupils aged 10–12. Proceedings of Measuring Behavior.www.measuringbehavior.org

[9] Gordeiro T.L., Duarte A., Collucci A., Frade M. (2014). Baropodometer as a Clinical Tool for Evaluating and Following Treatment of Postural Deviations - A Case Report. J Spine. 3: 175.

[10] Grissaffi D. (2007). Posture and core conditioning. BOOK. Pg. 1-42.

[11] Kendall F.P., Mccreary E.K., Provance P.G., Rodgers M.M., Romani W.A. (2005). Muscles testing and function, with posture and pain. 5th Edition. Baltimore: Williams &Wilkins. Pg.480.

[12] Kratěnová J., Žejglicová K., Malý M., Filipová V. (2007). Prevalence and Risk Factors of Poor Posture in School Children in the Czech Republic. Journal of School Health Volume 77, Issue 3, Pg 131–137.
[13] Loveless M.D. (1999). Pediatric spinal deformity. Jacksonville Medicine, 6:227-229.
[14] Loots M. (1999). A multi-variate approach to posture. University of Pretoria. (Thesis - PhD.) 348 p.
[15] Latalski M., Bylina J., Fatyga M., Repko M., Filipovic M., Jarosz M.J., Borowicz K.B., Matuszewski L., Trzpis T. (2013). Risk factors of postural defects in children at school age. Annals of Agricultural and Environmental Medicine. Vol. 20, No 3, Pg. 583–587.
[16] Motow-Czyż M., Orczyk A., Marek Orczyk. (2014). Postural defects correction in the process of physical education and sport. Physical Activity Review. Vol. 2. Pg.31-36
[17] Misra A., Nigam M., Alagesan J. (2012). Effect of exercises in cervical postural deviation due to backpack in school children. International journal of current Research. Vol. 4, Issue. 08, Pg. 146-149.
[18] Markola L., Bardhyl M., Markola B., Quka N. (2016). Book. Motor Education.
[19] Oliver G.D., Heather R., Blair A., Christopher P., Dougherty D.O. (2010). Implementation of a Core Stability Program for Elementary School Children. Sports Health Care. Vol. 2 No. 6
[20] Stroebel S. (2002). The prevalence of postural deformities among children age 11 to 13 years in some Western Cape Schools. Stellenbosch: University of Stellenbosch. (Dissertation - PhD.) 130 p.
[21] Tremblay M.S & Willms J.D. (2000). Secular trends in the body mass index of Canadian children. Canadian Medical Association Journal. 163(11):1429-1433.
[22] Wiggins R.M.D.C.M & Victoria B.C. (1931). Posture in children. The Canadian Medical Association Journal. Pg. 820-825.