Study for Determining Laterality in Children with Motor Disabilities in Adapted Physical Activities

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Abstract

The purpose of this study is to determine the laterality of nine children with medium motor disabilities in order to continue adapted physical activities as well as to play a certain part in the development of the intervention plans personalized by the other specialists of the centre. The following tests have been used: the Flamingo Test, RSSCAN Pressure Platform, the Bruininks-Oseretsky Battery, the R. Rigal Test, the Test of intermingling fingers and the test of out of step corkscrewing and uncorking of a small plastic recipient.

We have identified two cases of ambidexterity, three cases of cross laterality and four cases of right laterality.

1. Introduction

The attitude of the society towards the disabled has changed over years and it has not been favourable to these people. Moveover, there are few studies in the field of adapted physical activities for 3 to 6/7 years old children with motor disabilities. These are the two main reasons for undertaking this study.

The physical education syllabus should be modified for children with disabilities according to their degree of disability. If there are children who do not have severe disabilities, these must take part in the collective activities (with the entire class) avoiding only the medical counter indications for a certain kind of effort particularized for each child. All these play an important role in the process of social integration of the disabled children. (Ungureanu and Niculescu, 2009)

Motor disabilities mean any kinds of disorder in the body functioning and shape, which disturb the normal growth and the harmonious development of the body, modifying its exterior aspect. (Ionescu and Moţet, 1964)

The main motor disorders which cause difficulty in general coordination are delays in motor development. (Moţet, 2001)

In children of preschool age "drivability development is closely related to language development, cognitive processes, social and emotional skills. (Ungureanu, 2009)

Epuran (1976) claims that: “psychomotricity appears, thus, both as an ability and a complex function of adjustment of individual behaviour and it includes the participation of different processes and psychological functions that assure the perception of information and the adequate execution of the responding act at the same time.” (Epuran, 1976)

Initially, children test their capabilities and comes to innovate gestures, then movements in order to achieve a goal. (Guillarmé, 1982). Laterality plays an important part in a child's development, because it influences the self-image and contributes to the final shape of the body.

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In their great majority, the authors explain laterality through cerebral predominance, mentioning the studies conducted with people who have suffered brain injuries.

The brain dominance is a process that unfolds gradually until the age of 6 – 7 years old. Around the age of 4 – 5 years old there comes a kind of stabilization of laterality. At this time about 50% of the children are right handed, almost 10% are left handed and 40% are ambidextrous. Laterality becomes stable around the age of 6 or 7 when the child learns to write. (Bizouard, 1995) Some authors consider that laterality is somewhere at the conjunction of the real body (the anatomic and functional one) and the imaginary body (the psychological one), with a crucial role in the development of a child’s personality. (Albu et al., 2006) - M. Auzias (1979) estimates that: “the tests that can be used to establish the level of hemispheric laterality of a child are characterized by a large diversity, their selection being left at the examiner’s latitude.”

The first of the tests enumerated by the author is the corking of a bottle, which we have also used in our research.

J.J. Guillarmé (1985) considers that: “For the lower the following evaluation exercises are used: hop-scotch, kick the ball with your favorite leg, foot beat for jump. For the kids up to six years, it should be taken into consideration the foot on which he may be in good balance.” (Guillarme, 1985)

The purpose of the current study is to determine laterality in children with disabilities in order to continue a good unfolding of the adapted physical activities with these children as well as to play a part in developing the intervention plans, personalized by the other specialists of the centre (kinetotherapist, psychologist, educator).

2. Materials and methods

The research was carried out at „The Centre of Early Intervention for Children with Disabilities - World Vision Romania – Craiova”, where there was chosen a group of nine children aged between 4 and 6/7 with medium motor disabilities. The children were about the same age and they were selected according to the cause of their disability (congenital). They all had deficiencies of the locomotor apparatus.

The research was undertaken between 5th August 2008 – 28th April 2009, two hours a week, at the above mentioned centre which is placed within the Faculty of Physical Education and Sports - Craiova, which offered all facilities the research needed as well as the help of the volunteer students in the Kinetotherapy and Physical Education departments.

Taking into account the disabilities of the subjects in the current study as well as the beliefs of the researchers in the domain, I have selected for the lower the following tests: your foot to your favourite kick, the ball rounders (present in the Battery Bruininks-Oseretsky) and the leg on which the child can stand longer in balance (Flamingo - adjusted on 30”), and for upper limbs: the test R. Rigal, the Test of intermingling fingers, the The test of out of step corking and uncorking a small plastic recipient, and in the battery and Pretest Bruininks-Oseretsky – adapted to which he has noted for the hand laterality, one hand that they used children, the disposal of ball (not that used to take the ball on the table).

In addition, there has been used the platform of plantar pressure distribution Balance RSSCAN, with which I succeeded in measuring and scanning the plantar pressure.

In order to achieve the goals, I administered the tests for the determination of laterality to see if specifically designed programmes are effective, or, according to the results, they should be amended.

The specifically adapted programmes were transferred to the lesson plans within the adapted physical education activities with these children. There were used adapted movement games for all the stages of the lesson. As a result, the method used in the whole experiment has been the play method, and in the present study, the method of tests.

The use of some exercises in determining the subjects’ skills in the field of physical education and sport has been made through the methods of tests. (Hantiu, 2012)

For preschool and primary school age, physical education must be mainly focused on the psychomotor development of children, without neglecting the other components of general education. Imitation represents a motric behaviour of reproducing the teacher’s demonstration, that results into the children’s accomplishment of the demonstrated behaviour. In the psychomotor and social development the child imitation is very important while being connected to the game, too. (Ungureanu, 2010) The didactic activity which includes surprise, waiting for a compilation competition can become game and this one gets a social caracter because, the child comes into contact with other children or with the adult. (Albu and Albu, 2000) The main characteristics of games are defined by their nature as well as by the age of those who practise them. For children, they are the main stimuli of their psychological development, with an important role in training them for social integration (Ungureanu, 2009)

The games were designed and graded according to the disabilities as well as the age of the children involved in the research.

The adaptation of the programmes was mainly done by eliminating the physical activities that were counter indicated for he kind of disabilities each child was suffering from and, then by dosing effort (intensity, volume, breaks).

Each lesson lasted one hour, the motric density being small because for 3 to 6/7 years old children with motor disabilities breaks should be longer as they get more tired than children without disabilities. The effort was graded according to the
children’s disabilities, through a large number of repetitions in order to understand and fix movements with the right break between two repetitions as well as after all repetitions are done, until the following set of repetitions. That is why the length of the lesson (20’ - 30’, longer than for preschool children without disabilities) is justified.

3. Results

Test no 1. – R. Rigal test for hand laterality – adapted for 3 to 6/7 years old children with motor disabilities

For the interpretation of the results the points that the child has obtained for each activity will be counted following the next explanations: - 14 and – 8 - left-handed; -7 and +7 – ambidexter;+ 8 and + 14 – right-handed.

Interpreting the results we can say that (see table 1):

- One single subject is left-handed (The subject no. 8); One single subject is ambidexter (The subject no. 9);
- The other seven subjects are right-handed (The subject 1-7).

Table 1. The score obtained the children for each activity and the total points

| Hand used for: | Subject 1 | Subject 2 | Subject 3 | Subject 4 | Subject 5 | Subj 6 | Subj 7 | Subj 8 | Subj 9 |
|----------------|-----------|-----------|-----------|-----------|-----------|-------|-------|-------|-------|
| 1 Throwing a ball | 2         | 2         | 2         | 2         | 2         | 2     | 2     | -1    | 2     |
| 2 To wash your teeth | 2         | 2         | -1       | -1       | 2         | 2     | 2     | -1    | 1     |
| 3 Combed | 1         | 2         | 2         | 2         | 1         | 2     | 1     | -1    | 2     |
| 4 Writing | 2         | 2         | 2         | 2         | 2         | 2     | 2     | -2    | -2    |
| 5 To eat | 2         | 2         | 2         | 1         | 2         | -1    | 2     | -2    | 2     |
| 6 Drawing | 2         | 2         | 2         | 2         | 2         | 2     | 2     | -2    | -2    |
| 7 Achievement a texture | 2         | 2         | -1       | 1         | 2         | 0     | 0     | 0     | 1     |
| Total score | 13        | 14        | 8         | 9         | 13        | 9     | 11    | -9    | 4     |

Test no. 2 - The crossed fingers test for hand laterality

The interpretation – there are evaluated the children with right handed lateral predominance if after a few clapping sounds they leave up the thumb of the right hand or the children with left handed lateral predominance if they leave above the thumb of the left hand.

The adjustment consisted in the fact that the speed of the clapping was not taken into account and neither was the fact that some children had difficulties in the fast intermingling of their fingers, these ones being left to act in their own pace and waited for until they succeeded in order to register the result.

To the crossed fingers test the subjects 1, 2, 5, 6 – have a right manual lateral predominance and the subjects 3, 4, 7, 8, 9 – have a left manual lateral predominance (see the table 2).

Test no. 3. – The test of out of step corking and uncorking of a small plastic recipient in order to find out the hand laterality

Instructions – The teacher set in front of the children, on the table, a 0.5 l bottle telling them that, for the beginning, they have to take it from the table. The next instruction was to uncork and then to cork it back again. There were used these steps because some of the children, even if they were taking the bottle with one hand, for the corking or uncorking it, they used the same hand. That is why, later, they used to move the bottle in the hand they preferred for the activity. For the children who did not understood the task (1 or 2), it was explained again but only after they took the bottle from the table. The adaptation of the test was done by letting the children, who did not succeed, to keep the bottle between the elbow and the body using their hand only to hold the neck of the bottle in order not to drop it and cork or uncork it.

For the interpretation, there was written down the hand the children had used to cork and uncork the plastic recipient. (Ungureanu, Niculescu, 2011)

So, the subjects 1, 2, 5, 6 and 7 have right manual laterality and the subject 3, 4, 8 and 9 have left manual laterality

Table 2 – The result for the Test no. 2, 3, 4 and 5

| Test 2. | Test 3. | Test 4 | Test 5. |
|---------|---------|--------|---------|
| The subjects | Predominance of hand | The hand used for execution | Handedness for throwing a | The leg used to kick the | Cycles (in seconds) of maintaining on each foot |
|---------|---------|--------|---------|
|---------|---------|--------|---------|
Test no. 4. – The pretest for hand and floor laterality from Bruininks-Oseretsky Batery– adapted
Interpretation – it was registered for hand laterality, the hand that the children used to throw the ball (not the one used to take the ball from the table). For the floor laterality the left or the right leg was registered according to the leg they used to kick the rounders ball set at 15 cm in front of the tip of their toes.

The results pentru lateralitatea manuală, as shown in table 2, are:

- subjects from number 1 to number 7 and the subject 9 have right manual laterality;
- for subject no. 8 a left manual laterality was determined;

The podal laterality for all subjects happen to have right podal laterality, less the subject number 7 which had left podal laterality (as shown in table 2).

Test no. 5. - Flamingo test (adapted for 30’’) – for floor laterality
The adaptation of the test for children with disabilities was by letting them raise one bent leg ahead and find balance with both arms. All children will be initially helped by volunteers until they find balance, then they will be left alone but permanently monitored.

After applying the test for the subjects no. 1, 2, 4 and 9 was determined left podal laterality and for the subjects no. 3, 5, 6, 7, and 8 was determined right podal laterality. (see the table no.2)

Test no. 6. - The measuring and scanning of the plantar pressure by using The Pressure Platform RSSCAN
For the test present, it was used “the platform of plantar pressure distribution Footscan Scientific Version, RSSCAN International, Olen, Belgia that is able to make measurements with a frequency of 500 Hz. And register the entire action of both plantars.

With the help of the latest system of computerized scanning of the leg (the pressure platform RSSCAN), we want to consider the plantar pressure distribution in orthostatism, for children with motor disabilities in order to establish the floor laterality, sustaining the obtained results with adapted tests, previously applied.

The measurements were made at The Centre of Research of The Faculty of Physical Education and Sports, University of Craiova in March 2009. The rezulted data were directly processed, with a specific RSSCAN soft and the evolution of the contact pressure, by time, was found as well as its repartition on the characteristic plantar anatomic parts during the bilateral support moments.

After the interpretation, the precise determination of the more or less repartition on one foot or a relatively even repartition on both feet according to the children’s disabilities is justified.

In most cases the results obtained in classical tests of detemining the floor laterality were confirmed.

4. Discussions

For the subject no. 1 after all the tests for determining manual and podal laterality have been applied there was decided right manual laterality and left podal laterality, especially due to his disabilities and as a result having criss-crossed laterality.

For the subject no. 2, was decided right laterality, both for manual and podal laterality, mainly due to the disabilities he is suffering from.

For the subject no. 3, was established left manual laterality and right podal laterality he was presented as having criss-crossed laterality.

The subject no. 4 was found to be an ambidexter.

For the subject no. 5 there was determined right laterality both in manual and podal laterality especially due to spastic tetraplegic disability he is suffering from.
The subject no. 6 we should also consider the older age that approaches laterality establishment. It can be said that he/she is the closest of all to establishing it, which, in his case was considered to be right laterality.

For the subject no. 7 the conclusion was right laterality.

The subject no. 8 has left manual laterality and right podal laterality and we can assert that he has criss-crossed laterality. After the interpretation of all manual and podal laterality tests, the subject no. 9 was considered to be an ambidexter.

After administering all the tests, each child's interpretation have been picked up, making each Subject’s Individual Evaluation Test, as it shown in the following model for subject 1.

A individual evaluation test sheet – SUBJECT 1

Age: 6, 10 years                   Disability: spastic tetraplegia                        Cause: congenital

The tests for the evaluation of some indices of the psychometric ability (in order to establish the laterality of the hands and floor):

- The interpretation of the R. Rigal test for manual laterality (adapted) – Subject 1 – received a score of 13 points which means, from the test interpretation, that it was found to have right manual laterality.
- The interpretation of The crossed fingers test for manual laterality. The subject has right manual laterality predominance which stresses the results of the R. Rigal test (13 points).
- The interpretation of The corking and uncorking of a small plastic recipient test for finding out the manual laterality. The subject was found to have right manual laterality.
- The interpretation of the Bruininks-Oseretsky Battery Pretest for manual and podal laterality – adapted

Subject number 1 has right manual laterality as he uses his right hand for this test as well as for all the other activities of the tests applied for manual laterality. The disability he suffers from (spastic tetraplegia) limits the use of his left foot and hand and that justifies the use of his right hand and right foot for activities, most of the times. That results from the applied test and it determines right podal laterality for him (even if he found balance on the left foot).

- The interpretation of the The Flamingo test (adapted at 30’’)- for podal laterality. The subject managed to stand on his left foot for 18” (60%) from the total standing time (30”) and on the right foot for 10” (33.33%), which resulted, for this test, in left podal laterality.
- The interpretation of the records with RSSCAN Pressure Platform.

In figure no. 1, in the upper part there can be seen the left plantar print (yellow) and the right plantar print (pink) obtained while the subject had his shoe on (on the left) and off (on the right). There can be observed a variation of the pressure centre from one print to another, after an irregular curve, with a large move after X, which proves a difficulty of the subject in keeping a still vertical position. There can also be seen a higher pressure on the left foot heel and that means that the subject uses this foot for standing and balance most of the times.

In the charts at the bottom there are presented the coordinates of the pressure center (Z and Y) for all the 3330 ms the measurement lasted, the variation in time of the total pressure force (N) and of the components for the left foot (yellow) and the right foot (pink). The tendency of the subject to find support on the left foot can be clearly seen during the second half of the time. By comparing it with the analysis of the subject with his shoes on we can assume that he uses proper footwear which clearly improves the distribution of the plantar pressure more and the capacity of maintaining balance vertically, less.
The measuring sequence divided in 6 equal parts, and the plantar print for the 6 periods of time is presented in figure 2. It gives a picture on the evolution of balance, for each caught moment, being calculated, the trace covered by the pressure center (COF), as well as the area inclosed by the contour described by COF. The area described by COF increases with the instability. There can be clearly seen a tendency to use mainly the heel of the left foot for support.

For Subject 1 from the interpretation, there was determined his tendency to find support on the left foot and that confirmed his standing on the left foot for 18", that is 8" more than on the right foot (10"), from the adapted Flamingo test, as well as sustaining the body weight on the left foot, too, in order to kick the ball with the right foot, in the Bruininks-Oseretsky Battery pretest. We can, thus, affirm that, after the interpretation of all the podal laterality tests, Subject no. 1 has left podal laterality.

Finally, for Subject 1, after administering all tests for determining manual and podal laterality, right manual and left podal laterality was found for him especially due to his disabilities and thus having crossed laterality.

5. Conclusions

In order to interpret the laterality through the tests, the children's age was taken into account, because in spite of children's age - appropriate for the primary level of education - they didn't attend primary school yet because of their physical abilities, for which reason they didn't begin to write fluently and, as a result, we cannot say that laterality is fixed in children, through tests.

After the interpretation, not in all manual or podal laterality tests, the results were identical (that is, the children used the same hand or foot in different tests).

Still, considering these too, we have applied the test in order to determine laterality for us to know that we have to stress making exercises on the non-dominant side during adapted physical activities (although we have continuously worked for ambidexterity), but also for the specialists in the specific activities centre (psychologist, educator, kinethotherapist). They will be able to elaborate personalized intervention plans for laterality by comparing the answers the children gave in the specific test that we administered.

The final conclusion, that came after determining laterality predominance in children from 3 to 6/7 years with motor disabilities, did not require a radical change of the already elaborated adapted programmes, because their operational structures (adapted movement games) regarded a development of ambidexterity and ambilaterality since the research started. However the results of the test helped us realise that in the future we will have to focus on exercises with the non-dominant side.

References

Albu, A., & Albu, C-tin. (2000) - Asistenţa psihopedagogică şi medicală a copilului deficient fizic - Ed. Polirom, Bucureşti, p. 240.
Albu, C-tin., Albu A., Vlad T.B.,& Iacob I. (2006) - Psychomotricity, The European Institute Publishing House, Iasi, p. 30.
Auzias, M. (1975) – Enfants gauchers, Enfants droitiers – Delachaux et Niestlé, Paris, p. 31.
Bizouard P. (1995) – Développement psychomoteur du nourrisson et de l'enfant – La Revue du Patricien, Paris, p. 110.
Epuran, M., (1976), The psychology of physical education, Sport-Turism Publishing House, Bucharest, p. 114.
Guilarmé J.J. (1985) – *Education et rééducation psychomotrique* – Editions Sermap-Hatier, Paris, France, p. 57.

Guillarmé J. J. (1982), *Education et rééducation psychomotrices*, Editions Sermap-Hatier, Paris, France, p. 30.

Hanțiu, I. (2012) – *Teoria și metodica educației fizice și sportului (Note de curs)* – Faculty of Physical Education and Sports, University of Oradea, p. 15.

Ionescu A., & Motet D. (1964) - *Corectarea deficiențelor fizice la copii de vârstă școlară* - Ed. Did. Și Ped. București, p. 5.

Moțet D. (2001), *Psihopedagogia recuperării handicapurilor neuromotorii*, Editura Fundației Humanitas, București, p. 94.

Ungureanu A., Niculescu M., held Nov 18th – 19th 2011 - Manual laterality, component of psychomotricity, determination in children with motor disabilities (article BDI) – 4th Annual International Conference „Physical Education, Sport and Health” (ISSN 1453 - 1194), in Pitești, Romania, p. 887

Ungureanu A., Niculescu M., held Nov 20th – 21th 2009 - How to determine podal laterality in 3-6/7 year old children with motor disabilities in order to practice adapted physical activities (article BDI) – 2nd Annual International Conference „Physical Education, Sport and Health” (ISSN 1453 - 1194), in Pitești, Romania, p. 126.

Ungureanu, A. (2010) *The methodology of physical education for preschool and primary school education* – Universitaria Craiova Publishing House, p. 65.

Ungureanu A., (2009) Teza de Doctorat - „Contribuții privind integrarea socială a copiilor cu dizabilități motorii, prin activități fizice adaptate” – I. O. S. U. D. - Universitatea din Pitești – îndrumător Prof. Univ. Dr. Niculescu Mugurel Horățiu, p. 54.

Ungureanu, A. (2009) – *Teaching physical education classes through movement games* – Universitaria Craiova Publishing House, p. 9.