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MOVEMENT COORDINATION DISORDERS IN MEN WITH PSYCHIC DISEASES OR MENTAL IMPAIRMENT

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SUMMARY

Introduction

The problem of motor coordination in individuals with psychic diseases and mental impairment has thus far been poorly described in scientific literature. A normally developed motor system can execute all vital motor tasks only when the central and peripheral nervous system can control this movement properly. Thus, motor coordination, namely the interaction of the motor system and the nervous system, is necessary.

Aim

To assess with objective methods motor coordination in individuals suffering from psychic disease or mental impairment and to compare the results to those measured in healthy subjects.

ZABURZENIA KOORDYNACJI RUCHOWEJ U MĘŻCZYZN Z CHOROBAMI PSYCHICZNYMI LUB UPOŚLEDZENIEM UMYSŁOWYM

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STRESZCZENIE

Wstęp

Kwestia koordynacji ruchowej u osób z chorobami psychicznymi lub upośledzeniem umysłowym jest słabo opisana w literaturze naukowej. Normalnie rozwinięty układ ruchu może wykonywać złożone zadania ruchowe tylko pod warunkiem właściwej kontroli ze strony ośrodkowego i obwodowego układu nerwowego. A zatem ruch wymaga poprawnej koordynacji ruchowej, czyli współpracy układu nerwowego i układu ruchu.

Cel

Ocena obiektywnymi metodami koordynacji ruchowej u mężczyzn z chorobami psychicznymi lub upośledzeniem umysłowym i porównanie z wynikami uzyskanymi u osób zdrowych.

Subjects and methods
10 patients with psychic diseases, 22 patients with mental impairment and 51 healthy men were investigated: gross and fine coordination, intellectual skills and fitness of speech.

Results
Motor abilities were diminished in Psychiatric Centre residents, men with mental impairment performed worse than those with psychic diseases. The patients manifested poorer coordination in comparison with the healthy group and statistically significant differences were found in individuals with mental impairment as compared to healthy individuals, and in the few tests between individuals with mental impairment and those with psychic diseases.

Conclusions
Coordination deficiencies co-occur with mental impairment rather than with psychic diseases. The test of physical disability, including lateralisation, should precede the therapy of individuals with psychic diseases and mental impairment.

Keywords: movement coordination, lateralisation, psychic diseases, mental impairment, fitness assessment

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Badania i metody
U 10 mężczyzn z chorobami psychicznymi, 22 mężczyzn z upośledzeniem umysłowym i 51 zdrowych mężczyzn oceniono dużą i małą koordynację ruchową, umiejętności intelektualne i sprawność mowy.

Wyniki
Umiejętności ruchowe rezydentów Domu Opieki były gorsze niż zdrowych mężczyzn, i gorsze u osób z upośledzeniem umysłowym niż tych z chorobami psychicznymi. Znamiennie statystyczne różnice uzyskano pomiędzy wynikami osób z upośledzeniem umysłowym w porównaniu z osobami zdrowymi, i w przypadku nielicznych testów pomiędzy obiema grupami badanymi.

Wnioski
Deficyty koordynacji ruchowej, w tym zaburzenia lateralizacji, współistniały częściej z upośledzeniem umysłowym niż z chorobami psychicznymi. Badania koordynacji powinny poprzedzać planowanie indywidualnej terapii zajęciowej lub fizjoterapii u tych osób.

Słowa kluczowe: koordynacja ruchowa, lateralizacja, choroby psychiczne, upośledzenie umysłowe, ocena sprawności

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Introduction

The basis of human functioning is the ability to move efficiently. This ability to move can be perceived as global movements, involving large parts of the body, such as walking, bending the body forward, moving large objects and many more. Different functions are attributed to the so-called fine motor skills, which are often interpreted exclusively as manipulative activities, involving mainly hands. However, also feet execute some local, finer, manipulative, although very crucial movements.

A normally developed motor system can execute all vital motor tasks only when the central and peripheral nervous system can control this movement properly. Thus, apart from muscle strength and the physiological exercise capacity, motor coordination, namely the interaction of the motor system and the nervous system,

is necessary. Individuals with psychic diseases or mental impairment often have difficulty with motor coordination, which further hampers their family, social and professional interactions. First, the nature of the difficulties has to be determined in order to improve their motor development during the course of an occupational therapy.

Motor lateralisation, that is right- or left-handedness or legness, is one of the important manifestations of motor coordination. It is the non-dominant hand that holds an object, whereas the dominant hand manipulates it. When digging or overcoming obstacles one stands on the non-dominant leg, and the motor tasks are performed by the dominant leg.

Literature review

The problem of motor coordination in individuals with psychic diseases and mental impairment has thus far been poorly described in scientific literature. Carmeli *et al.* (2008) stated that they were the first ones to deal with the problem of motor coordination and motor control in individuals with intellectual disabilities. Their research mainly concerned lateralisation that is the differences in the use of the dominant and non-dominant hand. They observed that motor tasks, which were performed with the dominant hand by healthy individuals, were sometimes performed with the dominant hand and sometimes with the non-dominant hand by people with intellectual disability. They found reduced hand preference in individuals with intellectual disabilities. These individuals had difficulties with the integration of perceptual information into the motor action.

Motor coordination also means the precision of movement in a variety of motor tasks and in different external conditions. Mohan *et al.* (2001) concluded without a doubt that people with intellectual disability were significantly more inaccurate in the mirror-tracing tasks and manifested significantly less bilateral transfer of motor skills in comparison with healthy individuals. This would explain their difficulties in everyday functioning, in which good movement bilateral integration is often needed.

Capdevielle *et al.* (2013) concluded that motor coordination in people with mental disorders is an important feature of these human social interactions, but has been little studied in the context of mental diseases. Individuals with mental disorders are characterized by specific signature concerning interpersonal motor coordination. Schizophrenia impaired intentional coordination, but not spontaneous non-intentional coordination, whereas social phobia only affected leader conditions. Motor control through motor coordination behaviors is a fundamental part of social interactions deficits in schizophrenia and social phobia. Therefore, given these results, it would be necessary to assess motor coordination in social interactions. For an appropriate therapy to be developed as part of the rehabilitation process one would have to discriminate the deficits in social interactions.

Body balance also means the coordination ability that connects the motor system with the nervous system. According to Hale *et al.* (2007 and 2009) there is a need for studying body balance in individuals with mental impairment. In their research on the susceptibility to falls in these individuals they found that there were many causes of these falls, but the primary cause was the abnormal pattern of walking. Decreased cerebral motor control also resulted in a slower response of the motor system to postural perturbations.

Ageing in individuals with intellectual disability also exacerbates many aspects of physical fitness. Oppewal *et al.* (2014) reported the deterioration of many components of physical fitness in elderly individuals with intellectual disability over time, and this exacerbated the results in the Barthel ADL Index and often led to full dependence on other people. The authors found that in the assessment of physical

fitness in individuals with intellectual disability it is worth applying such tests as grip strength, manual dexterity, balance, assessment of gait, and muscular endurance. This is due to the fact that these methods are highly informative and enable the study of motor skills in individuals with intellectual disability.

Studies on movement coordination in individuals with psychic diseases are hard to be found in the literature. Some authors have published studies on physical fitness in general. For instance, Gretchen-Doorly *et al.* (2012) were interested in cardiorespiratory endurance, muscular flexibility and muscular strength in patients with schizophrenia. They found reduced motor skills in their subjects and suggested increased physical activity for these patients. However, they did not investigate any features associated with motor coordination. Jerome *et al.* (2009) concluded that physical fitness in patients with schizophrenia is sometimes reduced, mainly as a result of their lifestyles, which occasionally deteriorates within-episodes, but remains unchanged between psychotic episodes (Walther *et al.* 2015).

Motor skills in individuals with mental impairment and psychic diseases are similar, but not identical. These are individuals with decreased physical fitness. However, physical fitness, and particularly motor coordination, is a feature that is strongly conditioned by the function of the nervous system.

Changes in the central nervous system in individuals with mental impairment are quite different than in those with psychic diseases. It is for this reason that the authors of the present paper assumed that their impact on motor coordination must be different.

Aim

To assess with objective methods motor coordination in individuals suffering from psychic disease or mental impairment and to compare the results to those measured in healthy subjects. A thesis was adopted that movement coordination deficiencies co-occur to a greater extent with mental impairment (MI) rather than with psychic diseases (PD).

Subjects and methods

Primarily, the study group consisted of 42 patients and 51 healthy controls. Unfortunately, ten patients were not able to perform (or to complete) the required tests and thus the final group was limited to those who performed all tests. The study group consisted of 32 male patients (aged 49.9±14.2) from the Psychiatric Health Care Centre. The sample included 10 patients with psychic diseases (PD group: schizophrenia – 3 individuals, personality disorders – 4 individuals, dementia, alcoholism, epilepsy – 3 individuals) and 22 patients with mental impairment (MI group: mild impairment – 9 individuals, moderate impairment – 10, severe impairment – 3). The control group comprised 51 randomly selected healthy men (FM group) at a similar age (47.9 ± 14.4,: elementary education – 2 individuals, vocational – 21, secondary – 21, higher – 7).

Procedure

Patient examinations included gross motor coordination and fine motor coordination.

The examination of gross motor coordination included:

- Motor coordination of the whole body combined with the motor skills related to the activities of daily living – Barthel Activities of Daily Living Index – ADL (Mahoney and Barthel, 1965),
- Lateralisation of the upper extremities – the difference of flexor muscle strength of the right and left hand (hand strength, HS) measured using the Squeeze Dynamometer (Hilgenkamp *et al.*, 2012),
- Kinaesthetic differentiation of the lower extremities – using the neurological knee-heel test (KH), whose performance was evaluated on a 3-point scale: 0 – unable

to perform, 1 – performs inaccurately 2 – performs well,

- Frequency of lower extremity movements – using the foot tapping test (FT) – the task for the subject was to move foot to the sides as quickly as possible, to the right and to the left, over a vertical bar with the height of 10cm. The duration of the test was 20 seconds. The number of foot transfers over the bar was counted.
- Frequency of movements of the lower extremities – running on the spot (RP) within 30 seconds, the result included the number of times feet hit/stamp the floor and the qualitative assessment of the movement technique on a scale of 0–5.
- Body balance – walking on a gym bench – BB (Skowronski, 2007)
- Fine motor coordination was determined using the following tests:
- Hand-eye coordination – selected Munich Functional Developmental Diagnostics tests (MFDD): unscrewing a bottle cap, bead stringing, making a modelling clay cylinder, drawing a circle,
- Hand-eye coordination – (VMC) using the Piorkowski apparatus, consisting of a keyboard with 10 signal lamps and buttons to turn them off. The task for the subject was to respond to the light signal as quickly as possible by pressing a button located under the lamp being lit (Figure 1).

The subjects performed three tests lasting 30 seconds

- At any rate within 30 seconds (VMCfr)
- 15 stimuli within 30 seconds (VMC 15)
- 25 stimuli within 30 seconds (VMC 25)

Figure 1. The Piorkowski apparatus.

The results of the Piorkowski test consisted of the number of correct button presses.

- Lateralisation of the upper extremities – measured using the Edinburgh Handedness Inventory test (EHI), providing the subject with objects described in individual test trials for the presentation of movements.
- And handedness (H-s) tested based on the learned hand movement responses, which are responses to the tasks suggested as part of the study (e.g. hand selection for the tasks of unscrewing a bottle, writing, drawing, etc.).

The basic intellectual skills related to speech, reading and understanding were also determined:

- Naming objects in pictures
- Uttering simple sentences
- Participation in a dialogue
- Reading a simple text
- Writing from dictation
- Signing one's name
- Drawing instead of writing
- Uttering stereotyped phrases

Subsequently, the physical fitness of speech organs was investigated. This physical fitness is conditioned by the functioning of the central nervous system – especially of the sensory and motor speech centres, but also by developmental defects of the articulatory organs.

The manifestations of the efficiency of articulatory organs was determined:

- Utterance of stereotyped phrases (perseverance – persistent utterance of a particular word or a phrase in the absence of the reasons for its utterance) or echolalia (repetition of words and sentences uttered by another person, which is typical of psychiatric disorders caused by the damage to the central nervous system and it is also found in schizophrenia) indicate the overall efficiency of the speech organs, but at the same time lack of control over what is being spoken. This can be an indicator

of the efficiency of speech organs, but at the same time point to disorders of the central nervous system
- Efficiency of the tongue,
- Efficiency of the lips,
- Proper bite and missing teeth.

As found in the study, low efficiency of articulatory organs was manifested by the possible presence of speech disorders (sigmatism, rhotacism, lambdacism, kappacism, unvoiced speech, slurred speech).

Additionally, certain features that could have affected the results of the aforementioned basic tests were determined. These included features related to the body structure, i.e. height, body and bend flexibility (bend forward in a simple sit in front of the gym bench and moving fingers as far as possible along a ruler placed transversee ly at the edge of the bench). If the subject reached the ruler, 30 points were scored. If the subject pushed a hand beyond the rula er, more points were scored (in centimeters), whereas fewer points were scored if the subject failed to reach the ruler. The muscle strength of the lower extremities (long jump from the spot with both feet), of the upper extremities (pushing a 2kg medicine ball with one hand), and of the abdominal muscles (the number of bends forward lying on the back within 30 seconds), was also determined (Skowronski. 2007). Physical fitness may be conditioned by the weight-height proportions of the body structure and flexibility. Likewise, proper muscle strength helps in the efficient performance of motor coordination tasks.

The group of healthy men was only tested for:
- Lateralisation of upper extremities – the difference of flexor muscle strength of the right and left hand (hand strength, HS) measured using the Squeeze Dynamometer,
- Kinaesthetic differentiation of the lower extremities – using the neurological knee-heel test (KH)
- Frequency of lower extremity movements – using the foot tapping test (FT),
- Hand-eye coordination – (VMC) using the Piorkowski apparatus,
- Lateralisation of the upper extremities using the Edinburgh Handedness Inventory test (EHI).

Results

Both groups of patients achieved worse results in gross motor coordination tests and the majority of statistically significant differences related to the group with mental impairment. A few differences between the groups of patients were also found (Table 1).

It is worth noting that the differences in the right hand strength and the number of running on the spot cycles were found between the groups of patients. In both of these tests, individuals with MI achieved worse results.

Both groups of patients achieved worse results in fine motor coordination tests and the majority of statistically significant differences related to the group with mental impairment. A few differences between the groups of patients were also found (Table 2).

As motor coordination was reported to depend on some body characteristics, both basic measures and some general fitness tests were performed in all participants. The results are presented in the Table 3. There were differences in the performance of manual dexterity tests between the study groups. Better results were achieved by individuals with psychic diseases than those with mental impairment. The differences between MI and PD groups related to intellectual skills estimated using the chi square test proved to be statistically insignificant (Table 3). Statistically significant differences in the results of the other investigated features related to: height between MI and HM ($Z = 2.80$, $p = 0.005$), and bend between PD and MI ($Z = 2.21$, $p = 0.03$).

Table 1. Gross motor coordination compared between patients with psychic diseases (PD) or mental impairment (MI), and healthy men (HM). The results were expressed as mean ± standard deviation, or median with quartiles, or the number of persons who performed/did not perform the test. The statistical significance was assessed, using the Kruskal-Wallis test with Dunn's correction, U Mann-Whitney test if two groups were analysed, or chi² test, respectively.

		PD	MI	HM	Z value, Kruskal-Wallis test with Dunn's correction or chi² test; only if p <0.05
ADL M±SD		88.5±17.8	80.3±20.3	100	MI/HM 4.66
HS M±SD	right	15.2±4.6	11.5±4.7	17.5±3.5	MI/HM 4.78; PD/MI 0.033
	left	14.4±3.9	11.5±4.8	16.9±3.4	MI/HM 4.26
	Absolute difference right/ left	1.6±1.7	1.6±1.5	1.6±1.1	
KH 0/1/2	right	1/2/7	4/8/10		MI/HM 3.68
	left	1/2/7	4/9/9		MI/HM 3.98
FT M±SD	right	27.1±7.6	20.8±7.3	43.8±8.5	PD/HM 3.69; MI/HM 6.79
	left	26.5±8.5	21.3±8.5	41.4±7.6	PD/HM 3.86; MI/HM 6.41
	Absolute difference right/ left	3.4±1.8	2.5±2.4	3.1±2.5	
RP	Number of cycles $\overline{X}$ ±SD	19.1±3.5	11.5±6.5		PD/MI 10.86
	quality Me (Q25-Q75)	4 (1.5–5)	2 (0–5)		
BB Me (Q25-Q75)		2.5 (0.5–4)	2 (0–4)		

Abbreviations: ADL – Barthel *Activities of Daily Living Index; RP – running on the spot; HS – hand strength; KH – knee-heel- test; FT – foot taping; BB – body balance*

Table 2. Fine motor coordination compared between patients with psychic diseases (PD) or mental impairment (MI), and healthy men (HM).

		PD	MI	HM	chi²
MFDD did not perform/performed					
Unscrewing a bottle cap		0/10	1/21		–
Bead stringing		0/10	5/17		–
Modeling clay cylinder		2/8	7/15		–
Drawing a circle		3/7	6/16		–
Kruskal-Wallis test with Dunn's correction					
VMCfr	right	37.5±10.2	20.2±13.1	45.4±8.12	MI/HM 6.23
	left	39.1±11.9	20.4±12.4	46.5±7.95	MI/PD 2.82 MI/HM 6.42
	Absolute difference right/left hand	2.3±2.2	2.3±1.7	2.2±1.6	–
VMC15	right	15.3±0.9	10.6±5.8	15.0±0.00	MI/PD 2,42 MI/HM 3.03
	left	14.6±0.5	10.7±5.7	15.0±0.00	MI/HM 3.52
	Absolute difference right/left hand	0.7±1.3	0.9±1.6	0.0±0.0	MI/HM 2.78
VMC25	right	22.2±7.5	13.0±9.8	25.0±0.14	MI/HM 5.62
	left	22.9±5.3	11.8±10.0	25.0±0.00	MI/PD 2,50 MI/HM 6.02
	Absolute difference right/left hand	1.3±2.2	2.6±2.8	0.0±0.0	MI/HM 5.54
To tapp the rhythm can/cannot		2/8	12/10	chi²	
EHI right-handed/left-handed		6/4	12/10	37/14	
H-s right-handed/left-handed		10/0	19/3		

Table 2.(cont). Fine motor coordination compared between patients with psychic diseases (PD) or mental impairment (MI), and healthy men (HM).

	PD	MI	HM	chi²
Lateralization based on objective tests (VMCfr and FT)				
Right hand, right leg	2	2	13	
Right hand, left leg	0	4	20	
Left hand, right leg	4	8	16	
Left hand, left leg	4	8	2	

Abbreviations: MFDD – Munich Functional Developmental Diagnostics tests; VMCfr (VMC) vision-manual coordination (the Piorkowski test at any time); FT – foot taping

Table 3. The other investigated features of the body structure and physical fitness, intellectual skills, and efficiency of the speech organs.

Features of the body structure and physical fitness	**PD**	**MI**		**HM**
		n		**n**
Flexibility (in points)	22 ±11	9	11±10	16
Long jump with both feet (cm)	109.4±46.5	5	75.2±37.0	12
Pushing a medicine ball (cm)	625.0±292.0	6	655.0±134.4	2
Crunches (number) Me Q25-Q75)	10 (3–12)	5	10 (5–12)	10
Height (cm)	175.8±7.1		171.3±6.6	176.7±7.06
Body weight (kg)	94.21±6.4		82.9±20.3	85.0±12.95
intellectual skills cannot/can				
	PD		**MI**	
Naming objects in pictures	0/10		2/20	
Uttering simple sentences	0/10		7/15	
Participation in a dialogue	4/6		12/10	
Reading a simple text	4/6		14/8	
Writing from dictation	1/9		12/10	
Signing one's name	1/9		8/14	
Drawing instead of writing draws/writes	1/9		2/20	
Uttering stereotyped phrases improperly/well	2/8		7/15	
Efficiency of the speech organs				
Tongue inefficient/efficient	0/10		0/22	
Lips inefficient/efficient	0/10		0/22	
Proper bite Missing teeth Open bite	6 4 0		11 10 1	
No speech disorders Careless Slurred Echolalia Sigmatism	6 3 1 0 0		7 7 5 1 2	

Abbreviations: PD – psychic diseases; MI – mental impairment, HI – healthy individuals

The lateralisation test provides different results depending on the method applied in the test. Lateralisation of the upper extremities measured using the EHI test and handedness tested on the basis of the learned H-s motor responses related to the hand provide divergent results, which also differ from the assessment of the better result of VMCfr and FT. Significant differences were found in the difference between hands in VMC15 and VMC25, where patients achieve much worse results than individuals from the HM group. However, when all participants of the assessment were classified on the basis of these two objective tests into those who use their right/left hand and the right/left foot more efficiently (regardless of the objective difference in the results), one can notice that among the PD and HM groups there are far fewer individuals using the right hand and the left foot, while this category is numerous in the MI group. The distribution of subjects is presented in Figure 2.

In the intellectual sphere involving fine motor skills the majority of subjects in both groups performed simple tasks, while a larger group of individuals had problems with complex tasks (dialogic speech and reading) (Table 3.). A statistically significant difference between individuals with psychic diseases and those with mental impairment was found with regard to writing from dictation. Individuals with psychic diseases fail to perform this task much more frequently.

Discussion

Generally, it can be said that in the light of the results of all our study, the groups of patients achieved worse results than the control group. The assessment of motor coordination showed that the patients manifested poorer coordination in comparison with the healthy group and statistically significant differences were found in individuals with mental impairment as compared to healthy individuals, and in the few tests between individuals with mental impairment and those with psychic diseases.

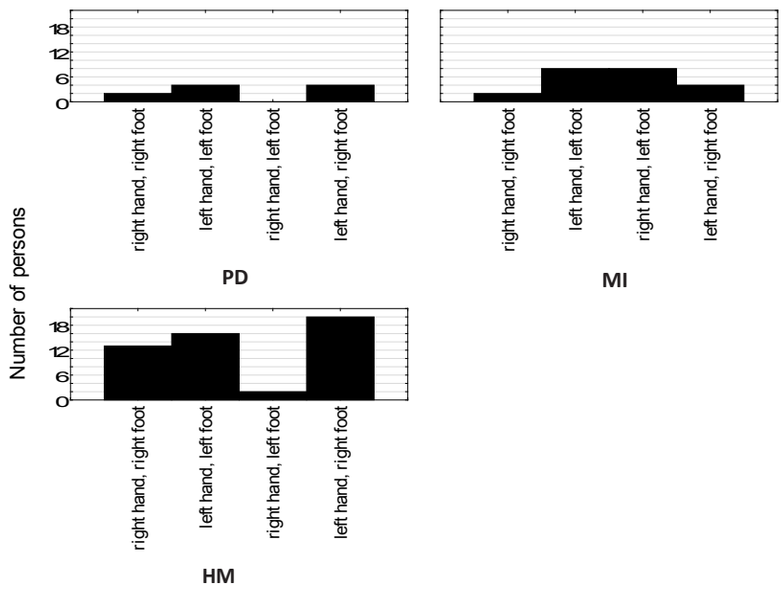

Figure 2. Number of persons using right/left hand and right/left foot, analyzed by two tests (visual-motor coordination free rate VMCfr and foot tapping FT), in patients groups (PD-psychic disorders, MI – mental impairment) and healthy men (HM). The statistically significant difference between all groups: chi² 19.21, p = 0.004, whereas there was no statistically significant difference between PD and HM. There was also no statistically significant difference between MI and PD, whereas such a statistically significant difference was found between HM and MI is (chi² = 16.01, p = 0.001).

Del-Monte *et al.* (2013) found that poorer motor coordination is not only the feature typical of patients with schizophrenia, but also of their relatives, and is thus genetically determined. Poorer motor coordination can be a predictor of schizophreenia. It is difficult to draw such conclusions for the study group, as there were too few individuals with schizophrenia. Moreover, members of their families were not subject to investigation.

Poorer motor coordination was also related to ambiguous results concerning lateralization: individuals with mental impairment are generally less strongly lateralized than the other subjects, but it was difficult to compare their results with those of the healthy individuals due to the low difficulty level of the tests maintained for the sake of the patients. This confirms the results obtained by other authors: manual dexterity was significantly lower in the intellectually disabled group compared to healthy peers in early adolescence (Lahtinen *et al.*, 2007).

Studies such as the present one, on the relation between general physical fitness, manipulative efficiency of the hand and motor coordination as compared with verbal communication efficiency in individuals with with mental problems, have rarely been undertaken. Gouvier *et al.* (1994) compared the interactions during verbal communication between disabled students using wheelchairs and non-disabled students. They found that verbal and non-verbal communication was poorer in physically disabled individuals. Clegg *et al.* (2007) point to the need of speech therapy in individuals with schizophrenia. This can be achieved through social interactions. If the aims of group meetings with these individuals are physical activities, one can simultaneously improve their physical fitness, speech skills, and social communication. The relationship between the incidence of impaired lateralization, improper handedness and legness, and the development of speech, reading and writing has been a fact known for a long time (Johnston *et al.* 2009, Shearer 1968).

The hand-eye coordination test (VMC) demonstrated the differences between the two groups of patients. The difference between the two groups of patients and healthy individuals was very significant, but this was due to the fact that healthy individuals performed the test achieving the maximum result possible, due to the low difficulty level. However, setting the test parameters at this level was necessary due to the limited motor skills of the patients.

In addition, in the assessment of the VMC test results one has to take into account the fact that the learning effect may occur: the test performed using the other hand is performed better than expected due to the fact that the subject is already familiar with the test technique. However, even if one assumes that such an effect occurs, it should be remembered that the test was performed first with the right hand, and then with the left hand, and therefore the dominance of the right hand clearly indicates right-handedness. The authors also analyzed the results with regard to the dominant/non-dominant hands, and the learning effect was not reported.

Lahtinen *et al.* (2007) found that the value of IQ is strongly associated with the body balance, manual dexterity and the strength of abdominal muscles. In our studies we found no difference in intellectual abilities between men with mental impairment or psychic diseases (based on quite general tests used to assess the level of basic communication skills and social behavior), while in contrast the differences in lateralization degree were noticeable, and influenced the performance level in coordination tests.

The authors suggest that body balance problems result from the dysfunctions of the central nervous system, but this can be improved by physical activities. The relationship between impaired balance (which may be caused by lateralisation impairment)

and the incidence of falls was investigated by Hale *et al.* (2007). However, these authors conclude that poor results may be due to the fact that the subjects failed to understand the tests. Indeed, our experience shows that 10/52 of the subjects failed to perform the planned tests, but those who performed them, that is they understood the verbal commands and instructions given by the instructor, still achieved worse test results than the healthy individuals. This may contribute to the higher incidence of falls observed in this group.

Many authors draw attention to the particular importance of motivation in the development of physical fitness in individuals with mental problems. Motivation should be developed by a therapist. However, practicing physical activities in a group provides stronger motivation, therefore the results of the activities are better. Participation in competitive sports by individuals with MI also contributes to the development of motivation, which also shows in the activities of daily living (Farrell *et al.*, 2004, Požerine *et al.* 2008, Hutzler and Korsensky, 2010). Our results also agree with those described by Lahtinen, in which none of the participants of this study was actively involved in organised sport activities, such as Special Olympics. Most of the participants worked in sheltered employment, where the tasks were oriented toward manipulative skill activities rather than use of gross motor/fitness activities. Most of the participants had little to no physical education experience.

Faulkner and Carless (2006) describe the impact of a well-planned motor rehabilitation as an important part of psychiatric rehabilitation. They point to the importance of the proper selection of the type and intensity of physical activities. They suggest that therapeutic sessions should include both physical activities and psychological interventions. Their claim is documented on the basis of evidence-based medicine achievements.

Conclusions

Having taken into account the results of all our tests, both groups of patients achieved worse results than individuals from the control group. The assessment of motor coordination showed that the patients manifested poorer coordination in comparison with the healthy group and statistically significant differences were found in individuals with mental impairment as compared to healthy individuals, and in the few tests between individuals with mental impairment and those with psychic diseases. Our research confirms that motor rehabilitation of individuals with psychic diseases and particularly of those with mental impairment is highly desirable as it may improve their everyday functioning. However, it must be based on a sound assessment of the degree of physical disability, including lateralisation disorders.

Key findings

Gross and fine motor control abilities were diminished in Psychiatric Health Care Centre residents, men with mental impairment performed worse than those with psychic diseases and both groups worse than healthy men.

What the study has added

Various aspects of motor control may depend on disturbed lateralisation, and the careful examination of that aspect should be the basis for physical therapy and/or occupational therapy.

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