

Motor actions formation in 3-4-year-olds with down syndrome: efficient progress test and monitoring set

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Abstract

Objective of the study was to develop a progress test and monitoring set to track the motor skills formation process in the 3-4-year-olds diagnosed with Down syndrome.

Methods and structure of the study. The progress test set was subject to an experimental study at "Sunny Children" NGO centers in the Yekaterinburg, Kamens-Uralsk, Verkhniaya Pyshma, Revda, Berezhovskiy and Zarechny affiliates (Sverdlovsk Oblast). We sampled for the tests the 3-4 year-olds diagnosed with Down syndrome (n=40) and concomitant diseases including minor cardiac defects and visual and hearing impairments. The kids were sampled on the family consents for the tests and personal data processing. Most common among the concomitant diseases are the cardiovascular system ones.

Results and conclusion. The three-stage progress test and monitoring system makes it possible to timely find the children having specific problems/ needs in the motor skills mastering process in every group and focus the adaptive physical education instructors' service on their developmental challenges. A special attention in the set of the motor skills development service should be paid to whether or not the child shows an interest in active games and physical exercises, with the interests rated by teachers' monitoring in the training process. Test sessions will be run at least three times a year to fairly profile the individual motor progress. Such test and monitoring service should be designed to adequately rate the individual movement quality and controls versus the group- and age-specific standards.

The monitoring and test service is commonly considered the most productive and informative progress rating method in the adaptive physical education / health service for this health group. This service will help the adaptive physical education instructor concentrate on the key aspects to timely and efficiently design and manage the service on an individualized basis. Such test and monitoring service helps analyze the adaptive physical education service benefits and drawbacks on a timely basis to attain the interim and final progress goals for success.

Keywords: Down syndrome, motor actions, adaptive physical education.

Background. Down syndrome is ranked among the most usual chromosomal aberrations diagnosed in 0.1% of the newborn population by the national statistics [1]. Thus the Sverdlovsk Oblast health statistics report around 30-35 Down-syndrome-diagnosed newborns every year. The syndrome includes delays and disorders in psychomotor and speech functions associated with a range of congenital malformations. This is the reason why the motor functionality variations are given a special priority by the mental and physical development test sys-

tems. For success in the highly coordinated complex motor skills formation process, the kids need to master their basics as a foundation for their further progress. There is a commonly known and accepted fine/ gross motor skills formation sequence customized to the natural mental and physical development process stages and terms. A key logic of this process is that the motor skills set formed in some stage should provide a foothold for the next motor skills formation stage [4]. Theoretical and practical analyses of the Down-syndrome-diagnosed kids'



socializing processes have demonstrated the relevance and significance of these issues. The global research community is still in need of specific and successful physical development control methods, albeit the existing integrated rehabilitation systems within the common adaptive physical education service are still known to somewhat facilitate harmonious development of the Down-syndrome-diagnosed children [6].

Objective of the study was to develop a progress test and monitoring set to track the motor skills formation process in the 3-4-year-olds diagnosed with Down syndrome.

Methods and structure of the study. The progress test set was subject to an experimental study at "Sunny Children" NGO centers in the Yekaterinburg, Kamensk-Uralsk, Verkhniaya Pyshma, Revda, Berezovsky and Zarechny affiliates (Sverdlovsk Oblast). We sampled for the tests the 3-4 year-olds diagnosed with Down syndrome ($n=40$) and concomitant diseases including minor cardiac defects and visual and hearing impairments. The kids were sampled on the family consents for the tests and personal data processing. Given on Figure 1 hereunder are the consolidated health data of the sample.

Most common among the concomitant diseases are the cardiovascular system ones including atrial septal defect (65% of the sample); gastrointestinal diseases (duodenal atresia, Hirschsprung's disease, atresia of the anus): 21%; hearing impairments (conductive and sensorineural hearing loss): 19%; visual impairments (strabismus, congenital cataract): 51%; and congenital hip dislocation: 49% of the sample. Each child was diagnosed with at least two concomitant diseases with secondary abnormalities of different origins. We sampled the 3-4-year group with respect to the known research

data on the Down syndrome in four-minus year-olds normally associated with heavy underdevelopments of the key mental functions (memory, thinking, speech), followed by some progress in the mental functions and their versatility range since 4-5 years of age [5].

Zhiyanova P.L. reports an interesting correlation between the cognitive progress and gross motor skills formation progress. Progress of the Down-syndrome-diagnosed kids, in her opinion, is hampered by poor bodily sensitivity that adversely effects every movement quality and the motor controls on the whole [2]. She mentions that the Down-syndrome-diagnosed children with hypotension may suffer from inadequate limb straightening, imbalances, poor joint controls, inadequate co-contraction (i.e. counter muscles contraction disharmony around the joint), inadequate proprioceptive postural and movement controls, joint hyper-mobility, etc.; with the children normally tested with serious postural control issues. However serious are the latter, the children are still normally driven by natural progress needs and striving to master the key movements making resort to a range of compensatory mechanisms including the Down-syndrome-specific symmetrical poses and monotonous symmetrical motor patterns [3]. Therefore, the adaptive physical education service to the Down-syndrome-diagnosed children will include the most efficient developmental exercises, based on the prior motor skills statuses and staged/ interim efficiency rating tests, to facilitate the individual progresses.

Results and discussion. We believe that the Down-syndrome-diagnosed kids' motor skills rating criteria need to factor in their individual psychophysical and socializing progress profiles. We engaged experts to rate the motor skills in the sample versus the elementary motor skills quality

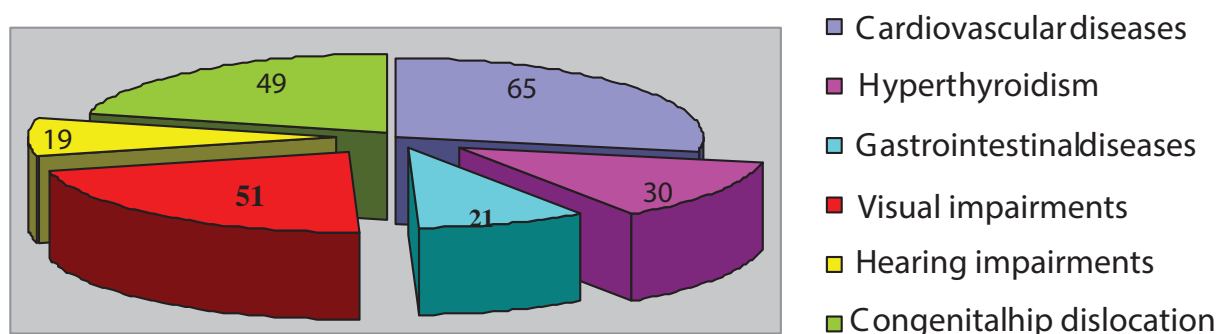


Figure 1. Consolidated health data of the sample ($n=40$): concomitant diseases, %

**Table 1. Motor skills test report (excerpt)**

Motor skills test	Scores, points									
	0			1			2			Total
1. Go upstairs alternating legs on every step										
2. Walk fast downward on a moderately steep slope holding an assistant's hand										
3. Make a few standing jumps holding hands on a support										
4. Make standing jumps without a hand support										
5. Catch a light middle-size ball flying straight to the hands from 1m distance										
6. Throw with the both hands a light middle-size ball to the partner										
7. Kick the ball in front of you without a support/ assistance										
Total score:										

benchmarks, with the classified execution errors. The motor skills were grouped into the key skill groups to have them tested and ranked as follows: unformed, partially formed and formed skills were rated by 0, 1 and 2 points, respectively: see the Table hereunder.

The above test set makes it possible to rate the final and interim adaptive physical education system efficiency for the whole period, with test service including the prior, interim and final tests at least. Note that due to the physical development rates of the Down-syndrome-diagnosed children varying in a wide range, they may not always be benchmarked versus the standard. The individual progresses from the interim to final tests will be computed by the formula: $N = X / Y$, where N is the current test result in points, X is the current test result in the relevant physical units, and Y is the prior test result in the physical units.

This approach considers the motor skills formation service as geared to transform the child's mental and physical statuses on a harmonized/ integral basis. The prior tests will rate the children's developmental statuses and needs to design the correctional service on an individualized basis. The final tests will track the individual progress in the motor skills to see if the actual results match with the expectations. And the interim tests will be designed to rate the staged progress and make necessary adjustments on the way. On the whole the test set should facilitate the efforts to design and manage the individual = physical education service route for the mental and physical progress.

Conclusion. The three-stage progress test and monitoring system makes it possible to timely find the children having specific problems/ needs in the motor skills mastering process in every group and focus the adaptive physical education instructors' service on their developmental challenges. A special attention in the set of the motor skills development service should be paid to whether or not the child shows an interest in active games and physical exercises, with the interests rated by teachers' monitoring in the training process. Test sessions will be run at least three times a year to fairly profile the individual motor progresses. Such test and monitoring service should be designed to adequately rate the individual movement quality and controls versus the group- and age-specific standards.

The monitoring and test service is commonly considered the most productive and informative progress rating method in the adaptive physical education / health service for this health group. This service will help the adaptive physical education instructor concentrate on the key aspects to timely and efficiently design and manage the service on an individualized basis. Such test and monitoring service helps analyze the adaptive physical education service benefits and drawbacks on a timely basis to attain the interim and final progress goals for success.

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