SCHOOL SCREENING FOR SPINE DEFORMITY WITH CLINICAL TEST AND SPINE MOUSE DEVICE

Popova Ramova Elizabeta[1,] Poposka Anastasika[2] Ramov Leonid[3]

[1]High Medical School Bitola, Department for physiotherapist education, University „St. Clement Ohridski"Bitola R. Macedonia

[2]Orthopdeic clinic, Medical faculty. Skopje, University „SS. Kiril and Methodius„ Skopje, R. Macedonia.

[3] Medical faculty, Stip, University „Goce Delcev'' R.Macedonia

Contact person: betiramova62@yahoo.com

Abstract

Background: The school screening for spine deformities is an important health activity where a large numbers of health workers, it burden with the cost of the activity itself, and the education of the staff. Bad posturesare frequent last decades, because are increasing long bad positions and physical non activity by adolescents. **The aim** of our investigation was to determinate the bad posture level among school children by clinical examination tests and spine mouse software. **Material and method**: Examination included 840 children age 6-15 years in nine classes of basic school, with examination of 4 clinical tests by standard way, and spine mouse device software.**Results**: Test was the most positive in class 2, and test 1 was positive by 75% of population. The frequency of positive tests by classes was not significant $p>0.05$, but percentage of total children by positive tests was significant. **Conclusion:** Tests for School screening are only qualitative measurement and are not used for condition evaluation itself, spine mouse devise is significant for early detection of bad posture by school children.

Key words: school screening, spine deformity, software.

Introduction

Spine deformities'school screening is an important health activity where a large numbers of health workers and employers in the Ministry of Health and Ministry of Education are included[1,2]. The health activity is a burden with a cost of activity itself, staff education, which made the screening and attitude of society towards this activity. Idiopathic scoliosis is a tri-dimensional developmental deformity of the spine. It affects about 2-3% of adolescents population[3,4,5]. The bad posturesare frequent in last decades is increasing because long bad positions and physical non activity by adolescents are more frequents. The 10% of bad postures are not treated for 3-6 months and could increase the curve from 5-50%, from the beginning[6]. The gold standard for diagnosis of scoliosis and bad posture is a x-ray imaging, however children are not exposed to it for screening for them in school screening examination[7,8.]

In the process of early detection questionnaires and clinical monitoring have been included[9,10]. The clinical examination has several limitations, such as the subjective participation of the examiner and the lack of qualitative measurement and evaluation of in a given period. There have been attempts for founding new technical possibilities of the curve measurement[11].

In addition to the already existing percutaneous methods, the importance of the radiographic image is huge and for now it can be used for determination only of the size of the curves in frontal and sagittal plane, but, on the other hand, it is with a great dose of radiation and it cannot be repeated earlier than 6-12 months. There have been continuous efforts and constant development of the technical possibilities for percutaneous diagnostic procedures and observation of the conditions over the last several decades[12]. Ten years ago a software program Spine mouse was applied for the first time[13,14].

The purpose of our investigation was to determinate the level of bad posture among school children at the basic school by clinical examination tests and spine mouse device.

Material and methods

The study has been performed with the approval of High Medical School in Bitola, Department for physiotherapist education and Ministry of Education. Agreements of school principal and parents were required prior to examination. Examination included 840 children between 6-15 years old in nine classes of basic school. Questionnaire with personal data of the child, his/her age, attending grade, which was completed by the parent together with the signed permission for participation in the examination.The spine'sclinical examination included four tests. Test 1-higer set shoulder, Test 2- Adams test for back asymmetry, Test 3- test by Matthias, Test 4-for shorter pelvifemoral muscles. Test was made in front of special Schroth's background, for determination of asymmetry in frontal and sagittal plane. Each test was noted like positive or negative. Examination with the percutaneous software program Spine mouse is significant for determination of the differences from the normal curves in sagittal plane and the appearance of weakness of the back muscles (14,15). The software is standardized to present the differences from the physiological values of the curves according to sex and age. The software is characterized with absence of X-ray, small dimension, ergonomic design and compatible Microsoft Office for the execution of the recording. The child is put in the position of the test by Mathias and he/she is recorded immediately; he/she remainsin the same position for 60 seconds; then the recording is repeated. When there is weakness of the back muscles, the curves in the sagittal plane are emphasized and the software detects them. The statistical analyze of data was made with Chi square test and significance of $p<0.05$.

Results

Distribution of school children by sex and classes is shown in table 1. Chi square $Hi^2=12.54$, $p>0.05$ therearen't diferences in distribution by sex and ozall population can be analyzed like homogenic.The positive tests 1-4, by sex and classes are shown in table 2 and figure 1.

Tab.1 Frequency of school children by sex and classes

Class	Total	male	Female
1	93	51	42
2	60	31	29
3	88	39	49
4	94	44	50
5	82	46	36
6	92	41	51
7	106	46	60
8	100	51	49
9	106	55	51
X±SD	91.22±14.12	41.88±7.27	46.33±9.24
Total	821	404	417

Tab.2 Distribution of positive tests by classes

classes	n	T1	%	T2	%	T3	%	T4	%
1	93	59	63	41	44	66	71	28	30
2	60	49	82	36	60	43	72	25	42
3	88	77	87	47	53	47	53	33	37
4	94	71	75	42	45	51	54	31	33
5	82	59	72	30	36	46	56	29	35
6	92	64	69	32	35	66	72	46	50
7	106	76	72	47	44	65	61	39	37
8	100	79	79	33	33	64	64	39	39
9	106	81	76	34	32	64	60	44	41
Total	821	615	75	342	42	512	62	305	37
X±SD	91.22±14.12	68.33±11.1		38±6.4		56.88±9.85		33.77±7.46	
		T=5.4 P<0.01		T=12.34 P<0.01		T=10.98 P<0.01		T=6.9 P<0.01	

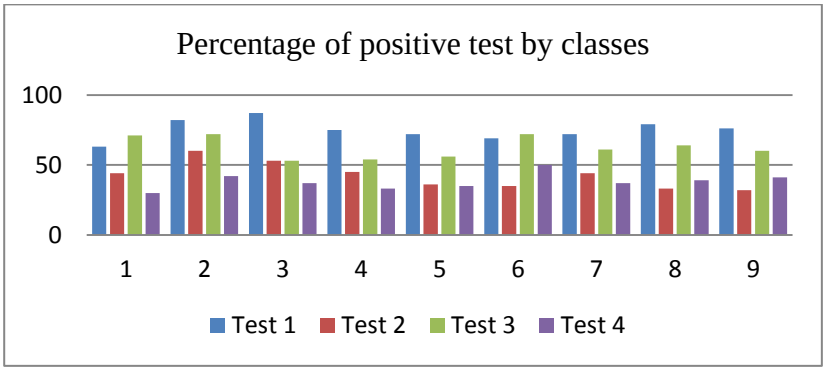

Fig.1 Percentage of positive test by classes

Clinically positive tests presented in gradess how negligible representation for all tests. The significance of positive tests was tested with chi square test. Test.1, $Hi^2=1.59$, $p>0.05$, Test.2, $Hi^2=4.67$, $p>0.05$, Test.3, $Hi^2=2.56$, $p>0.05$, Test.4, $Hi^2=4.54$, $p>0.05$. The percentage of positive tests from total is showedin Test 1(75%), Test 2 (42%), Test 3 (62%), and Test 4 (37%). Testing the percentege of positive test from total children with T=test is showing significants. T1, $t=5.4$, $p<0.05$; T2, $t=12.34$, $p<0.05$; T3, $t=10.98$, $p<0.05$; T4, $t=6.9$, $p<0.05$. Percentageof positivetests isdisplayedinfigure 1.Test 1 is highest in class 2 and 6, test 2 in class 3, test 3 in class 1,2 and 6, and test 4 in class 2 and 3. Class 2 has the most positive test 1, 3 and 4.

The results of the clinical examination for deformities in sagittal plane or bad posture and of the examination with the software in position of Mathias are shown in Table 3.

The significance of frequency by grades has been tested with the differences of proportions T=test. The frequency of children examined both with the clinical test and

the software is significant. The Clinical test 3 and examination with software in position of test 3 are showing in figure 2 and 3.

Tab.3 Freqentation of children with positiv Mathia´s test with clinical examination and examination with softwere

Classes	Total	Pozitive Mathia´s test	Hyper Kyphosis with Spine mouse
1	93	66	21
2	60	43	15
3	88	47	25
4	94	51	28
5	82	46	43
6	92	66	18
7	106	65	45
8	100	64	30
9	106	64	39
Total	821	512	264
X±SD	91.2±14.1	56.9±9.8	29.3±11
%	100	62	32
T- test		T=9.6 p<0.05	T=7.84 p<0.05

Fig.2

Fig.3

Fig.2 Clinical examination with test 3

Fig.3 Examination of test 3 with software

The percentage of clinical test 3 is 62%, and by software examination is 32%. This is significant tested with differences of proportions T=8.9, p<0.05.

Discussion

In Grivass[15] study, representation of structural scolios is higher in smaller curvature> 5 degrees (4.9%), while those of 10degrees (2.9%). The prevalence is higher among women, and in our study there is no difference of the test population by sex. The proportion of positive tests in our population was with the highest percentage in the second grade.

Scolios is quality examinations are defined in 1960 and published in the orthopedic medical community[16]. Test 1and 2are standard and test 3 is lately included for curves in sagittal plane[17]. Test1 maybe afalse positive if there is igallitet in lower limbs and better performed in sitting position on a flat surface[18]. The body balance and CNS role are important for deviations in handat the time of examination, dysfunctions of this system could result for this test to be false positive, no pathological findings on spine[19,20].

Test 2, with asymmetries greater than 5mm is relevant for structural scoliosis' occurrence and could be measured with scoliometer, but this measureis not correlated with size of bend x-ray imagese as measured in two different planes[21,22,23,]. Grivass and al. investigated the dorsal asymmetry in healthy children and concluded that the appearance and early detection do not depend for future deformity[23]. This test is not significant, compared with stereographic metermeasurement[20]. Dorsal asymmetry maybe due to developments of adipose tissue, muscles and bones and is not same for all people. Tests1 and 2 were represented at our population with 75% and 42%, note this asymmetry.

Observed from 3-D analysis, spine deformities require analysis in sagittal plane[24]. Postural or physiological curves show a diurnal variations due to anti gravity muscles fatigue. Deformity is more prominent in the afternoon hoursand during 7 minutes carrying a heavy load 8kg[25,26]. Postural dysfunctions are one of the faults for scoliosis development.

The school screening examination is being practiced in many countries in the world for early detection and prevention of the development of one functional deformation into structural[27,28,17]. The quantitative measurement of the curve in its conclusion is significantly possible only with a radiographic image and the patients are disposed to x-ray[29]. There have been attempts for enhancement of the percutaneous methods for indirect determination of the size of the curves[11]. In our research we encountered children with distinct curves in the sagittal plane discovered as a positive clinical test as well as a distinct spine kyphosis found out with the software examination. Since the software is significant for examination of curves in a sagittal plane as compared to the x-ray image, the frequencies of presence from the software have to be accepted. Consequently, the frequency of children with distinct spine kyphosis and weakness of the back muscles would be 32% instead of 62% discovered with the clinical examination in our research. As reported in the literature the software program was used for the first time in 1997. Since then, the published articles have presented the significance of its application in measuring of the spine curves and its mobility both in children and in adults with different spine diseases[13,14,29,30,31,32,33]. Only in one article the significance of the software program was compared with the radiographic images as a measure for determination of the size of the curve in sagittal and frontal plane[34,35]. The authors of this article have emphasized that this software is significant for curve

determination in a sagittal plane and for confirmation of the scoliosis curve further investigations are necessary.

Regarding the cost of the examination of the spine deformities as a screening program, we found out that they have not been practiced in Great Britain because they burden the health system[22]. In the United States there are large population examinations, but these are primarily clinical examinations with tests, topographometry and questionnaires[34]. In Japan this kind of examination is regulated by law and is executed with clinical survey, questionnaire and percutaneous methods that contain a low dose X-ray radiation, but there are no unified methods[19]. In Australia the screening examination is made by the parents with instructions from leaflets distributed through the school[35]. In Macedonia general systematic examinations regulated by law are performed in elementary schools every 24 months. The general systematic examination is made by a general practitioner and a nurse and it also includes an examination of the muscular spinal system (spine, feet and chest)[2]. These examinations help to discover children having bad posture. The detection is based on a qualitative conclusion of presence or absence of positive finding without quantitative determination of the size of the curve. The differences of proportion from two different methods for test 3 are significant. In clinical examination test 3 can be positive, if test 4 was positive. Examination with software excluded this possibility.

The introduction of percutaneous methods and unified questionnaires might enable monitoring of the situation of the verified cases of increased chest kyphosis and lordosis as it was done in our research with or without treatment, in time intervals shorter than 12 months.

Conclusion

School screening examination for spine deformities with clinical tests is only qualitative conclusion at the point of examination with no possibility for deformity monitoring and its evolution. Tests could be reportedas positive by many external and internal factors of the individual. Radiographic examinations should not beused, if other percutaneous methods do not have quantitative measurements seems to be statements too.

Frequency of children with bad posture is significant and it has been confirmed both with the clinical examination and with the software examination.

The software program is easy for application, but its drawback is in its use by only one examiner, which results in low speed rate for examination of a large population and this is an important feature of this type of examinations.

References

1. Douglas D.2008. Routine scoliosis screening of dubious value. Pediatrics. 121:9-14.
2. The low of health care in Macedonia. Pupblic newspaper of Macedonia 2008.: 46/1993,55/1995, 10/2004,84/2005,111/2005,65/2006,5/2007,77/2008.
3. Watanabe S, Eguchi A, Kobara K. et all. 2008. Influence of trunk muscle contraction on spinal curvature during sitting reclining against the backrest of a chair. Electromyogr Clin Neurophysiol. 48(8):359-65.

4. Al-Arijani, Al-Sebai MW, Al-Khawashki HM et al. 2000. Epidemiological patterns of scoliosis in a spinal center in Saudi Arabia. Soudi Med J.21(6):554-7.
5. Weinstein.SL., Dolan.LA., Cheng.JC., et all. 2008. Adolescent idiopathic scoliosis.Lancet. 371(9623):1527-37.
6. Hawes CM, Brien JPO. 2006. The transformation of spinal curvature into spinal deformity: pathological processes and implications for treatment. Scoliosis. 1:3.doi:10.1186/1748-7161-1-3.
7. Goldberg CJ, Moore DP, Fogarty EE et al. 2006. Adolescent idiopathic scoliosis:metric analysis of the deformity. Stud Health Technol Inform.123:109-16.
8. The national self-Detection Program for scoliosis. http://www.scoliosis.australia.org/self detection program.
9. Kotwicki.T., Kinel.E, Strylo.W.,et all. 2007. Estimation of the stress related to conservative scoliosis therapy: an analysis based on BSSQ questionnaires. Scoliosis.3;2:1.
10. Shelton.YA. 2007. Scoliosis and kyphosis in adolescents: diagnosis and management. Adolesc Med State Art Rev. 18(1):121-39.
11. Vrtovec. T., Pernus.F., Likar.B. 2009. A review of methods for quantitative evaluation of spine curvature. Eur Spine J. 913-41.
12. Schumann.K., Püschel.I., Maier-Hennes.A. et al. 2008. Postural changes in patients with scoliosis in different postural positions revaled by surface topography. Stud Health Technol Inform. 140-3.
13. Berrgyman.F, Pynsent.P, Fairbank.J, et all. 2008. A new system for measuring three-dimensional back shape in scoliosis. Eur Spine J. 17(5):663-72.
14. Kellis E, Adamou G, Tzilios G,. et all. 2008. Reliability of spinal range of motion in healthy boys using a skin-surface device. J Manipulative Physiol Ther. 31(8): 570-6.
15. Barrios C, Perez-Encinas C, Maruenda J et al. 2006. Significant ventilatory function restriction in adolescent with mild or moderate scoliosis during maximal exercise tolerante test. Spine. 31(3):1512.
16. Negrinin S, Carabalona R. 2006.Social acceptability of treatments for adolescent idiopathic scoliosis:a cross-sectional study.Scoliosis.1:14.
17. Grivas TB, WadeMH, Negrini S et al. 2007. SOSORT consensus paper:school screening for scoliosis: Where we are today?.Scoliosis.2(1):17.
18. University of IOVA Hospital and clinics. School screening Program (http://www.uihea.lthcare.com/depts/medmuseum/wallexhibits/school/present/detection.html.webside).
19. Takemitsu Y, Harada Y, Ando M. 1978. Incidence of scoliosis in Japan by mass screening examination of school children. Orthop Trans.2:278.
20. Torelli G, Nordwall A, Nachemson A.1981. The changing pattern of scoliosis treatment due to effective screening. J Bone Joint Surg Am. 63:337-41.
21. US preventive service Task Force.2004. Screening for idiopathic scoliosis in adolescents. Recommendation statement. Agency for Healthcare Research and Quality.
22. Mirtz TA, Thomson M, Greene L et al. 2005. Adolescent idiopathic scoliosis screening gor scoliosis community, and clinical health promotion practice ulizing the precede-proceedmodel. Chiropr Ostepat.13:25.
23. Grivas TB, Vasiliadis ES,O'Brien JP. 2008. How to improve the effectiveness of school screening for idiopathic scoliosis. Stud Healt Technol Inform.135:115-21.

24. Grivas TB, Vasiliadis ES,Maziotou C et al. 2006. The direct cost of ,,Triasio school screening program. Scoliosis.2:7.
25. Crista Lehrent-Schrot. Dreidimensionale Skoliosebehandlung. 1998.Gustav Fischer. ISBN 3-437-21070-X.page:76-83.
26. Burwell RG, Aujla RK, Freeman BJC et al.2000. Patterns of extra spinal left-right skeletal asymmetries in adolescent girl with lower spine scoliosis:relative lengthening of the ilium on curve concavity and of right lower limb segments. Spine.15(18);2358-63.
27. Wong.HK., Hui.JH., Rajan.U., et all. 2005. Idiopathic scoliosis in Singapore schoolchildren: a prevalence study 15 years into the screening program. Spine. 30(10):1188-96.
28. Goldberg.CJ., Moore.DP., Fogartv. EE., et all.2008. Scoliosis: a review. Pediatric Surg Int. 24(2):129-44.
29. Portek.I, Pearcy MJ, Reader GP., et al. 1983. Correlation between radiographic and clinical measurement of lumbar spine movements. Br J Rheumatol.(22):197-205.
30. Mannion F.A., Dvorak J., Muntener M., et al.2005. A prospective study of the interrelationship between subjective and objective measures of disability before and 2 months after lumbar decompression surgery for disc herniation. Eur J Appl Physiol.4:454-65.
31. Mannion F.A, Knecht K., Balaban G., et al. 2004. A new skin-surface device for measuring the curvature and global and segmental ranges of motion of the spine: reliability of measurements and comparison with data reviewed from the literature. European Spine Journal, Springer-Verlag Heidelberg. Vol.13.No.2:233-38.
32. Post.B.R., Leferink.JM. 2004. Spinal mobility: sagittal range of motion measured with the SpinalMouse, a new non-invasive device. Arch Orthop Trauma Surg. 124:187-92.
33. Ripani M, Di Cesare A, Giombini A et al. 2008. Spinal curvature: comparison of frontal measurements with the Spinal Mouse and radiographic assessment. J sport Med Phys Fitmess. 48(4):488-94.
34. US preventive service Task force.2004. Screening for idiopathic scoliosis in adolescents. Recommendation statement. Agency for Healthcare Research and Quality.
35. Hecker EJ, Feria de Sakud.2009. Implementation and evaluation of a c ommunity wide health fair. Pub Health Niurs.17:247-56.