THE LEVEL OF GLOBAL MOVEMENT COORDINATION, SPACE-TIME ORIENTATION AND JUMPING ABILITIES OF PERSONS WITH DIFFERENT KINDS OF FUNCTIONAL ASYMMETRY – PILOT STUDY

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Abstract
The aim of this study was: 1. Comparison of the level of movement coordination, space-time orientation and jumping abilities of people with different types of functional asymmetry. 2. Attempt to determine the dominant direction of rotation in individuals with homogeneous and heterogeneous functional asymmetry. Material and methods. 34 persons with different types of lateralization were tested. Measurement of global coordination and jumping abilities were carried out with Starosta's tests. The level of space-time orientation was determined with the use of modified test of Maciejewski and Stronczyński. To assess the type of asymmetry Zazzo's tests were used. Conclusions. The highest level of global coordination was characterized by people with left-sided asymmetry, while the lowest – with the lateralization undetermined. There were differences in the dominant direction of rotation in subjects with different types of lateralization. In individuals with left-sided and crossed asymmetry rotations to the right dominated, whereas in people with undetermined lateralization – to the left. In subjects with right-sided asymmetry, there was no dominant direction of rotation. The biggest differences in the dominant direction of rotation in the first task – the maximum rotation in the jump from two legs was observed in individuals with left-sided lateralization. The highest level of orientation was observed in subjects with left-sided lateralization. There were no significant differences in jumping abilities in individuals with homogeneous and heterogeneous asymmetry.

Key words: functional asymmetry, global movement coordination, jumping abilities, space-time orientation

Introduction

The issue of human asymmetry is considered from the point of view of its structure (morphological asymmetry), the function of limbs and sensory organs (functional asymmetry), and dynamics of the performed movement (dynamic asymmetry). Functional and dynamic asymmetry also called impartiality or lateralization is a reflection of the domination of one side of the body. It involves the division of functions and specialization of movement organs - arms and legs as well as sense organs - eyes and ears. This division results from the function of the brain, namely the dominance of one of the cerebral hemispheres. According to Zazzo (1974): "...functional dominance of one half of the body is determined not by the learning of it, but by the predominance of one hemisphere over the other" (p. 4). The layout of functions results from the intersection of the nerve pathways, as a consequence of which the nerve path of the left hemisphere determines the activities of the right side of the body, and vice versa, the right hemisphere affects the functions of the left side.
There are different kinds of phenomena in functional asymmetry. The most obvious one is the uniform/homogeneous lateralization - right-sided or left-sided. But there is also heterogeneous lateralization - crossed and undetermined. The problem of morphological and functional asymmetry was undertaken by various authors (Bogdanowicz, 1992; Koszczyc, 1989, 1991; Kuśnierz, 2004; Olex-Zarychta, 2010; Spionek, 1961, 1973, Starosta, 1990, 2003, 2006; Stoklosa, 1994; Wolanski, 1957). In research works so far, the influence of such asymmetry on the level of movement coordination abilities has not been determined.
Aims:
1. Comparison of the level of global movement coordination, space-time orientation and jumping abilities of persons with different types of functional asymmetry.
2. Attempt to determine the dominant direction of rotation of persons with homogeneous and heterogeneous functional asymmetry

Material and methods

The study was conducted in 2011 - 34 third year students of the University School of Physical Education in Poznan (21 subjects with right-handed lateralization, three persons with left-sided lateralization, 4 persons - with crossed and 6 persons - with undetermined) took part in the research. Measurement of global movement coordination was performed using two test tasks and a coordination-meter of Starosta (1978, 2003).

In the analysis the best result of the three-time executed task was taken into account- of the two and one leg rotation to the right and left. The reliability of the test was 0.99 (Maric & Baic, 2005). Level of jumping ability was assessed using the test and jumping meter of Starosta (1978). Out of the three jumps from one leg and two legs to the right and left leg the best result was selected for calculations. The reliability of the test was 0.92 (Radzińska & Starosta, 2002). Measurement of space-time orientation was conducted using the test of Maciejewski and Stronczyński (1997), as modified by Karpińska and Podciechowska (2011). The test consisted of covering by running, and as quickly as possible, the layout of fields numbered from 1 to 9, starting and ending at the point marked "X". The size of each field was 1.2x1.2m. The reliability of the test was 0.83 (Karpińska & Podciechowska, 2011).

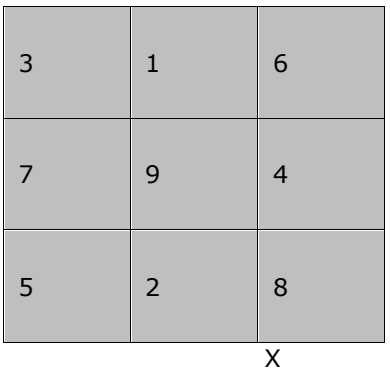

Fig. 1. Test of space-time orientation in modifications of Podciechowska and Karpinska (2011)

To assess the kind of asymmetry, the battery of tests of Zazzo (1974) was used. Test reliability ranged from 0.69 to 1.00 (Karpinska & Podciechowska, 2011) (Table 1.).

Table 1. Reliability of individual test tasks of functional lateralization of Zazzo (1974) (Karpinska & Podciechowska, 2011)

Lp.	Name of the task	Reliability
1	Mixing cards	0.88
2	Shuffling cards	1.00
3	Spreading out cards	0.90
4	***Diadoho-kinesy***	1.00
5	snooping – cardboard box held with both hands	0.88
6	Snooping- cardboard box held with right hand	0.78
7	Snooping- cardboard box held with left hand	0.77
8	Aiming	0.86
9	Class game	0.77
10	Kicking a Block	0.69

Results and discussion

Level of global movement coordination. The students tested were characterized by relatively low levels of global movement coordination. In a simpler task - maximum rotation in a jump from both legs obtained an average score of 678.7°, which accounts for 44 points in the scale of "T" (Starosta, 1978). In a more complex task - maximum rotation in a jump from one leg, the result was 518.9° (28 points). The results of the tests differed in students with different kinds of lateralization. The studied individuals characterized by a homogeneous lateralization - right or left sided- achieved higher results in the maximum rotation in jump from both legs and in both directions from those individuals with crossed and undetermined lateralization (Fig. 2). The differences of results were statistically significant.

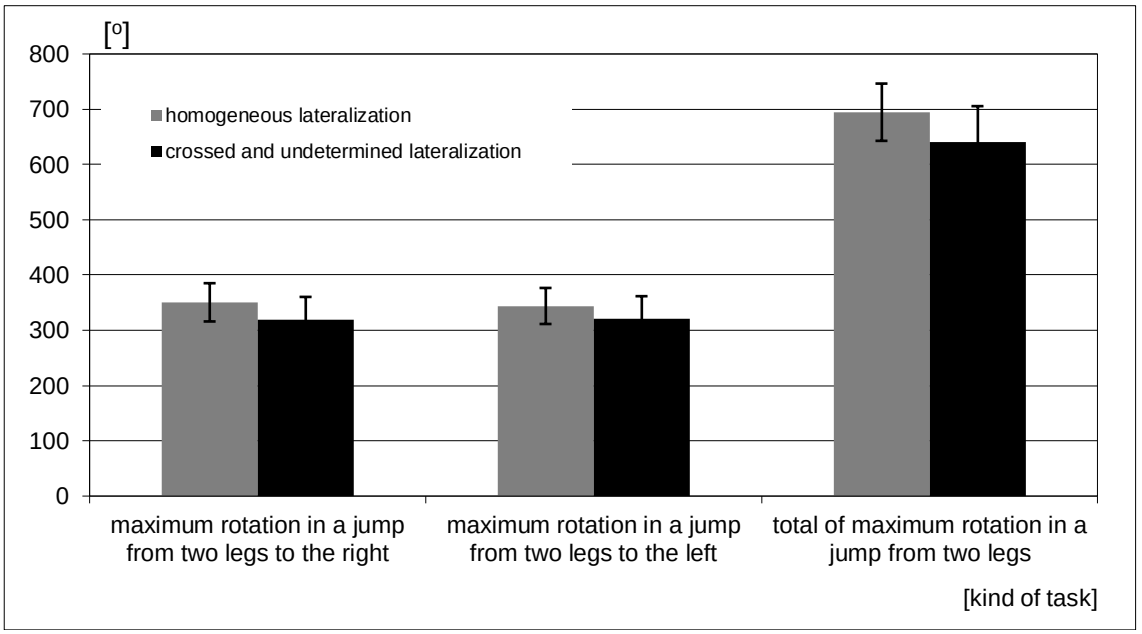

Fig. 2. Level of global movement coordination (maximum rotation in a jump from two legs) of students with homogeneous and heterogeneous asymmetry

The highest levels of global movement coordination (the maximum rotation in a jump from two legs) were featured by persons with left-sided asymmetry (fig.3). Their average score was 745° (52 points). The lowest results were obtained by those tested with undetermined lateralization.

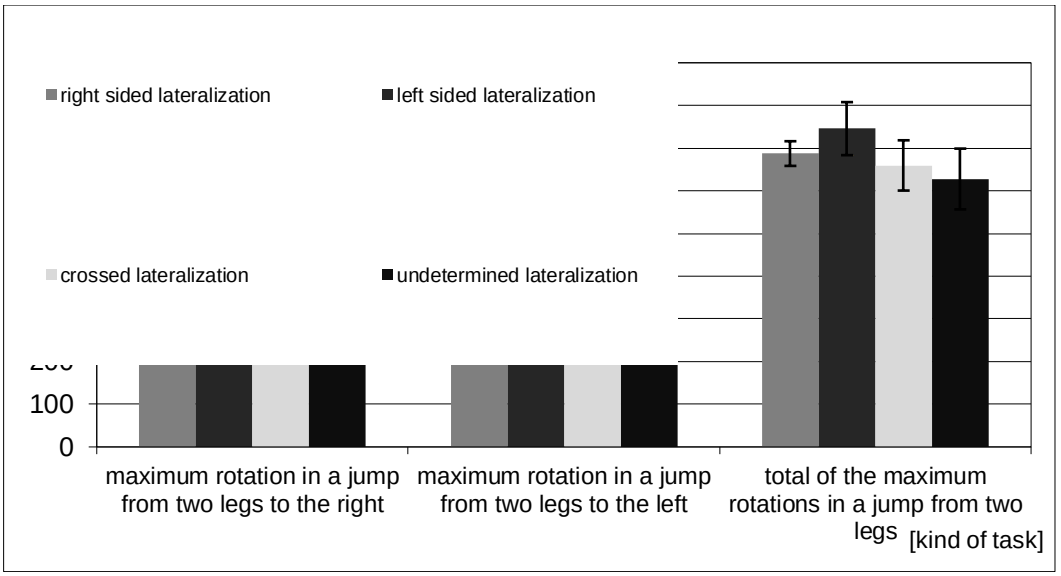

Fig. 3. Comparison of the level of global movement coordination (maximum rotation in a jump from two legs) of persons with different types of asymmetry

In the more difficult task - the maximum rotation in a jump from one leg - results were similar, however slightly better turned out to be the students with homogeneous lateralization (fig. 4).

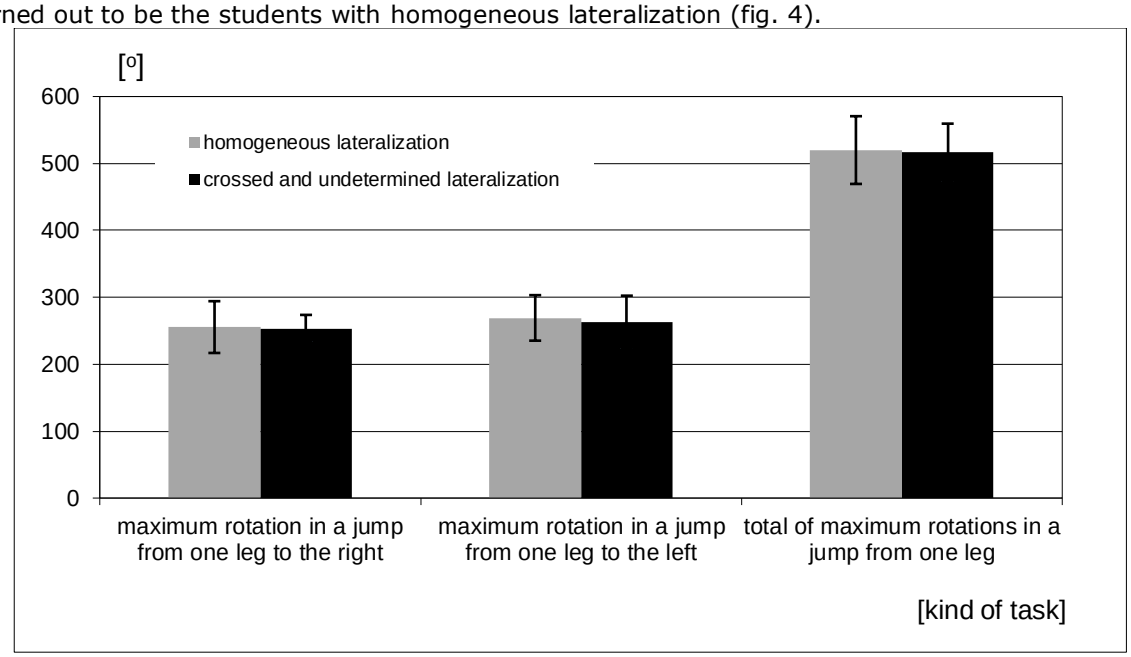

Fig. 4. Level of global movement coordination (maximum rotation in a jump from one leg) of people with homogeneous and heterogeneous asymmetry

The highest level of global movement coordination - the maximum rotation in a jump from one leg- were obtained by students featuring left-sided asymmetry (fig.5).

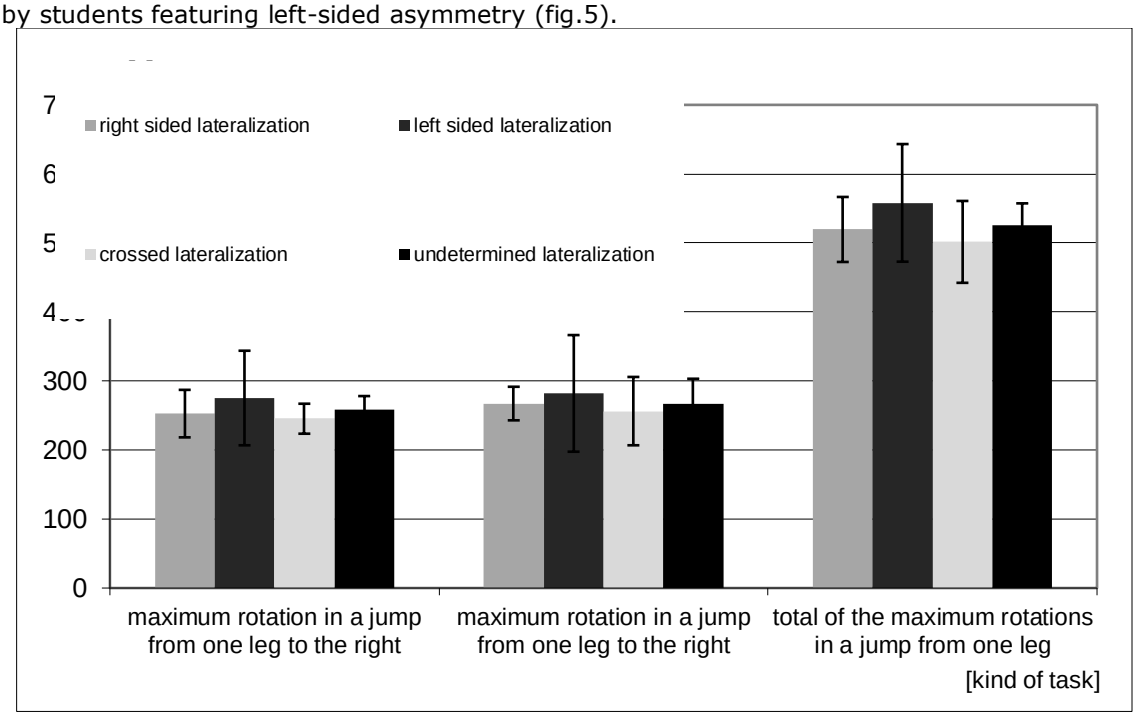

Fig. 5. Comparison of the level of global movement coordination (maximum rotation in a jump from one leg) of students with different types of asymmetry

2. Predominant direction of rotation. Determining the dominant direction of rotation in rotational exercises was the subject of very few authors (Dębczyńska, 1990; Drabik, 1983, 1984; Fetz, 1972; Oberbeck, 1989; Starosta, 1957, 1965, 1975, 1990, 2003; Winter, 1953; Dębczyńska-Wrobel & Starosta, 2007) . According to some authors, the dominant direction of rotation is genetically determined (Oberbeck, 1989), according to others (Starosta, 1975, 2003) it is shaped by the environment (Dębczyńska-Wrobel & Starosta, 2007). In research works of Dębczyńska-Wrobel and Starosta (2007) it was observed that: "...natural direction of rotation may be the ones to the left, as well as those to the right. It was noted that this direction can be acquired and be developed through practice of disciplines especially oriented to the asymmetric way of performing technical exercises that contain rotations" (p. 265). These studies, however, did not include the type of functional asymmetry of those tested people. The predominant direction of rotation differed depending on the type of asymmetry of the tested subjects. In the test of W. Starosta - maximum rotation in a jump from both legs -

individuals with left-sided and crossed asymmetry featured a dominating direction of rotation to the left, whereas people with undetermined lateralization – demonstrated slightly better results when performing rotation to the right. No differences in the predominant direction of the asymmetry in students with homogeneous asymmetry - right sided- were recorded (fig.6). In a more complex task - maximal rotation in a jump from one leg, all individuals featured the predominance of rotations to the left (fig.7).

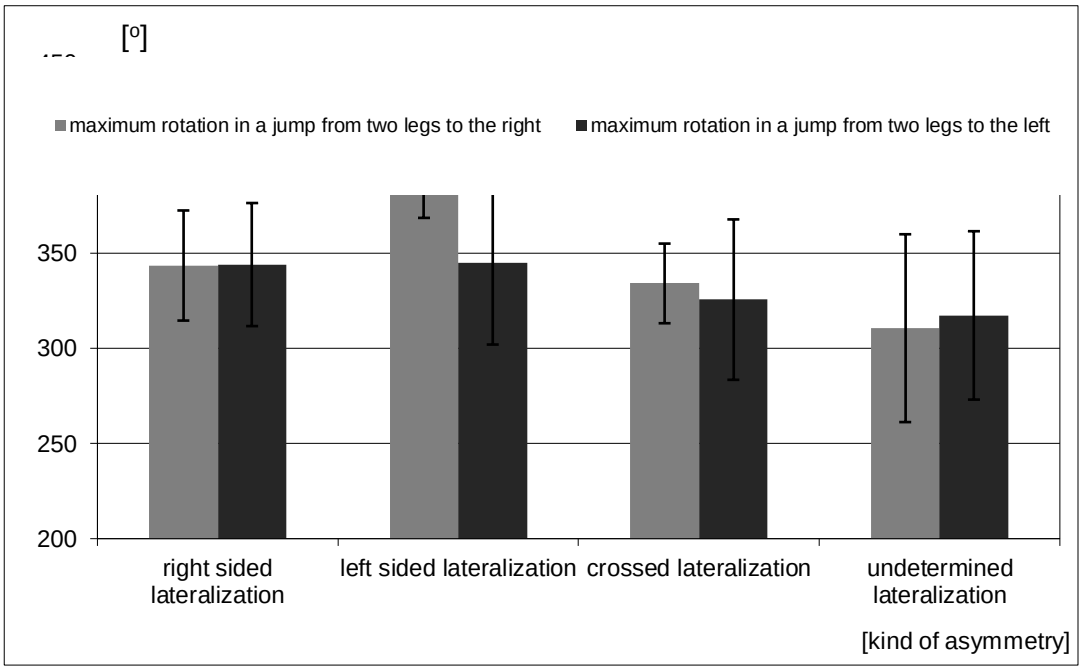

Fig. 6. Comparison of the dominant direction of rotation (maximum rotation in a jump from both legs) in person with different types of asymmetry

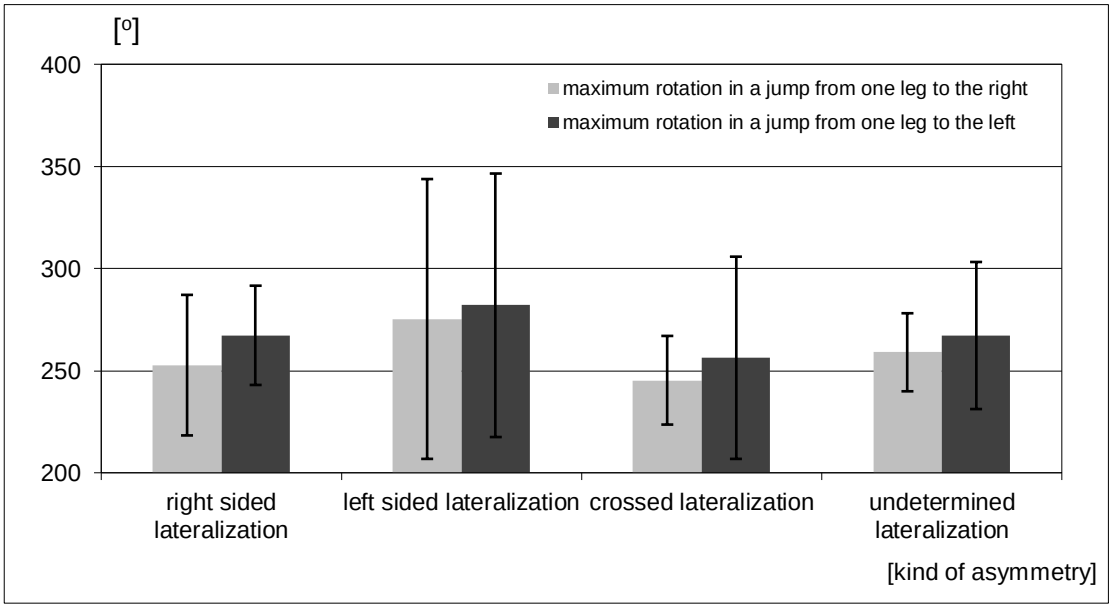

Fig.7. Comparison of the dominant direction of rotation (maximum rotation in a jump with one leg) in individuals with different types of asymmetry

3. Level of space – time orientation. The analysis of results showed that those manifesting homogeneous asymmetry - right and left sided- were characterized by a slightly higher level of space and time orientation (fig.8).

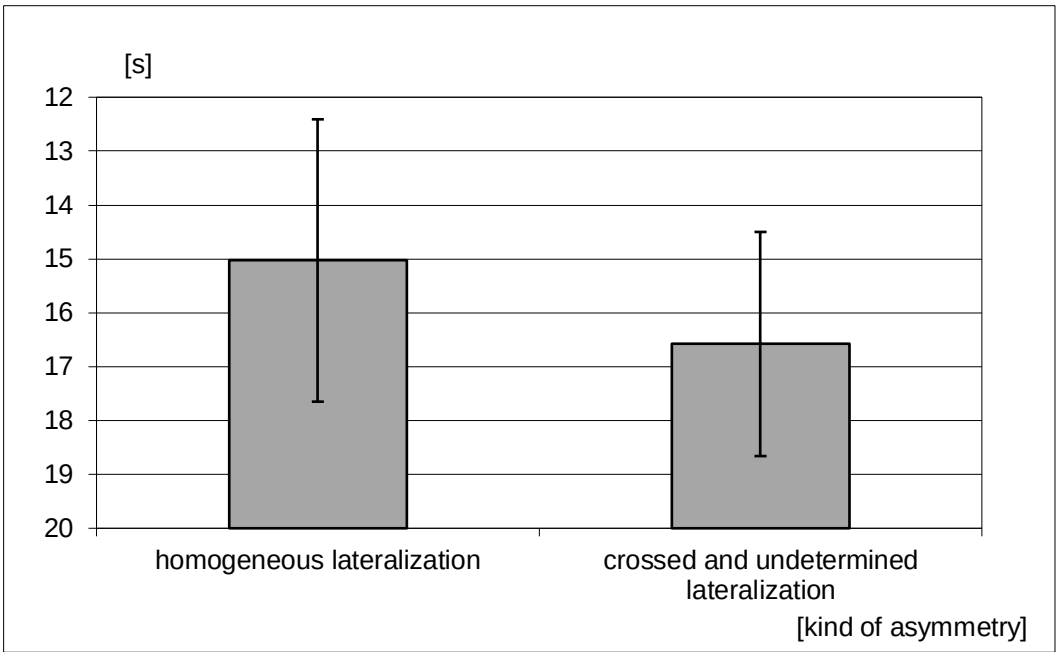

Fig. 8. Level of space and time orientation in persons with homogeneous and heterogeneous asymmetry

As in the test of global movement coordination, the person having a left-hand sided type of asymmetry obtained , significantly higher scores in the test of space-time orientation than other tested subjects (2-3 s. difference) (fig.9).

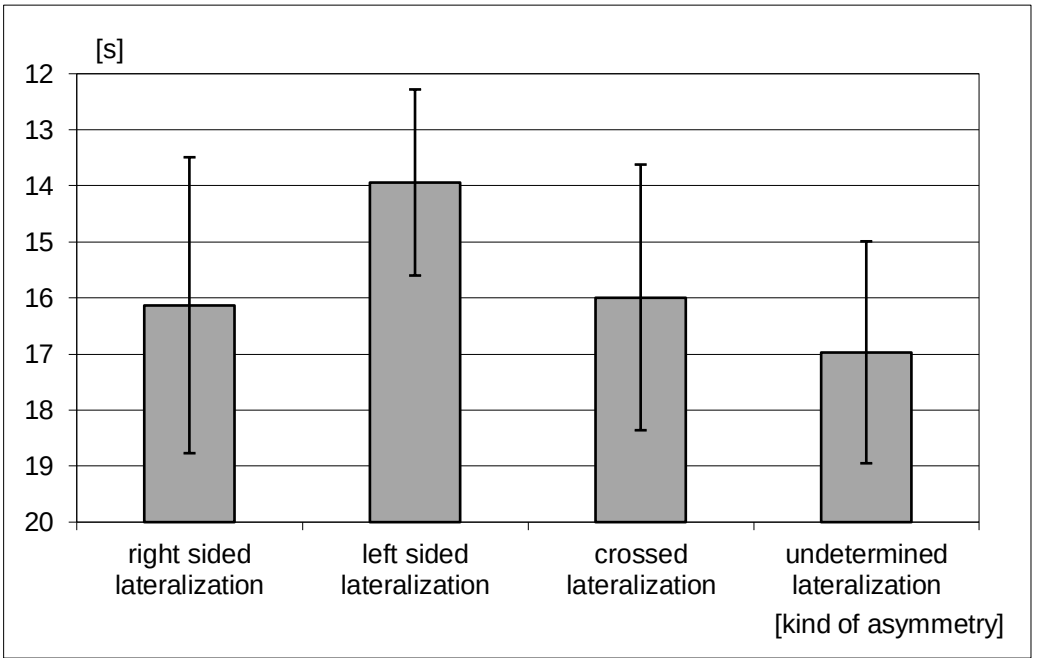

Fig. 9. Comparison of space-time orientation of students with different types of asymmetry

4. Level of jumping ability. Studies have shown differences in the level of jumping abilities (maximum vertical jump) in the tested subjects. In the three test tasks of Starosta (1978), slightly higher results were obtained by subjects with heterogeneous asymmetry (crossed and undetermined). The varied foundations of this ability, which manifests itself in both strength and speed and movement coordination may affect the results of the test (Starosta, 2003) (fig.10).

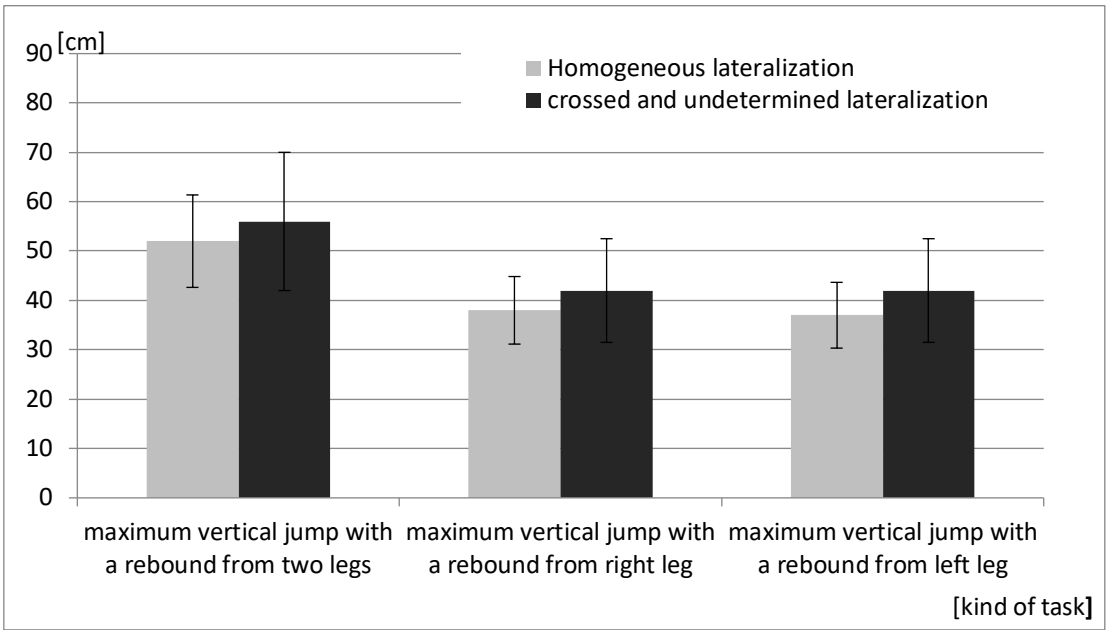

Fig. 10. Level of jumping ability (maximum vertical jump), in persons with homogeneous and heterogeneous asymmetry

The results of jumping ability from the right and left leg in both groups did not differ significantly. Vertical jump from the left leg dominated in people with left-sided and undetermined lateralization, and in people with undetermined asymmetry, the results of the right and left leg were the least diverse (fig.11).

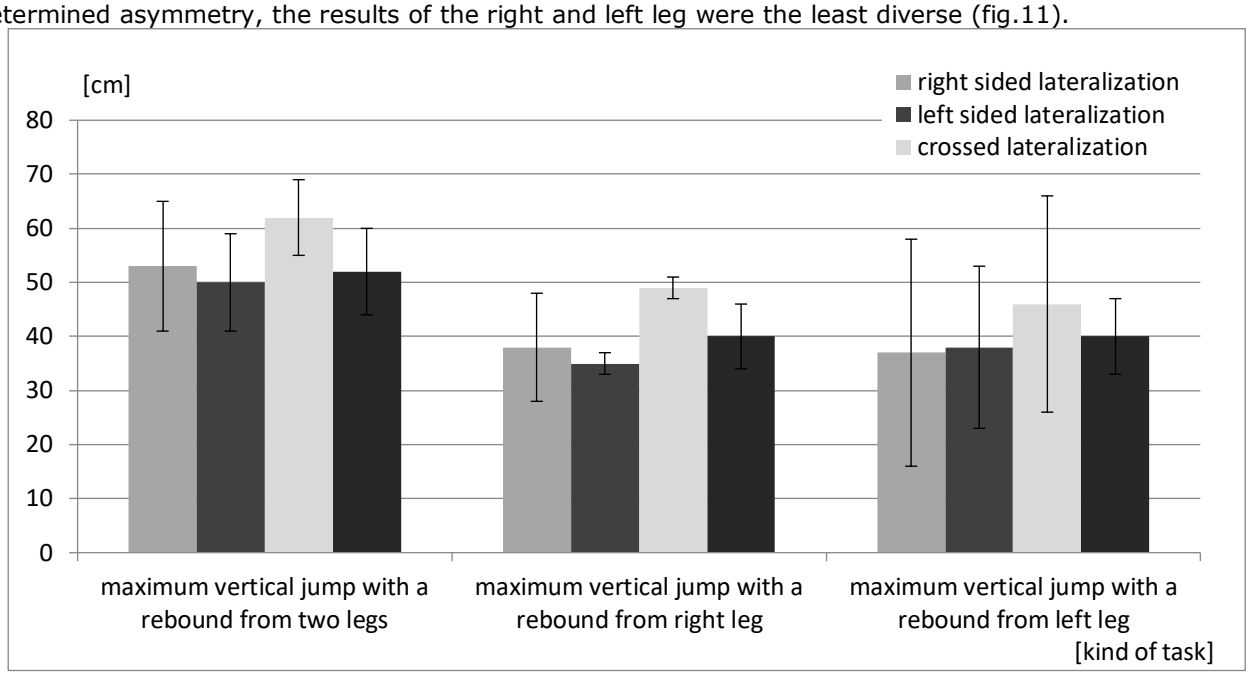

Fig. 11. Comparison of jumping abilities (maximum vertical jump) of persons with different types of asymmetry

Conclusions

The highest level of global movement coordination was featured by persons with left-sided asymmetry, while the lowest - with undetermined lateralization.

2. Variation was observed in the dominant direction of rotation in people with different kinds of lateralization. In persons with left-sided and crossed asymmetry rotations to the right prevailed and in people with undetermined asymmetry - to the left. In individuals with right-sided asymmetry, there was no dominant direction of rotation. The biggest differences in the dominant direction of rotation in the first task - the maximum rotation in a jump with a rebound from two legs was observed in subjects with left-sided lateralization.

3. The highest level of orientation was found in subjects with left-sided lateralization.

4. There were no significant differences in jumping abilities in people with homogeneous and heterogeneous asymmetry.

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RAZINA KORDINACIJE POKRETA, PROSTORNO VREMENSKA ORIJENTACIJA I SKOČNE SPOSOBNOSTI OSOBA SA RAZLIČITIM VRSTAMA FUNKCIONALNE ASIMETRIJE

Sažetak

Cilj ove studije bio je: 1. Usporedba razine koordinacije pokreta, prostorno-vremenske orijentacije i sposobnosti skakanja ljudi s različitim vrstama funkcionalne asimetrije. 2. Pokušaj utvrđivanja dominantnog smjera rotacije kod pojedinaca s homogenom i heterogenom funkcionalnom asimetrijom. Materijal i metode. Ispitane su 34 osobe s različitim vrstama lateralizacije. Mjerenje globalne koordinacijske i skakačke sposobnosti provedeno je testovima "Starosta". Razina prostorno-vremenske orijentacije određena je korištenjem modificiranog testa Maciejewskog i Stronczyńskog. Za procjenu vrste asimetrije koristili su se Zazzovi testovi. Zaključci. Najviši stupanj globalne koordinacije karakterizirali su ljudi s lijevom bočnom asimetrijom, dok je najniži - s lateralizacijom neodređen. Bilo je razlika u dominantnom smjeru rotacije kod osoba s različitim vrstama lateralizacije. Kod osoba s lijevom i ukriženom asimetričnom rotacijom u desno prevladava rotacija, dok kod osoba s neodređenom lateralizacijom - u lijevo. U ispitanika s pravosmjernom asimetrijom nije bilo dominantnog smjera rotacije. Najveće razlike u dominantnom smjeru rotacije u prvi zadatak - maksimalna rotacija u skoku s dvije noge opažena je kod pojedinaca s lijevom stranom lateralizacijom. Najviša razina orijentacije primijećena je kod ispitanika s lijevom stranom lateralizacijom. Nije bilo značajnih razlika u skakačkim sposobnostima kod pojedinaca s homogenom i heterogenom asimetrijom.

Ključne riječi: funkcionalna asimetrija, globalna koordinacija pokreta, sposobnosti skakanja, orijentacija prostora i vremena

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