Evidence-based monitoring of the stimuli and effects of prophylaxis and kinesiotherapy based on the exercises of safe falling and avoiding collisions as a condition for optimising the prevention of body injuries in a universal sense – people with eye diseases as an example of an increased risk group

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

Bartłomiej Gąsienica Walczak[1ABCDE], Bartłomiej Jan Barczyński[2,3ADE], Roman Maciej Kalina[4ABCDE]

[1] Faculty of Medicine, Rzeszow University, Rzeszow, Poland
[2] Archives of Budo, Warsaw, Poland
[3] 4 MEDICINE REK LLP, Warsaw, Poland
[4] Faculty of Physical Education, Gdansk University of Physical Education and Sports, Gdansk, Poland

Received: 14 December 2017; **Accepted:** 02 February 2018; **Published online:** 16 March 2018

AoBID: 11989

Abstract

Background and Study Aim: Often the boundary between prophylaxis and therapy is difficult to define. People with diseases of the eye are at increased risk of a collision with both vertical obstacles or objects which are in motion, and unintentional fall. The aim of this study is knowledge about methods, means, effort indicators during a practice session, as well as the quality of body control during a simulated fall in laboratory conditions before and after a specific course.

Material and Methods: Clinical group (CG) 5 male with eye diseases: age 18.2 ±0.45 years; height 171 ±12.4 cm, weight 66.2 ±14 kg. Prophylactic group (PG) 36 male physiotherapy students (mean, SD): age 21.5 ±2.25 years; height 181.28 ±5.26 cm; weight 79.47 ±8.65 kg. We used the susceptibility test to the body injuries during the fall" (STBIDF). Total points is a general indicator of the susceptibility to body injuries during the fall (SBIDF): low (0), average (1-3), high (4-8), very high (9-14). Relatively for particular body parts (SBPIDF): low (0), average (1), high (2-6).

Results: CG average session time 33 minutes, 40 specific exercises were used, 63% falls (150-160), 37% others. The intensity of all sessions of kinesiotherapy in the moderate zone, while 2 minutes of specific training sequences in the high zone. PG respectively: 38 minutes, 50 exercises including 60% (180-190) of various falls and 40% fun forms of martial arts, fall simulations, avoiding collisions. The average intensity of training 130 HR (moderate zone). SBIDF before the specific course was in CG: 9 ±1.87 points (6 to 11); in PG 8.56 ±2.87 points (0 to 14) and). After, respectively: CG: 3.2 ±1.17 points (2 to 5) and in PG 0.75 ±1.01 points (0 to 3) $p<0.001$.

Conclusions: We recommend the cumulating of 10 empirically verified sessions within 2-3 weeks of health stay as an optimal incentive for injury prevention due to falls and/or collision. Combining these exercises with occupational therapy and creeping orientation training can be an effective and attractive way to improve the quality of life of people with eye disease.

Keywords: epidemiology of injuries • fun forms of martial arts • non-apparatus test • quality of life • training load

Conflict of interest: Authors have declared that no competing interest exists

Ethical approval: The study was approved by the local Ethics Committee

Provenance & peer review: Not commissioned; externally peer reviewed

Source of support: Departmental sources

Author's address: Bartłomiej Gąsienica Walczak, Faculty of Medicine, University of Rzeszow, Al. Kopisto 2a, 35-959 Rzeszow, Poland; e-mail: bgw@interia.pl

INTRODUCTION

Often the boundary between prophylaxis and therapy is difficult to define. This phenomenon is particularly highlighted during motor skill learning for health and survival. Definition of the **motor skill learning** (*noun*: the acquisition of new motor skills, either as a child or as part of sports training [1]) does not include an extremely important aspect – the acquisition of new motor skills by the people with disabilities.

There are three threats – fall, collision, aggression – on which any independently moving person (regardless of age, gender, motor skills), cannot be affected under certain circumstances [2, 3]. Most of the people with disabilities, who are able to move independently are a group that is particularly susceptible to unintentional fall and collision, but without the help of other people, they are unable to defend themselves against aggressors (individual or group). Everyone (not excluding the wide group of the people with disabilities) can appropriately prepare so that overcome these threats or minimise effects (range of injuries, save the life) [4-12]. References in the last sentence are accumulating the most important works of agonology initiated in 1938 by Tadeusz Kotarbiński [13], at present dynamically developed innovative agonology in interdisciplinary approach [14-16].

In this work, we deal with the issue of the preparation people with eye diseases for the protection of the own body against damage, and in extreme situations to avoid death, on account of unintentional fall or collision with an object in motion or with a vertical obstacle, or as a result of accumulating of these events (fall preceded by the collision e.g. with the cyclist). These premises reveal two aspects of blurring the borders between prophylaxis and therapy body injuries as a result of mentioned events. The first aspect refers to the people with eye diseases (as an example of a relatively homogeneous increased risk group). The progressive threat of loss of sight is enhanced prophylaxis aspect health-related training based on safe fall and avoiding collision exercises. The negative experience of prior falls and collisions (also concerning the mental sphere) empowering accentuate of kinesiotherapy. Thus from the perspective of optimising the social communication in areas of public health and health service planning [17] the most appropriate seems expression: "prophylaxis and kinesiotherapy based on the exercises of safe falling and avoiding collisions". The second aspect refers to healthy people, and those who are older, the more they accumulate negative experiences as a result of unintentional falls and collisions. If they have a lack of motor competence in safe fall, avoiding collisions and reducing the impact of a collision with an object in motion or with a vertical obstacle, then in the in the conditions of lower visibility, especially in darkness, they have a higher risk of falls than people with eye diseases.

It is entitled assumption that "universal course of prophylaxis and kinesiotherapy based on the exercises of safe falling and avoiding collisions" is addressed for the healthy people and people with eye diseases. Complexity and social role of that problem inclined for the profound critic of monitoring phenomenon the most important elements of the system from "micro" to "macro" scale: "diagnosis – systemic applications".

The most accurate data cover epidemiology in macro scale. According to 2014 WHO report 285 million people all over the world have the visual impairment sight defect, 39 million are blind, and 246 million have restricted visual field. More than 80% blind people are above 50 years old [18].

Motor skills – *plural noun* the ability of a person to make movements to achieve a goal, with stages including processing the information in the brain, transmitting neural signals and coordinating the relevant muscles to achieve the desired effect [1].

Public health – *noun* the study of illness, health and disease in the community. → **community medicine** [1].

Health service planning – balancing the needs of a community, assessed by such indices as mortality, morbidity, and disability, with the resources available to meet these needs in terms of medical manpower (ensuring the numbers in training grades meet but do not exceed future requirements for career grades) and technical resources , such as hospitals (capital planning), equipment , and medicines. Success is measured by a process ***medical audit in*** which the use of resources is weighed against the efficiency of their use (e.g. treatments undertaken, bed occupancy) and effectiveness in terms of outcome (e.g. deaths, complications, quality of life, return to work) [17, p. 296].

Personal safety – justified sense of survival ability in various emergency situations, either of external nature (e.g. violence, aggression, unintended fall, fire, tsunami) or internal nature (e.g. stress, disease, fear) [50].

Simulation – caused in model an event, which under some circumstances is similar to the event occurring in examined real object [51].

As an example we can present the data from Poland: in 2004 there were 1,820,300 disabled people due to eyes injuries or diseases; in 2010 Polish Association of Blinded registered 63,514 people [19].

Phenomenon in microscale concerns analysis of results in experimental studies (including clinical trials, field trials, community intervention and cluster randomized trials) or non-interventional studies (including case-control studies, cohort studies, cross-sectional studies, prospective studies, retrospective studies, registries, proportional mortality studies, ecologic studies, hypothesis generation, hypothesis screening, post-authorisation safety studies). Meta-analyses provide the knowledge about current research status especially about original achievements of researchers, the activity of research centres, description of method and tools used, the effectiveness of implementation processes, costs and other less important details. As an example may be Ecosse et al.[20] publication pointing visual disorders as one of the most frequent causes of physical activity restriction. It means deterioration of physical activity, higher liability for loss balance and a higher risk of injury in case of fall. Almost 15% of people with visual impairment sight defect declared the fall at least once per year [20].

According to estimates, Black et al. [21] during the 1-year follow-up, 31 (44%) participants experienced at least one fall and 22 (31%) experienced falls that resulted in an injury. Saftari and Kwon [22] in last revive – citing data from e Media Centre Fall Fact Sheet [23] – emphasise that "Falls are the second leading cause of accidental deaths after road traffic accidents worldwide. It is estimated that 646,000 people die from falls worldwide". The authors of this review of publications regarding the falls of people with visual impairment inform that the most (in the brackets the number of works) are dedicated to visual acuity (18), visual field (13), contrast sensitivity (10), depth perception (8). Much less is publications on issues directly fear of falling [24]. Lack of work monitoring the applied methods, means and characteristics of physical effort people with impaired visual function during prophylaxis and/or kinesiotherapy based on the exercises of safe falling and avoiding collisions.

Therefore it is not a surprising conclusions of a number of very valuable epidemiological studies, limited to reduce of the risk of falling, i.e. "Persons with visual field loss may benefit from mobility training to reduce the risk of falling" [25]; "Since vision loss may be a contributing factor to falls that occur in hospitals, implementing an assessment of vision at hospital admission would be useful to alert staff to those patients who are at risk for falls due to poor vision, so that preventative measures can be applied" [26]. This paradigm has dominated the global science space. This obvious and necessary aspect of the prevention of falls has empirically proven limitations. The effectiveness of prevention programs ranges from 15% to 40% [27-30]. With the ageing of societies and the maintenance of current epidemics indicators of disease and accident (optimistic forecast), the effectiveness of prevention programs will decrease. The missing element of the real paradigm of risk prevention and its consequences (significantly reduced by teaching safe fall) is possible by implementing unique courses of prevention and therapy developed and empirically verified by Polish experts of sports science and health science [10, 31-33].

The aim of this study is knowledge about methods, means, effort indicators during a practice session, as well as the quality of body control during a simulated fall in laboratory conditions before and after a specific course.

MATERIAL AND METHODS

Participants

Clinical group (CG) 5 male with eye diseases: age 18.2 ±0.45 years; height 171 ±12.4 cm, weight 66.2 ±14 kg; three patients with diagnosed different eye diseases, two blind. Patients k ED-1 and B-1 before and during the experiment participated once a week in 45 minutes lesson of physical education. Others, in leisure, were stimulated by additional sporting activities (Table 1). All of them have been pupils of Special Education Centre for blind and visual impairment children in Cracow. Observations (including motoric tests and questionnaire surveys) have been taken at the beginning of February 2014 and at the end of June 2014.

Prophylactic group (PG) 36 male physiotherapy students (mean, SD): age 21.5 ±2.25 years; height 181.28 ±5.26 cm; weight 79.47 ±8.65 kg (Table 1). Among physiotherapy students, 6 (16.7%) declared, that they do not take any sports activity during the free time including one who declared

Occupational therapy – the treatment of physical and psychiatric conditions by encouraging patients to undertake specific selected activities that will help them to reach their maximum level of function and independence in all aspects of daily life. These activities are designed to make the best use of the patient's capabilities and are based on individual requirements. They range from woodwork, metalwork, and printing to pottery and other artistic activities, household management, social skill (for psychiatric patients). Occupational therapy also includes assessment for mechanical aids and adaptations in the home [17, p. 455].

Counterproductive – from praxeological perspective certain action can be: productive – non-productive – counterproductive – neutral. The action is **counterproductive** when a doer achieved goal opposite than intended [51].

Table 1. The characteristics of patients with the clinical group (the ordinal variable assigned to the patient's code is less susceptibility to the body injuries during the fall before kinesiotherapy Specific Course SFACPED – results of the STBIDF).

Patient's code	Age [years]	Height [cm]	Weight [kg]	Characteristics of disability	Physical activity in leisure
Eye diseases patient's (n = 3)					
ED-1	18	164	50	high myopia, blindness of the left eye, amblyopia of the right eye	
ED-2	19	191	71	astigmatism, myopia	strength training: twice a week for 30 minutes
ED-3	18	164	86	pigmentary retinal degeneration	football: once a week 60 minutes
Blind patient's (n = 2)					
B-1	18	161	56	Recklinghausen syndrome, atrophy of the optic nerves	
B-2	18	175	68	retinal degeneration, atrophy of the optic nerves	swimming: twice a week for 60 minutes

Table 2. Estimation of the age and somatic indicators of 36 male physiotherapy students before starting the course of safe falling and avoiding collisions for people with eye diseases.

Variable		SD	min	max	Skewness g_1	Kurtosis g_2
Age [years]	**21.56**	**2.25**	**20**	**34**	**5.11**	**28.62**
Height [cm]	**181.28**	5.26	170	193	**0.14**	**–0.19**
Weight [kg]	**79.47**	8.65	65	95	**0.13**	**–1.19**

it occasionally. Eight of them (22.22%) did not specify the sports activity, but activity in category sport for all defined as a medium (3), high (2), active (2) and recreational (1). Twelve (33.33%) pointed one preferred kind of sport: soccer 33 persons; strength training 3 persons, 2- person volleyball; singly (ice hockey, mountaineering, running, snowboarding). Six (16.7%) regularly trained two sports in which dominated: soccer (3), strength training (2) volleyball (2); rest of sports (judo, running, skiing, snowboarding, taekwondo). Two (5.6%) trained 3 sports (skiing, soccer, swimming and running, soccer, volleyball). The most all-rounded: leader (dance, cycling, running, sailing, swimming); vice-leader (combat sports, skiing, soccer, strength training). Among students the most often declared motoric exercise was soccer (9 declared, e.g. 25%).

They were all physiotherapy students of Institute of Physiotherapy, Podhale State College of Applied Sciences, Nowy Targ, Poland (first-degree studies, the third year of physiotherapy 2009/2010 and 2010/2011). Motoric tests have been taken at the beginning of October and before the end of February (accordingly in the academic year).

STUDY DESIGN

Structure of the "universal courses of prophylaxis and kinesiotherapy based on the exercises of safe falling and avoiding collisions" (Universal Courses PK-SFAC)

The universal courses combine two common methodological aspects. First, the primary goal of specific motor skill learning (to which intentionally all patients aimed), PT students and also kinesiotherapy experts) was the safe falling: rear fall and rear fall with turn; fall to the side (left and right). However, only for the researchers, the main cognitive aim was the susceptibility to body injuries during the fall (SBIDF). This phenomenon (SBIDF) a be measured in every man, who understands simple commands and immediately converts into equally simple motor activities (on soft ground). It means that multidimensionality psychomotor test is able to measure SBIDF before the person takes specific prophylactic or kinesiotherapy [33].

Second, motor competence for avoiding collision have been evaluated on a current basis (expert evaluation) in each session based on proper exercises ("not tests").

Clinical group (CG)

Special course safe falling and avoiding collisions for people with eye diseases (Specific Course

SFACPED) consisted of 10 sessions (theoretical to 45 minutes) once a week within the lessons of physical education. To ensure personal safety in each session participated maximally four people with eye diseases. Exercises have been done in a gymnasium. Every patient has done the scheduled exercises on the two big mattresses (precisely connected).

Prophylactic group (PG)

PT students carried out the first part (Universal Course PK-SFAC: lectures 10 hours, classes 20 academic hours, every 45 minutes) of authors programme "Theory and methodology of safe falls persons with eye diseases". Alternatively, students (one hour) participated in session as a practitioner (potential patient with eye diseases) and one hour as prophylactic/kinesiotherapy expert. In second role they also documented load during the particular session [10].

The susceptibility test to the body injuries during the fall (STBIDF)

Before and after specific courses safe falling and avoiding collisions we used the STBIDF [34].The structure of STBIDF is: three motoric trials performed on a tatami mat (soft ground). A manner of the body parts protection (head, hands, hips, legs) was being assessed, the most exposed to damage during the fall. Any incorrect collision – simulated by the fastest possible change of the posture from vertical to horizontal (lying on the back), were documenting by the mistakes of the first- ("1") or the second grade ("2"), and no mistakes "0". Total points is a general indicator of the susceptibility to body injuries during the fall (SBIDF): low (0), average (1-3), high (4-8), very high (9-14). Relatively for particular body parts (SBPIDF): low (0), average (1), high (2-6).

Marginal values of SBPIDF (as a result of summing errors made during the tasks) for the different parts of the body include between: legs 0 to 2; hips 0 to 3; hands 0 to 6; head 0 to 3. However the marginal values of summing points estimated after completing the Task 1 and 2 are in the range 0 to 4 points, and Task 3 in the range 0 to 6 points. For this reason, a comparative analysis (for the parts of the body and each task), takes into account the indicator of the proportion of errors (expressed in percentage) applied to the possible maximal value of estimated points (SBPIDF%max). For example, for the hands, this value is 6 points (100%) and 2 points (100%) for legs (no error indicator always 0%) [34].

The methodology of measurement and documentation of workload continuous with variable intensity during kinesiotherapy and prophylactic sessions

The following basic indicators were measured and noted: the duration of particular measures, i.e. given exercises or sets of exercises (T_E), the duration of the entire session (T), the intensity of the exercises (I_E), the intensity of the entire session (I). The duration of the exercises (set of exercises) was measured in minutes. The average heart rate recorded accurately to two decimal places is the indicator of intensity (IE), calculated after the end of a session. The heart rate was measured using palpatory method each time during 6 seconds several times during the exercise (at 2 or 3-minute intervals) and recorded in 'HR' column in the appropriate line in *Protocol Continuous Workload with Variable Intensity* [35]. The product of the duration of exercise and its intensity (e.g. TE1×IE1) is a measure of the workload after a given exercise or set of exercises (LE – exercise load). Conventional units are therefore a measure of the workload after a physical effort (a given exercise and the sum of all exercises performed during a given session). The workload (session load) during the entire session is calculated using the formula $LE = L_E + FRT \cdot 10$, where:

$$L_E = \Sigma(T_{E1} \cdot I_{E1}) + \Sigma(T_{E2} \cdot I_{E2}) + \ldots + (T_{En} \cdot I_{En}) = \sum_{k=1}^{n} T_{Ek} \cdot I_{Ek}$$

and FRT refers to the duration of functional rest ($T - \Sigma T_E$) due to the fact that there are cases when the interval between particular exercises (even though the principles of continuous effort with variable intensity are not violated) will exceed previously set minute or will result from unintentional event (e.g. a need to use a toilet); 10 is an arbitrarily adopted indicator of intensity for functional rest of adults.

For each person HRmax was calculated using the formula of Tanaka et al. [36]: HRmax = 208 – (0.7 × age). The *Protocol Continuous Workload with Variable Intensity* comprises moreover the *content of exercises* described in words or symbols and the *scope of exercise* recorded as, i.e. the number of repetitions, mistakes or any other relevant information. It also contains a list of symbols used and the classification of workload intensity in adults (%HRmax) according to Pollock et al. [37]: I_{VL} very light (<35); I_L light (35-54); I_{MO} moderate (55-69); I_H hard (70-89); I_{VH} very hard (≥90); I_M maximal (100) extended by the supramaximal efforts zone I_{SM} supramaximal (>100) [35].

Statistical analysis

In the estimation based on empirical data taken into consideration arithmetic mean, standard deviation, maximum result, and the minimum result. In order to determine the significance of the differences between the two means used *t-test for independent samples*.

Consent of the Ethical Committee

The study was conducted within the two research projects: (1) Rzeszow University "Motor, methodical and mental effects of education of students in the field of safe falling of blind and/or limb amputations" Resolution No. 3/02/2011 Bioethics Committee at the Rzeszow University, Rzeszow, Poland); (2) Academy of Physical Education in Katowice: "Reducing vulnerability to body injuries during the fall of people categorized as group being at high risk of losing balance and falling" (Resolution No. 04/2013 Bioethics Committee at the Jerzy Kukuczka Academy of Physical Education, Katowice, Poland).

RESULTS

Psychomotor effects

Only patient ED-1 revealed a high level of errors of body control during a fall in laboratory conditions, while the other four persons very high level (negative phenomenon) prior to the kinesiotherapy Specific Course SFACPED (Tables 3 and 4). The mean values of both $SBIDF_0$ and $SBPIDF_0$ indicators for legs, hips, hand and head of two subgroups patients (eye diseases and blind) and PT students prior to Universal Courses PK-SFAC are similar (Tables 3 to 5).

All eye diseases the male patient has reduced the errors to the average level, while the blinds to the high level (Table 6). Patients ED-3 and ED-2 revealed the highest capability of errors reduction of, respectively by 57.14%; 50% (Tables 3, 4, 6). Stronger is dynamics of errors reduction of the body parts during a fall by the PT students (Table 7, Figures 1 to 5). Only one of the PT students was able to perform STBIDF without mistake before the

Table 3. Errors of body control during a fall in laboratory conditions (measured by STBIDF indicators) of three eye diseases male patients prior to the kinesiotherapy Specific Course SFACPED.

Patient's code	Errors						Level
	$SBPIDF_0$ (points) & $SBPIDF\%max_0$ (%)						
	legs	hips	hands	head	$SBIDF_0$	SBIDF $\%max_0$	
ED-1	0	3	2	1	6		high
	0	100	33.33	33.33		**42.86**	
ED-2	1	3	2	3	9		very high
	50	100	33.33	100		**64.28**	
ED-3	1	1	6	3	11		very high
	50	33.33	100	100		**78.57**	
SBPIDF(ratio based on raw points)							
$\bar{X}$	**0.67**	**2.33**	**3.33**	**2.33**	**8.67**	-	
SD	0.58	1.15	2.31	1.5	2.51	-	
min	0	1	2	1	6	-	high
max	1	3	6	3	11	-	very high
SBPIDF%max (%)							
$\bar{X}$	**33.33**	**77.78**	**55.55**	**77.78**	-	**61.9**	
SD	28.86	38.49	38.49	38.49	-	**17.97**	
min	0	33.33	33.33	33.33	-	**42.86**	
max	50	100	100	100	-	**78.57**	

Table 4. Errors of body control during a fall in laboratory conditions (measured by STBIDF indicators) of two male patients of blind prior to the kinesiotherapy Specific Course SFACPED.

Patient's code	Errors						Level
	SBPIDF$_0$ (points) & SBPIDF%max$_0$ (%)						
	legs	hips	hands	head	SBIDF$_0$	SBIDF %max$_0$	
ED-1	0	3	2	1	6		high
	0	100	33.33	33.33		**42.86**	
ED-2	1	3	2	3	9		very high
	50	100	33.33	100		**64.28**	
ED-3	1	1	6	3	11		very high
	50	33.33	100	100		**78.57**	
SBPIDF(ratio based on raw points)							
$\bar{X}$	**0.67**	**2.33**	**3.33**	**2.33**	**8.67**	-	
SD	0.58	1.15	2.31	1.5	2.51	-	
min	0	1	2	1	6	-	high
max	1	3	6	3	11	-	very high
SBPIDF%max (%)							
$\bar{X}$	**33.33**	**77.78**	**55.55**	**77.78**	**-**	**61.9**	
SD	28.86	38.49	38.49	38.49	-	**17.97**	
min	0	33.33	33.33	33.33	-	**42.86**	
max	50	100	100	100	-	**78.57**	

Table 5. Errors of body control during a fall in laboratory conditions (measured by STBIDF indicators) of 36 male physiotherapy students prior to the Universal Course PK-SFAC.

Patient's code	Errors						Level
	SBPIDF$_0$ (points) & SBPIDF%max$_0$ (%)						
	legs	hips	hands	head	SBIDF$_0$	SBIDF %max$_0$	
ED-1	0	3	2	1	**6**		high
	0	100	33.33	33.33		**42.86**	
ED-2	1	3	2	3	**9**		very high
	50	100	33.33	100		**64.28**	
ED-3	1	1	6	3	**11**		very high
	50	33.33	100	100		**78.57**	
SBPIDF(ratio based on raw points)							
$\bar{X}$	**0.67**	**2.33**	**3.33**	**2.33**	**8.67**	-	
SD	0.58	1.15	2.31	1.5	2.51	-	
min	0	1	2	1	6	-	high
max	1	3	6	3	11	-	very high
SBPIDF%max (%)							
$\bar{X}$	**33.33**	**77.78**	**55.55**	**77.78**	-	**61.9**	
SD	28.86	38.49	38.49	38.49	-	**17.97**	
min	0	33.33	33.33	33.33	-	**42.86**	
max	50	100	100	100	-	**78.57**	

Table 6. Errors of body control during a fall in laboratory conditions (measured by STBIDF indicators) of male patients with visual impairment (n = 5) after to the kinesiotherapy Specific Course SFACPED.

Patient's code	Errors						Level
	$SBPIDF_1$ (points) & $SBPIDF\%max_1$ (%)						
	legs	hips	hands	head	$SBIDF_1$	$SBIDF\%max_1$	
ED-1	0	0	2	0	2		average
	0	0	33.33	0		**14.28**	
ED-2	0	0	2	0	2		average
	0	0	33.33	0		**14.28**	
ED-3	1	0	2	0	3		average
	50	0	33.33	0		**21.43**	
B-1	1	0	4	0	5		high
	50	0	66.67	0		**35.71**	
B-2	0	2	2	0	4		high
	0	66.67	33.33	0		**28.57**	
$SBPIDF_1$ (ratio based on raw points)							
$\bar{X}$	**0.4**	**0.4**	**2.4**	**0**	**3.2**	-	
SD	0.49	0.8	0.8	0	1.17	-	
min	0	0	2	0	2	-	average
max	1	2	4	0	5	-	high
$SBPIDF\%max_1$ (%)							
$\bar{X}$	**20**	**13.33**	**40**	**0**	**-**	**22.85**	
SD	**27**	**29.8**	**14.9**	0	-	**18.33**	
min	0	0	33.33	0	-	14.28	
max	50	66.67	66.67	0	-	37.71	

Table 7. Errors of body control during a fall in laboratory conditions (measured by STBIDF indicators) of 36 male physiotherapy students after the Universal Course PK-SFAC.

Patient's code	Errors						Level
	$SBPIDF_1$ (points) & $SBPIDF\%max_1$ (%)						
	legs	hips	hands	head	$SBIDF_1$	$SBIDF\%max_1$	
$SBPIDF_1$ (points)							
$\bar{X}$	0	0	0.67	0.08	0.75	-	
SD	0	0	0.88	0.27	1.01	-	
min	0	0	0	0	0	-	low
max	0	0	2	1	3	-	average
$SBPIDF\%max_1$ (%)							
$\bar{X}$	**0**	**0**	**11.11**	**2.78**	**-**	**5.36**	
SD	0	0	14.91	9.34	-	**7.32**	
min	0	0	0	0	-	0	
max	0	0	33.33	33.33	-	21.43	

course; however also the only one has made 14 mistakes (extremely not able to steer with his body during the fall). After 10 sessions of prophylaxis, he reduced all mistakes. Before course 23 PT students (63.69%) had a very high level of mistakes and reduced it from 9 to 14 raw points. During the training 14 patients reduced all the mistakes (Figure 2). Detailed analysis reveals the following number of students and sum of reduced mistakes accordingly: two by 12; two by 11; three by 10; seven of nine.

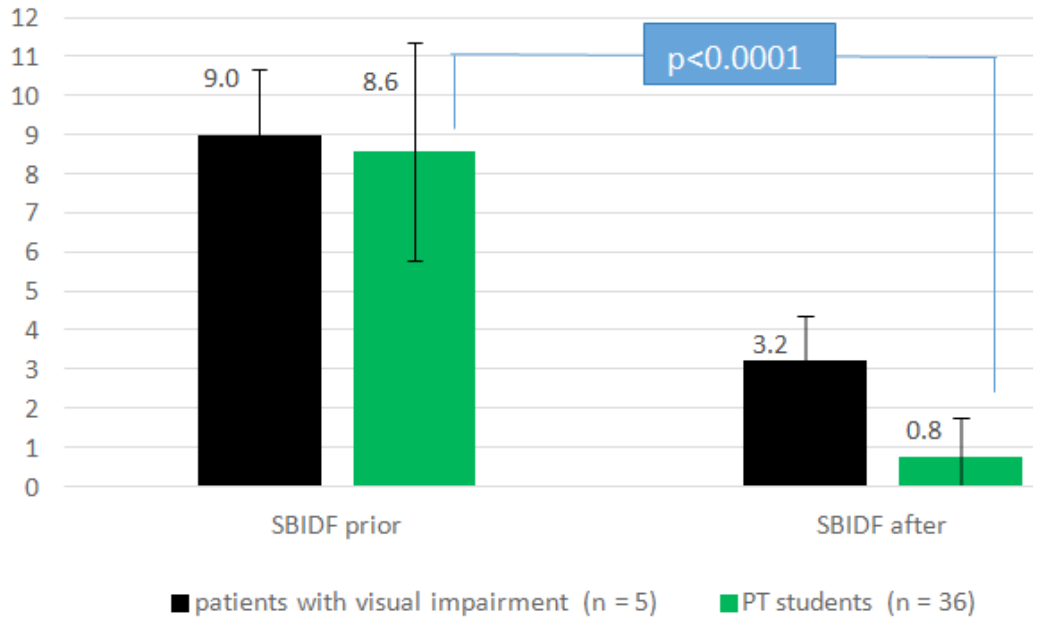

Figure 1. Dynamics of errors reduction of the body parts during a fall by the patients with visual impairment and PT students (between prior and after Universal Courses PK-SFAC respectively for groups CG and PG).

Subtraction results $SBIDF_0$ – $SBIDF_1$ means a move of 21 people from the very high and high-level group of done mistakes during steering their bodies to the low level (Figure 2). It means that reduction or keeping the low level of risk of body injury by 22 persons (one confirmed lack of mistakes in preliminary assessment) is the symptomatic effect of Universal Course PK-SFAC. The highest effect of this move the people, who reduced all mistakes ($SBIDF_0$ – $SBIDF_1$) covers 6 (16.7%) PT students, who denied taking any physical activity during the free time (Figure 3). Effect of reduction of all mistakes has not been achieved by the patients in the clinical group (Figure 4). Before the start of the Universal Courses PK-SFAC, the biggest differentiation of mistakes in steering the body during the fall between the patient's subgroups and PT students were sawn in hips, the smallest legs and head (Figure 5). After specific courses patients and PT, students eliminated mistakes in steering hips, in addition, the leg students.

Workload during kinesiotherapy and prophylactic sessions

During kinesiotherapy Specific Course SFACPED, about 40 exercises have been used with total time length T_E = 330 minutes (total time of the whole training T = 360 minutes). One kinesiotherapy session lasts for the average 33 minutes, and active time of exercises with breaks (continuous effort with changing intensity) was 20 to 35 minutes (most of them about 30 minutes). During prior and after Universal Courses PK-SFAC about 50 exercises have been used with total time length T_E = 360 minutes T = about 380 minutes. Session average 38 minutes. The rest of workload indicators provides the evidence for a bit stronger physiological stimuli on organisms of PT students during the course (Table 8).

Patients have done about 150 do 160 different falls back and on sides (63% of all exercises), which has been weaved with fun forms of martial arts, avoiding collision („no tests") and motoric simulations mostly finalised by fall (37%). PT students have done about 180 - 190 different falls (60% of exercises), and 40% exercises with avoiding a collision, motoric simulations, and first of all more fun forms of martial arts then patients (Tables 9 to 12).

DISCUSSION

One of the most significant discoveries of our research it is supplementation of two earlier verified hypotheses by new significant scientific facts. First hypothesis (2008) states: if methodical and educational standards are met, sex, age, and type of body build are not factors limiting the effectiveness of safe fall learning [9]. Second

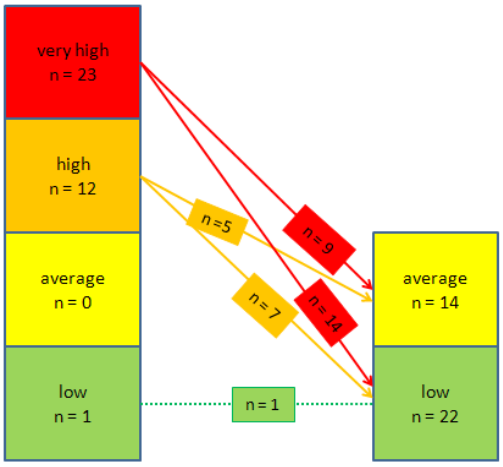

Figure 2. Migration of STBIDF results demonstrating the reduction of the susceptibility body injuries during fall by 36 physiotherapy students (prior to and after the SFACPED Specific Course).

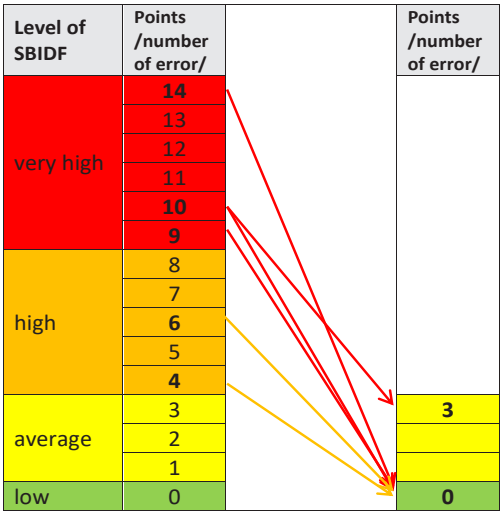

Figure 3. Migration of STBIDF results demonstrating the reduction of the susceptibility body injuries during fall by 6 physiotherapy students who do not take sports activities in their leisure (prior to and after the SFACPED Specific Course).

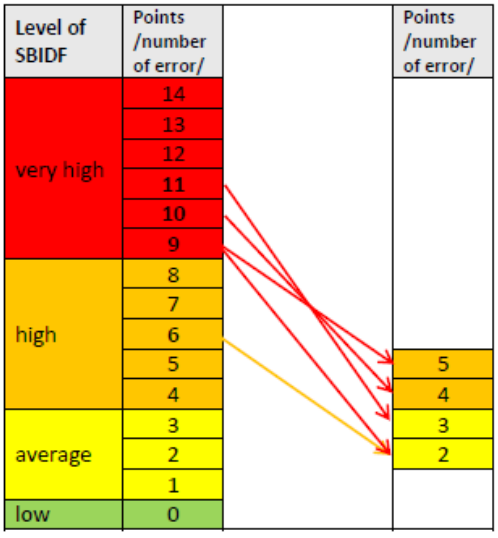

Figure 4. Migration of STBIDF results demonstrating the reduction of the susceptibility body injuries during fall by 5 patients with eye diseases (prior to and after the Specific Course SFACPED).

(2010), that teaching safe falls of young women and men by methods that prefer playful forms of exercises forms is as effective as the rigorous method, provided high attendance at classes [10].

Therefore, these new essential facts: structure and methodology of the "universal courses of prophylaxis and kinesiotherapy based on the exercises of safe falling and avoiding collisions" (Universal Courses PK-SFAC) are in the same manner effective in young patients with visual impairment, as in young men who do not take sports activities in their leisure.

Seemingly one could emphasise that both hypotheses have been verified by the identical tool – the "test of safe falls" (TSF). Motoric effects of experimental courses described in this article are based on the results of the susceptibility test to the body injuries during the fall (STBIDF). Although different tools, but the essence of the phenomenon can be reduced to the question: is appropriate, short-term specific course (10 sessions about 45 minutes each) able to reduce mistakes in steering the body during the fall and effectively improve personal motor safety. In other words, it diminishes the risk of body injuries both in a sudden loss of balance and when the fall is the only choice for health or even life care (example: avoiding a crash with bicyclist). Moreover, in many situations professional form of fall which means the use of amortising hit of hands is counterproductive (e.g. one is carrying the child and fall is unavoidable). In such a case "cradle" is a professional form of fall as well.

Another objection might be a small number of patients participating in the study (5 patients with visual impairment and 6 PT students not physically active in leisure). The only answer is that both themes ensure the reliability of the hypotheses mentioned above and inspire subsequent studies. Especially worthy of notice in a case of PT student from the group not physically active in leisure, who has made all possible mistakes (14 points) during the first STBIDF and no mistakes after the prophylactic course.

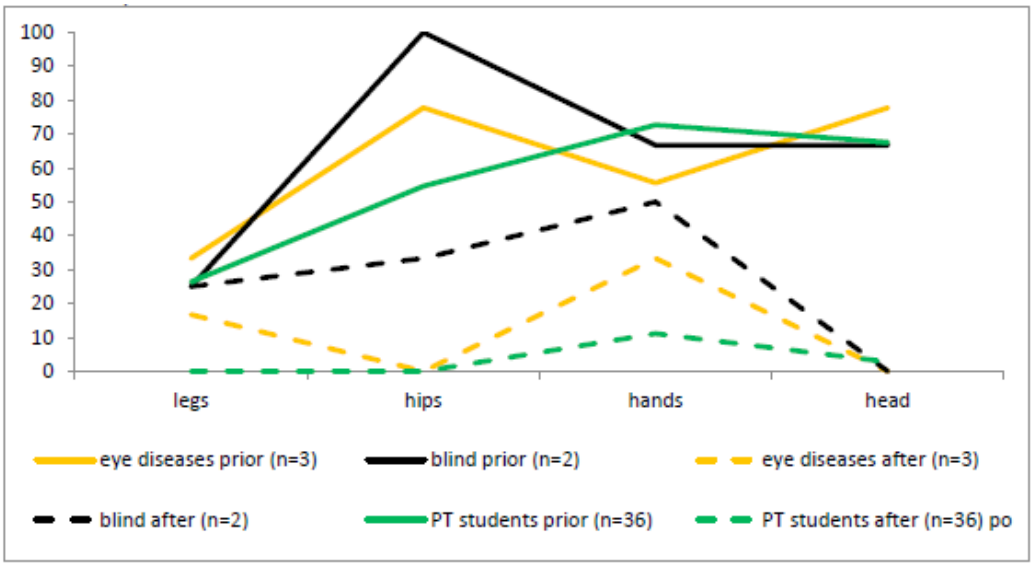

Figure 5. Visualization of SBPIDF%max indicators listed in Tables 3 to 7.

Table 8. Workload indicators 10 kinesiotherapy (CG) and prophylactic (PG) sessions.

Statistical indicators	Time (minute)		Intensity (HR)		Exercise load (conventional units)	
	sets of exercises (T_E)	entire session (T)	sets of exercises (I_E)	entire session I = LE/T	LE (L_E + FRT·10)	L_E ($T_E \times I_E$)
kinesiotherapy Specific Course (CG)						
Total	330	360				
$\bar{X}$	33	36		130		
min	20	30				
max	35	40				
prophylactic Specific Course (PG)						
Total	360	380				
$\bar{X}$	36	38		130	842.5	667.7
min	25					
max	45	45				

Moreover if we compare results of this subgroup (n = 6) with PT students who declared sports activity in leisure , but in the first exercise have made mistakes (n = 29), the proportion of person who eliminated the mistakes favours those, who has been not physically active in leisure: 5 with 6 (83.33%); 17 with 29 (58.62%).

Among 5 persons with visual impairment, three declared physically active in leisure. In such a kind of disability additional physical activity significantly influences the effectiveness of mistakes reduction during the fall in laboratory conditions.: non-active reduced mistakes in 44% to 47%, active in 60% to 78%. No one of them eliminated all the mistakes.

Results point to the complexity of the problem. It seems, that although physically active in leisure is an essential factor of prophylactic or therapy, the most important probably is a biological and mental predisposition. In general matter predispositions are equal with neuroplasticity phenomenon (brain plasticity and neural plasticity [38]). The frame of our publication limits the possibility of analysis from that perspective.

Table 9. The content of main exercises "rear fall and rear fall with turn" and workload indicators using during 10 kinesiotherapy sessions CG and 10 prophylactic PG sessions.

Content of exercises or sets (sequences): two or more skills which are performed together creating a different combination specific skill	Application during the course (X)		Total time (minute)		Intensity zone (%HRmax)	
	CG	PG	CG	PG	CG	PG
preparatory exercises for professional falls and technique "(rear fall) fall on back"						
lying on back, chin is drawn to the chest	X	X	4	2	I_{VL}	I_{VL}
lying on back, impact-absorbing arms	X	X	6	4	I_{L}	I_{VL}
straddle sitting, "cradle back"	X	X	8	5	I_{MO}	I_{L}
straddle sitting, "cradle back", manipulation exercises, fall on back, get up by with „hip rotation" & "spiral"	X	X	24	17	I_{MO}	I_{MO}
supported squat (hands between knees), fall on back, get up („hip rotation" & "spiral")	X	X	10	6	I_{H}	I_{MO}
half squat, fall on back, get up („hip rotation" & "spiral")	X	X	30	24	I_{H}	I_{H}
Jump & fall on back, get up („hip rotation" & "spiral")	X	X	12	10	I_{VH}	I_{H}
jump with full turn & fall on back, get up („hip rotation" & "spiral")	X	X	27	16	I_{VH}	I_{VH}
jump – dismount from the dais or jump with full turn & fall on back, get up („hip rotation" & "spiral")	-	X	-	6	-	I_{VH}
Total	**8**	**9**	**121**	**90**		
technique „rear fall (fall on back with rolling through the shoulder)" and motoric simulations						
long sitting – tuck sitting (once to the right shoulder, once to the left, determining the "dominant shoulder")	-	X	-	2	-	I_{L}
long sitting on a large orthopaedic wedge, rolling backwards or fall on back with rolling through the shoulder	-	X	-	12	-	I_{MO}
long sitting, rolling backwards through the „dominant shoulder" (legs joined together and strongly bent in the knees) or straddle sitting, fall on back with rolling through the shoulder	-	X	-	24	-	I_{MO}
supported squat, rolling backwards or fall on back with rolling	-	X	-	12	-	I_{H}
half squat or straight standing, fall on back with rolling through the „dominant shoulder"	-	X	-	12	-	I_{VH}
Total				**62**		

Important is not only daily physical activity of man and analysis of microcycles (7 days long) but also the kind of activity. Different kind of activity may be defined as a compilation of neurophysiological stimuli for the body during the exercises, before their start and after it as well. It is different to activate before an ambitiously important tennis match and routine jogging. Other emotions accompany experiences after winning and others after losing a match, and others after an exhausting run.

Judo and strength training there are favourite sports of PT student, who as the only one has done test STBIDF with no mistakes. This test has been used by Boguszewski [12] in study with three groups of adults: combat sports (n = 90: 36 judo, 23 taekwondo, 17 jujitsu, 14 wrestling); active (n = 49; minimum twice a week but not combat sports); inactive (n = 52). Results confirm the positive influence of two factors: optimal physical activity and its kind. General results of the test (SBIDF indicators in points, average, minimum ÷ maximum): combat sports 2.29, 0÷6; active 4.82, 1÷14; inactive 5.79, 1÷14. The differences between general results of the test and specific parts of the body are statistically significant in favour for combat sports athletes.

Deepened analysis of results of Boguszewski study [12] combined with our discoveries become confirmed in our's belief, that the quality of brain plasticity is the dominant factor in the expected adaptation for survival. Only 17% of combat sports athletes have done the test (STBIDF) without mistakes, while none from the group active, inactive was able to do it. Moreover Boguszewski discovered that in all men (n = 191) there is positive correlation between general result of the test (indicator SBDIF) and following findings (with $p<0.001$): number of body injuries ($r = 0.364$); number of hands injuries

Table 10. Content of main exercises "fall to the side (left and right)" and workload indicators using during 10 kinesiotherapy sessions CG and 10 prophylactic PG sessions.

Content of exercises or sets (sequences): two or more skills which are performed together creating a different combination specific skill	Application during the course (X)		Total time (minute)		Intensity zone (%HRmax)	
	CG	PG	CG	PG	CG	PG
technique "fall to the side" and motoric simulations						
lying on your side, rolling on the left and right of body side on the judo belt	X	X	10	7	I_L	I_{VL}
lying on your right side, rolling (on the judo belt) in left & impact cushioning left arm (& vice versa)	X	X	11	7	I_L	I_L
straddle sitting, holding the ankles (or arms crossed at the front) rolling body (or fall) alternately to the right and left sides	X	X	22	11	I_{MO}	I_{MO}
keeling sit, fall on side (alternately aside right and left)	X	X	9	7	I_H	I_{MO}
knee left lunge, fall on right side through the energetic extension of the right leg (left vice versa) or straddle standing fall on side (alternately aside right and left)	X	X	22	12	I_H	I_H
standing at a wide fall on side (alternately aside right and left)	X	X	10	8	I_{VH}	I_H
„A" stands at a wide stance with kimono belts wrapped around his ankles, ends of those belts are held 20-30 cm over the floor by a kneeling "B" and thrusts up any leg "A" thus him to make a side fall	X	X	14	12	I_{VH}	I_{VH}
Total			**98**	**64**		

Table 11. The content of main exercises "avoiding collision (no tests)" and workload indicators using during 10 kinesiotherapy sessions CG and 10 prophylactic PG sessions.

Content of exercises or sets (sequences): two or more skills which are performed together creating a different combination specific skill	Application during the course (X)		Total time (minute)		Intensity zone (%HRmax)	
	CG	PG	CG	PG	CG	PG
technique "fall to the side" and motoric simulations						
lying on your side, rolling on the left and right of body side on the judo belt	X	X	10	7	I_L	I_{VL}
lying on your right side, rolling (on the judo belt) in left & impact cushioning left arm (& vice versa)	X	X	11	7	I_L	I_L
straddle sitting, holding the ankles (or arms crossed at the front) rolling body (or fall) alternately to the right and left sides	X	X	22	11	I_{MO}	I_{MO}
keeling sit, fall on side (alternately aside right and left)	X	X	9	7	I_H	I_{MO}
knee left lunge, fall on right side through the energetic extension of the right leg (left vice versa) or straddle standing fall on side (alternately aside right and left)	X	X	22	12	I_H	I_H
standing at a wide fall on side (alternately aside right and left)	X	X	10	8	I_{VH}	I_H
„A" stands at a wide stance with kimono belts wrapped around his ankles, ends of those belts are held 20-30 cm over the floor by a kneeling "B" and thrusts up any leg "A" thus him to make a side fall	X	X	14	12	I_{VH}	I_{VH}
Total			**98**	**64**		

(r = 0.319); number of head and spine injuries (r = 0.262) [12]. The number of injuries; the number of mistakes in the steering of the appropriate parts of the body during the test. In the group of combat sports athletes (n = 90) there is negative correlation between frequency of training and indicator SBIDF (r = −0.364, p<0.001) and SBPIDFheands (r = −0.324, p<0.01) and SBPIDFheands (r = −0.280, p<0.01). General interpretation: the fewer training, the more mistakes in the steering of particular parts of the body during the test.

Important empirical premises confirming the rightness of thesis that "(...) behaviour environmental stimuli thought, and emotions may also cause neuroplastic change through activity-dependent plasticity" [38] are described in our studies, Boguszewski studies [12] as well Mroczkowski et al. [39] studies with 37 female PT students from 20 to 23 years old. The students undertook STBIDF twice in an interval of two weeks. "The first test was conducted accordingly to the original instruction of test (T1), where participants are not aware of assessment criteria of the test (...). Before the second trial, all assessment criteria

Table 12. The content of main exercises "fun forms of martial arts and motoric simulations" and workload indicators using during 10 kinesiotherapy sessions CG and 10 prophylactic PG sessions.

Content of exercises or sets (sequences): two or more skills which are performed together creating a different combination specific skill	Application during the course (X)		Total time (minute)		Intensity zone (%HRmax)	
	CG	PG	CG	PG	CG	PG
fun forms of martial arts and motoric simulations						
"act like a snake"	-	X	-	4	-	I_H
„provocateur of long jump"	-	X	-	5	-	I_H
"playing tag by numbers"	-	X	-	6	-	I_H
„rodeo" (fall on side)	-	X	-	6	-	I_H
fall from the chair, fall on back with rolling	-	X	-	8	-	I_H
"limping fox"	-	X	-	5	-	I_{VH}
"airport" (fall on side)	-	X	-	7	-	I_{VH}
"gyrating in pairs", fall on back with rolling	-	X	-	10	-	I_{VH}
„feeling the back"	X	X	8	8	I_{MO}	I_{MO}
Assuring security to a falling body (fall on side)	X	X	8	8	I_{MO}	I_{MO}
fall from the bed alternately to the right and left sides	X	X	8	7	I_H	I_H
fall on back after losing balance in the front (stumbling) – first half-turn towards falling	X	X	12	7	I_H	I_H
fall from the chair, fall on back	X	X	9	7	I_H	I_H
fall on back after losing balance in the back (slipping)	X	X	9	9	I_H	I_H
"gyrating in pairs", fall on back	X	X	10	9	I_{VH}	I_H
test of making safe falls in different configurations	X	X	11	9	I_{VH}	I_H
falls in various directions (back, sides) after being knocked out by the partner (or physiotherapist)	X	X	13	9	I_{VH}	I_H
Total			**88**	**124**		

During both courses dominated exercises with hard intensity (PG 46% and CG 38%), and together with exercises with very hard intensity sum of these strongest stimuli equals PG 64.9% and CG 67.3% (Table 13).

Table 13. Workload structure of kinesiotherapy (CG) and prophylactic (PG) courses according to the criterion of the proportion of efforts qualified to specific intensity zones.

Intensity zone (%HRmax)	Time and proportion during courses			
	minute		%	
	CG	PG	CG	PG
I_{VL} very light (<35)	4	13	1.2	3.6
I_L light (35-54)	27	14	8.2	3.9
I_{MO} moderate (55-69)	77	98	23.3	27.5
I_H hard (70-89)	**125**	**164**	**37.9**	**45.9**
I_{VH} very hard (≥90)	97	68	29.4	19
I_M maximal (100)	-	-	-	-
I_{SM} supramaximal (>100)	-	-	-	-

were presented (on the day of the research). After that, second test (T2) were conducted" [39, p.57].

Mroczkowski et al. precisely determined criteria of observation "hips" as one of the variables proving about quality of body control during fall in laboratory condition: "If a person does not the lower body and bend knees to an angle of 90 degrees in the assessment of knee flexion, and hits mattress with the pelvis, one point is given

as an error" [39, p. 57]. There is a high probability, which all observations cited in Mroczkowski et all. fulfil methodology criteria required for the users of that tool (STBIDF).

Taking such an assumption, we acknowledged this experiment Mroczkowski et al. [39] as valuable for the purpose of deepened analysis of the phenomenon of confrontation between two internal human forces (potentials): biological predispositions versus mental (intellectual) predispositions. We simplify the following assumption as taken for the analysis: cumulated effect of both forces in the ontogenesis of a participant of the study are their motor habits revealed during the subsequent task given during the test (simulated fall) in laboratory condition. The only stimuli (controlled by researchers) that can modify the answers has an intellectual character (all assessment criteria were presented before the second trial). Empirical proof of that force (intellectual stimulus) is reduction of the general test results (indicator SBIDF) from 4.189 ±2.559 on 2.811 ±2.385 ($p<0.001$) and SBPIDFhead from 2.351 ±1.033 on 0.703 ±1.13 ($p<0.001$) and SBPIDFheands from 1.324 ±1.492 on 0.757 ±1.425 ($p<0.02$). Clearly the force of motor habits can be shown by comparison of results in Task 2 of the test in both trials: proportion (%) of participants, who do not correct their errors during the second trial (committed the same amount or more errors); repeatability of results (%). Task 2 cumulates two new motor elements correlated with the potential of neuromuscular coordination: to hold sponge on chest using chin and a person is supposed to start clapping). Repeatability of results (in brackets: "participants, who do not correct their errors") is following: hands 89% (50%), hips 86% (29%), head 78% (71%) [39].

This general analysis of observational data from different experiments is also proof of the importance of mission for *innovative agonology* in maintaining and strengthening all dimensions of health and survival ability [15, 16]. A parallel phenomenon is needed for multidimensional monitoring of stimuli, which are responsible for visible changes or preserving the actual state of affairs: casus PG, 22 (61%) PT students eliminated mistakes, 13 (36%) reduced mistakes, 1 (3%) maintained ideal status (Figure 2). Assuming 0 points as a desired result of SBIDF, there is justification for a general assessment of the efficacy of 10 sessions of Specific Course SFACPED on the level 64%. Every third PT students should continue this form of health-related training, whereas well-documented workload (in combination with test results and experts observations) is the basis for prognosis and planning individual tasks as well selecting optimal means and methods.

Contrary to published catalogues of training means in combat sports (judo, taekwondo [40-42]) our specification in Tables 8 to 12 should make aware practitioners, that this way of monitoring of workload (apparently laborious) fulfils cognitive values and facilitate application. This way of collecting and monitoring of information is particularly useful in programming prophylactic and/or therapeutic sessions for people qualified to the group of the high risk of loss of balance and fall. Although few research reports are pointing increased anxiety (including eye disease people [43]) due to negative effects of falls and collisions with vertical obstacles or objects in the move, the results discussed here inclined to be optimistic. Seemingly far from the subject martial arts bibliotherapy [44, 45] (promoted as one of the detailed methods of *innovative agonology* [46]) may increase the effectiveness of "universal courses of prophylaxis and kinesiotherapy based on the exercises of safe falling and avoiding collisions" (Universal Courses PK-SFAC). In the future may also help in increasing effectiveness of specific courses addressed for particular groups of increased risk, as well for the parents, teachers and pupils.

Today's development of science, its interdisciplinary character and social usefulness puts us at the threshold of the digital health revolution. Technology enters not only in the field of medical education, but also patient care at home, in the hospital, and even in public places, such as large shopping centres. Current trends in the world are the development of consumer health services, which consist in providing through teleconsultation. However, the fastest growing branch is the market for smart devices in healthcare, thanks to which patients are constantly monitored, engaged in pro-health activities and, by various software invest in their health. Special devices cooperating with smartwatches or smartphones monitor health indicators such as blood pressure, heart rate or diet. Instead of frequent visits, patients avoid queuing, and in emergency situations, the doctors are immediately notified of the situation to undertake target oriented activities saving the life [47, 48].

Another significant trend is the augmented reality used in training [49]. This technology expands the knowledge, learn new skills, improve practical experience making them so realistic that we are able to see different scenarios, observe various diagnoses, perform specific procedures, i.e., specialists can virtually accompany the operations of an experienced surgeon. Augmented reality enables simultaneous training for an unlimited number of people, which helps to overcome the shortage of trained professionals around the world. Technological progress created another important market for patient comfort and care. Wireless and smart houses, equipped in various devices and robots permanently take care of us, correcting: our conditions (i.e., temperature, lighting, etc.), comfort (i.e., bed self-adjustment), and security (i.e., checks if gas escapes, but also can ionise the air or purge from pollution). Another example is a hospital robot that talks freely with patients, provides information and answers to practical questions, but also provides drugs, or make the basic diagnostic, i.e. temperature, blood pressure.

CONCLUSIONS

We recommend the cumulating of 10 empirically verified sessions within 2-3 weeks of health stay as an optimal incentive for injury prevention due to falls and/or collision. Combining these exercises with occupational therapy and creeping orientation training can be an effective and attractive way to improve the quality of life of people with eye disease.

REFERENCES

1. Dictionary of Sport and Exercise Science. Over 5,000 Terms Clearly Defined. London: A & B Black; 2006
2. Kalina RM. Sporty walki i trening samoobrony w edukacji obronnej młodzieży. Warszawa: Polskie Towarzystwo Naukowe Kultury Fizycznej; 1997 [in Polish]
3. Kalina RM, Kałużny RJ. Działanie człowieka w sytuacjach zagrożeń. Płock: Wydawnictwo Naukowe Novum; 2002 [in Polish]
4. Ashkinazi S, Jagiełło W, Kalina RM et al. The importance of hand-to-hand fights for determining psychomotor competence of antiterrorists. Arch Budo 2005; 1: 8-12
5. Harasymowicz J, Kalina RM. Training of psychomotor adaptation – a key factor in teaching self-defence. Arch Budo 2005; 1(1): 19-26
6. Syska JR. Psychomotoryczne efekty uprawiania przez kobiety nowoczesnych form gimnastyczno-tanecznych z elementami samoobrony. [PhD thesis]. Warszawa: Akademia Wychowania Fizycznego Józefa Piłsudskiego; 2005 [in Polish]
7. Harasymowicz J, Kalina RM. Honourable self-defence – the theoretical and methodological basis of training. Płock: Wydawnictwo Naukowe Novum; 2006
8. Kalina RM, Jagiełło W, Wiktorek P. Motor competence in self-defence of students of a detectives' school during their course of studies. Arch Budo 2007: 3(3): 1-6
9. Kalina RM, Barczyński B, Jagiełło W et al. Teaching of safe falling as most effective element of personal injury prevention in people regardless of gender, age and type of body build – the use of advanced information technologies to monitor the effects of education. ArchBudo 2008; 4: 89-89
10. Gąsienica-Walczak B, Barczyński BJ, Kalina RM et al. The effectiveness of two methods of teaching safe falls to physiotherapy students. Arch Budo 2010; 6(2): 63-71
11. Vít M, Zdenko Reguli Z, Sebera M et al. Predictors of children´s successful defence against adult attacker. Arch Budo 2016; 12: 141-150
12. Boguszewski D. Zdrowotne aspekty sportów i sztuk walki. Warszawa: Warszawski Uniwersytet Medyczny; 2017 [in Polish]
13. Katarbiński T. Z zagadnień ogólnej teorii walki. Warszawa: Sekcja Psychologiczna Towarzystwa Wiedzy Wojskowe; 1938 [in Polish]
14. Kalina RM. Agonology unknown science. Arch Budo 2016; 12: 231-237
15. Kalina RM. Cognitive and application barriers to the use of "agonology in preventive and therapeutic dimension". P. Salmon, A.-C. Macquet, editors. Advances in Human Factors in Sports and Outdoor Recreation. Proceedings of the HFE 2016 International Conference on Human Factors in Sports and Outdoor Recreation, July 27-31, 2016, Walt Disney World®, Florida, USA Series: Advances in Intelligent Systems and Computing. Springer; 25-35
16. Kalina RM. Innovative agonology as a synonym for prophylactic and therapeutic agonology – the final impulse. Arch Budo 2016; 12: 329-344
17. Martin EA, editor. Concise Colour Medical Dictionary. Oxford: Oxford University Press; 1996
18. http://www.who.int/mediacentre/factsheets/fs282/en/ (accessed 2017 Dec 01)
19. Łukasiak E, Oleksiak E. Osoby niewidome i niedowidzące. In: Kaczmarek BM, editor. Zbiorczy raport z diagnozy świadczonych usług z zakresu rehabilitacji społecznej dla osób niepełnosprawnych w Polsce. Warszawa: Publikacja powstała w ramach dotacji przyznanej przez Fundację im. Stefana Batorego oraz Ministerstwo Pracy i Polityki Społecznej w ramach Funduszu Inicjatyw Obywatelskich (FIO); 2011 [in Polish]
20. Ecosse L, Lamoreux EL, Chong E et al. Visual Impairment, Causes of Vision Loss, and Falls: The Singapore Malay Eye Study. Invest Ophthalmol Vis Sci. 2008 Feb;49(2): 528-533
21. Black AA, Wood JM, Lovie-Kitchin JE. Inferior field loss increases rate of falls in older adults with glaucoma. Optom Vis Sci 2011; 88: 1275-1282
22. Saftari LN, Oh-Sang Kwon. Ageing vision and falls: a review. J Physiol Anthropol 2018; 37: 11
23. http://www.who.int/mediacentre/factsheets/fs344/en (accessed 2016 Aug 09)
24. Palagyi A, Q Ng J, Rogers K et al. Fear of falling and physical function in older adults with cataract: Exploring the role of vision as a moderator. Geriatr Gerontol Int 2017; 17: 1551-1558
25. Freeman EE, Muñoz B, Rubin G, West SK. Visual field loss increases the risk of falls in older adults: the Salisbury Eye Evaluation. Invest Ophthalmol Vis Sci 2007; 48: 4445-4450

26. Leat SJ, Zecevic AA, Keeling A et al. Prevalence of vision loss among hospital in-patients; a risk factor for falls? Ophthal Physl Opt 2018; 38: 106-114
27. Tinetti ME, Baker DI, McAvay G et al. A multifactorial intervention to reduce the risk of falling among elderly older people. N Engl J Med 1994; 331(13): 821-827
28. Roberson MC, Campbell AJ, Gardner MM et a. The effectiveness of a community-based program for reducting the incidence of falls in the elderly: a randomized trial. J Am Geriatr Soc 2002; 50: 905-911
29. Skelton D, Dinan S, Campbell M et al. Tailored group exercise (Falls Management Exercise–FaME) reduces falls in community-dwelling older frequent fallers (an RCT). Age Ageing 2005; 34(6): 636-639
30. Haines TP, Hill AM, Hill KD et al. Patient Education to Prevent Falls Among Older Hospital Inpatients. Arch Intern Med 2011; 171(6): 516-524
31. Gąsienica-Walczak B, Kalina RM. Zmodyfikowany test bezpiecznego upadania – aplikacje w diagnozowaniu specyficznych kompetencji motorycznych osób niewidomych. In: Włoch T, editor. Międzynarodowa Jubileuszowa Konferencja Naukowa Wydziału Rehabilitacji Ruchowej. Kraków: Akademia Wychowania Fizycznego; 2012: 100 [in Polish]
32. Boguszewski D, Zabłocka M, Adamczyk JG et al. Evaluation of susceptibility to injuries resulting from falls of children with visual impairment. Eur J Adap Phys Activ 2013; 6(1): 7-16
33. Gąsienica-Walczak BK. Motoryczne, metodyczne i mentalne kwalifikacje studentów fizjoterapii z zakresu bezpiecznego upadania – perspektywa prewencji upadków osób z wadami wzroku, z unieruchomioną lub amputowaną kończyną. [PhD thesis]. Rzeszow: Uniwesytet Rzeszowski, Wydział Medyczny; 2017 [in Polish]
34. Kalina RM, Barczyński BJ, Klukowski K et al. The method to evaluate the susceptibility to injuries during the fall – validation procedure of the specific motor test. Arch Budo 2011; 7(4): 203-216
35. Kalina RM. Methodology of measurement, documentation and programming of optimal continuous workload with variable intensity – applications in sports medicine, physiotherapy, geriatrics, health-related training and sport for all. Arch Budo 2012; 8(4); 235-249
36. Tanaka H, Monahan KD, Seals DR: Age predicted maximal heart rate revisited. J Am Coll Cardiol 2001; 37: 153-156
37. Pollock ML, Gaesser GA, Butcher JD et al: The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in healthy adults. Med Sci Sport Exer 1998; 30: 975-991
38. Ponti G, Peretto P, Bonfanti L et al. Reh, Thomas A,editor. Genesis of Neuronal and Glial Progenitors in the Cerebellar Cortex of Peripuberal and Adult Rabbits". PLoS ONE 2008; 3(6): e2366
39. Mroczkowski A, Mosler D, Gemziak EP. Relation between knowledge about assessment criteria of susceptibility test of body injuries during a fall and body control during the test. Arch Budo Sci Martial Art Extreme Sport 2017; 13: 55-61
40. Dias da Silva RA, Motta Drummond MD, Couto BP et al. Content validation of training means for taekwondo. Arch Budo 2015; 11: 305-317
41. Pedrosa GF, Soares YM, Gonçalves R et al. Elaboration and evaluation of judo training means. Arch Budo 2015; 11: 7-16
42. Pedrosa GF, Soares YM, Gonçalves R et al. Content validation of a catalog of exercises for judo. Percept Motor Skill 2016; 122(3): 933-955
43. Hallford DJ, Nicholson G, Sanders K et al. The Association Between Anxiety and Falls: A Meta-Analysis. *J Gerontol B-Psychol* 2017; 72(5): 729-741
44. Klimczak J, Krzemieniecki LA, Mosler D. Martial arts bibliotherapy – the possibility of compensating the negative effects of the continuous education for aggression by electronic media and the aggressive interpersonal relationship of children and adults. Arch Budo 2015; 11: 395-401
45. Krzemieniecki LA, Moska W. Combat issues in literary works of Nobel Laureates for Literature – an interdisciplinary perspective of martial arts bibliotherapy. Arch Budo 2016; 12: 345-352
46. Mosler D, Kalina RM. Possibilities and limitations of judo (selected martial arts) and innovative agonology in the therapy of people with mental disorders and also in widely understood public health prophylaxis. Arch Budo 2017; 13: 211-226
47. Lai AM, Hsueh P-YS, Choi YK et al. Present and Future Trends in Consumer Health Informatics and Patient-Generated Health Data. Yearb Med Inform 2017; 152-159
48. Garge G, Balakrishna C, Datta SK. Consumer Healthcare: Current Trends. IEEE Consumer Electronics Magazine 2017; 7(1): 38-46
49. Witkowski K, Sobecki J, Maśliński J et al. The use of augmented-reality technology to improve judo techniques. Premises, assumptions, methodology, research tools, preliminary scenarios – the first stage of the study. Arch Budo 2016; 12: 355-367
50. Kalina RM. Multidimensional tests as a fundamental diagnostic tools in the prophylactic and therapeutic agonology – methodological basis of personal safety (Part I: *non-motoric simulation*). Arch Budo Sci Martial Art Extreme Sport 2017; 13: 191-201
51. Pszczołowski T. Mała encyklopedia prakseologii i teorii organizacji. Wrocław - Gdańsk: Zakład Narodowy imienia Ossolińskich. Wydawnictwo; 1978 [in Polish; the indices of terms: English, French, German, Russian]

Cite this article as: Gąsienica Walczak B, Barczyński BJ, Kalina RM. Evidence-based monitoring of the stimuli and effects of prophylaxis and kinesiotherapy based on the exercises of safe falling and avoiding collisions as a condition for optimising the prevention of body injuries in a universal sense – people with eye diseases as an example of an increased risk group. Arch Budo 2018; 13: 79-95