MODERN METHODS OF DIAGNOSIS AND REHABILITATION OF POSTURAL DEFORMITIES

(Research note)

Stamenka Mitova, Daniela Popova and Maria Gramatikova
South-West university “Neofit Rilski” Faculty „Public Health and Sports”, Department of “Sport and physical therapy „., Blagoevgrad, Bulgaria

Abstract
In recent years significantly increased the frequency of postural deformities in children during growth spurts. The global problem is not new, but increasingly raises the question of greater frequency and severity of these deviations. Early detection and proper diagnosis of postural disorders may prevent negative consequences and to ensure smooth functioning of the growing organism. Regular check of the stand is inalienable requirement in view of the timely detection of deviations. Significant differences in the assessments of postural deformities in children, many authors attribute to the lack of a unified methodology of study and clear criteria for diagnosis. The aim of this report is to analyze and diagnose the early changes and deformations of the musculoskeletal system with a system GPS100 in children of 9-12 years and approbate rehabilitation program. The study included 229 children aged from 9 to 12 years. The experimental method was applied. The system allows for standardization, objectivity and accuracy in the diagnosis and follow-up of treatment is applied in a number of pathologies.

Keywords: system analysis, postural disorders, children spinal deformities, correlation

INTRODUCTION
Postural deformities continue to be one of the most complex nosologies in modern orthopedics. Studies on the incidence and the outspread showed a continued increase of the values, while the age of the affected children constantly fall. The complexity of the problem is determined not only by the prevalence of the disease, striking the child’s body, but by subsequent dysfunction of organs and systems. Stand and the body posture, their maintenance and education depends on the correct form the spine of the proper functioning of the muscle’s strength, even the distribution of muscle-power, ie the harmonious work of all the muscles involved in the movement of the spine (Mitova, Popova & Gramatikova, 2015). Postural disorders are changes in motor habit to stand. Initially, the changes in the normal posture have a functional character, but in the absence of proper correction lead to permanent structural changes, primarily in the spine. Spinal deformities are permanent deviations from the normal shape of the spine. Curvature of the spine in a lateral direction (scoliosis) can be a deviation from the center line to the left or right depending on in which direction is the projection distortion (Popov (Honor), 2006). Deformities represents strain of the muscles of the foot, expressed fall in the transverse and / or longitudinal arch of the foot. In the presence of a flatfoot the center of gravity has changed as well as the statics of all units of

the human body’s cranial chain - calves, thighs, hips, the spine. Together with the altered gait and missing shock absorber function of the foot contribute to excessive overload on the knees, hips and spine. As a result, these structures receive one joint and muscle hypertension, which leads to dull pain when walking (Mitova, 2015).

Assessment of posture, there are many gauges (Figure 1). Over time, some are rejected, others are perfect, and others have arisen with the development of technology and are completely different from the previous ones.

Figure 1. Different ways of assessment off posture

GPS 100 is an innovative system for postural and plantar analysis, allowing for standardization, objectivity and accuracy in the diagnosis and follow-up of treatment and is applied in a number of pathologies. Postural analysis system in kinesitherapeutic practice allows the creation of a database for research and defined standards toward the normalization of the stand. Toward the diagnosis and determination of rehabilitation
treatment, the following screening methods are used: history, inspection, palpation, santimetry of lower limbs and plantograma feet, tested tear muscles, the mobility of the spine is explored as well as other special tests are applied (Mitova, 2015).

METHODS

The aim of the study is to analyze and diagnose early changes and deformations of the musculoskeletal system with a system GPS100 in children of 9-12 years as well as the approbate rehabilitation program. The tasks of the study are as following: to diagnose and analyze the early changes and deformations of the musculoskeletal system with a system for GPS100 and to make plantar postural analysis and to develop and approve rehabilitation program to determine the effectiveness of the experimental model of rehabilitation.

To achieve the objective and tasks of the planned study, the GPS100 system method was applied before and after the implementation of the rehabilitation program. The survey conducted from May 2014 to the month of March 2015 in Blagoevgrad after signing the written consent.

This study involved 229 children aged 9 to 12 years. The study was conducted at the Eighth SC in Blagoevgrad after parent’s signing of the written consent. To establish the existence of postural disorders we used an innovative system for postural analysis and plantar GPS100.

Methods of kinesitherapy: The main goal of our methodology was the correction of incorrect scoliotic posture and deformities, creating the habit of properly body posture, maintain and improve the function of the spine.

The main tasks of kinesitherapy:
- Positive psycho-emotional impact to motivate children to actively and willingly participate in the activities,
- Restore muscle balance and increase the muscle strength,
- Increased static-strength endurance of extensors of the spine, abdominal, chest, buttock muscles and the muscles of the shoulder girdle and the neck,
- Improving the strength of muscles supporting the arch,
- Building and reinforcing the habit for properly body posture, creating the habit of correct position of the feet when standing,
- Improving the function of the respiratory system and training in proper breathing,
- Improve the static and dynamic control of the spine.

The experimental method involves:
- proprioceptive workout - elastic bands, football, balance board multiaktiv stone (balance, strength, endurance, increases the sensitivity and the proprioceptive neuromuscular control), increased the dynamic joint and muscle stability),
- analitical workout - applied imitation exercises,
- gait and properly body posture dosed exercise, isometric and isotonic resistance in aerobic mode, passive and active stretching exercises, strength and endurance without and with appliances (football, elastic strips),
- masazh (reflex response of the disease process, improve blood circulation and limfoobrashtenieto leg and foot, increase muscle tone, supporting the arches of the foot; normalization (decrease) tone m. triceps surrae; eliminate pain, reduce fatigue).
- Manual mobilization - mobilization of the joints (Shopartova) of the body (Kraev & Popov (Krapev & Honon), 2009); traction dorsal mobilization of tarsus bones (Kraev & Popov (Krapev & Honon), 2009); rotary slide of the lisfranc body (Zhelev (Jelev), 2011); mobilizational stretching - stretching and joint mobilizations coadministration - in body crural (dorsoventral sliding and distraction) and subtalar joints (distraction and medial and lateral sliding). The basic guidelines are maintaining the affected ankle trophic and maintain the joint and muscle integrity, which led to an increase in the dorsal and plantar flexion, and inversion and the eversion.

In the experimental group we applied the developed rehabilitation program for prevention and control of the postural disorders. It includes a system of exercises generally developing by the character and special trainings methods of correctional nature, exercises with Swiss ball and balance board, exercises with elastic resistance massage. The age and the individual characteristics of the children were taken into account during the research. The exercises are performed with various appliances, the speed of the performance was moderate, and the load - an average. The selection is made considering not to increase the rotator mobility of the spine in order to avoid progression of the scoliosis. Our work was in line with the level of physical fitness, physical development and functional capacity of the neuromuscular system. We worked on strength endurance of the shoulder girdle, para-vertebral, abdominal and gluteal muscles. We load the back muscles with isometric muscle contractions, avoiding hyperextension of the spine to prevent the deepening of incorrect scoliotic posture.

The complex of exercises began with the application of imitation exercises, proper body posture and gait, with an emphasis on proper body posture, the key position of head with retraction of the chin, proper abdomen posture etc. Breathing exercise of different starting points, combined with the movements of the limbs. Symmetrical exercises in isometric mode from different starting positions - occipital leg with the knees bent, legs side by the side, knee support, as well as isometric exercises with the „Theraband“ - bands with resistance, consistent with the child’s development - a dorsal, ventral, gluteal muscles and the muscles of the shoulder girdle. Also were included exercises with a Swiss ball and balance board enshrined in the proposed methodology which does not allow long and static loads of the spine, jumps and sudden movements.
RESULTS AND DISCUSSION

This study involved 229 children aged 9 to 12 years of them boys 115 (50.22%) and 114 girls (49.78%). The survey conducted from May 2014. to the month of March 2015. We applied the examinations system GPS100 (Figure 2.) for postural and plantar analysis (Table 1.) of 229 children, then had separate group of 46 children (Table 2.) for the approbation of the rehabilitation program.

GPS100 system provides an opportunity for standardization, objectivity and accuracy in the diagnosis and follow-up of the implementation of the rehabilitation program. The system for analysis of the posture is composed of several units and software that enables acquiring images for the measurement of body parts, as well as information relating to the distribution of the weight, center of gravity and stability toward the patient to be examined.

Percent of detected spinal deformities in children studied was 16.60%, with 22.27% - deviations from the correct posture. Of these girls with poor posture were 12.23% and 10.04% boys. In 10.04% of the girls were found spinal curvature, and 6.56% within the boys. Proliferation of deformities in the studied children was 3.06%, and with lower vault - 14.84%. Of these girls with a flatfoot - 0.44 percent and 2.62 percent boys. At 6.98% of the girls had seen a lower arch and 7.86% for boys.

Correlation analysis between spine curvatures and deformities in the respondents: the correlation analysis was performed in all 229 persons. Weak correlation is established between the spinal deformities and the flat feet (Figure 3.) in the studied children with a correlation coefficient of Spearman r = -0.03 and 95% and the confidence interval (0.165 to 0.102).

The rehabilitation program approbation was attended by a total of n = 46 children, by mean age (± SD) 11 ± 1.1 years. Of these, n = 24 girls and n = 22 boys. The number of children is different, depending on how many of the respondents have given written consent to participate.

<table>
<thead>
<tr>
<th>Ages</th>
<th>Sex</th>
<th>Improper posture %</th>
<th>Spinal deformities %</th>
<th>BO%</th>
<th>Fallen vault %</th>
<th>Flat foot %</th>
<th>BO%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 age</td>
<td>F</td>
<td>3.93%</td>
<td>2.62%</td>
<td>9.61%</td>
<td>3.49%</td>
<td>-</td>
<td>12.66%</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>3.49%</td>
<td>1.75%</td>
<td>8.73%</td>
<td>2.62%</td>
<td>-</td>
<td>11.35%</td>
<td>32</td>
</tr>
<tr>
<td>10 age</td>
<td>F</td>
<td>4.37%</td>
<td>2.18%</td>
<td>7.42%</td>
<td>0.87%</td>
<td>-</td>
<td>13.10%</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>0.87%</td>
<td>1.75%</td>
<td>8.73%</td>
<td>0.87%</td>
<td>1.31%</td>
<td>9.17%</td>
<td>26</td>
</tr>
<tr>
<td>11 age</td>
<td>F</td>
<td>2.18%</td>
<td>1.75%</td>
<td>5.68%</td>
<td>1.31%</td>
<td>-</td>
<td>8.30%</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>2.62%</td>
<td>-</td>
<td>8.73%</td>
<td>1.75%</td>
<td>-</td>
<td>9.61%</td>
<td>26</td>
</tr>
<tr>
<td>12 age</td>
<td>F</td>
<td>1.75%</td>
<td>3.49%</td>
<td>4.80%</td>
<td>1.31%</td>
<td>0.44%</td>
<td>8.30%</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>3.06%</td>
<td>3.06%</td>
<td>7.42%</td>
<td>2.62%</td>
<td>1.31%</td>
<td>9.61%</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22.27%</td>
<td>16.60%</td>
<td>61.12%</td>
<td>14.84%</td>
<td>3.06%</td>
<td>82.10%</td>
<td>229</td>
</tr>
</tbody>
</table>

Correlation analysis between spine curvatures and deformities in the respondents: the correlation analysis was performed in all 229 persons. Weak correlation is established between the spinal deformities and the flat feet (Figure 3.) in the studied children with a correlation coefficient of Spearman r = -0.03 and 95% and the confidence interval (0.165 to 0.102).

Rehabilitation program approbation at 43.48% of children with poor posture, 56.52% of children with scoliosis of the 1st degree. At 21.74% was diagnosed a lower vault with 8.70 percent deformities. After applying the 9 months of rehabilitation program children were re-measured by the system GPS100. In 34.78% of the children we observed with poor posture, scoliosis at 28.26% of 1st level and 36.96% of the children stated correctly body posture. At 15.22% was diagnosed lower arch and deformities at 4.35%, while 10.87% - without specifics.

Table 1. Distribution of postural disorders by age and gender made by the examination system GPS100
CONCLUSIONS

Full motor recovery of children with deformities of the musculoskeletal system is directly related to and depends on the proper selection and proper organization of the applied kinesitherapeutic tools and methods. Along with their proven effectiveness, the physiotherapy techniques increasingly need the health promotion and prevention by modern approaches toward development and introduction of kinesitherapy in preschool and school age children. The safeguards should take the lead in combating the postural deformities. Regular, competently carried out examinations and precise documentation of deviations detected in order to later comparisons are crucial.

The GPS100 system for postural and plantar analysis allows standardization, objectivity and accuracy in the diagnosis and follow-up of treatment is applied in a number of pathologies. System and plantar postural analysis of the kinesitherapeutic practice allows making of a database with the research data, defining standards for normalization of the posture. All endangered children must be directed to conduct special gymnastic exercises. In more severe deviations must look up for help of an orthopedic specialist.

REFERENCES


Correspondence:
Stamenka Mitova
South-West University „Neofit Rilski”
Department „Sport and physical therapy“
Str. “Ivan Mihailov” 66, 2700 Blagoevgrad, Bulgaria
E-mail: stami80@abv.bg