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SUMMARY OF PROFESSIONAL ACCOMPLISHMENTS – initiating habilitation proceedings Wojciech Piotr Kiebzak, PhD, PT

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SUMMARY OF PROFESSIONAL ACCOMPLISHMENTS

Manual Therapy Institute

Faculty of Medicine and Health Sciences

the Jan Kochanowski University

Kielce 2018

1. Personal data

- Name(s) and surname: Wojciech Piotr Kiebzak
- Date and place of birth: 05.10.1959 Rumia
- Current position: senior lecturer
- I place of work: Department of Manual Therapy, Institute of Physiotherapy, Faculty of Medicine and Health Sciences at the Jan Kochanowski University in Kielce
- II place of work: Department of Physiotherapy, the Świętokrzyskie Centre of Pediatrics, the Provincial Integrated Hospital in Kielce

2. Diplomas and academic degrees

- Master of Physical Education 29.06.1983, 1152/1983; Faculty of Physical Education, Academy of Physical Education Gdańsk (mark: very good).
- speciality in motor rehabilitation 20.12.1985, Rehabilitation and Orthopedics Clinic, Medical Center for Postgraduate Education (CMKP) 7465/85 /Academy of Physical Education Poznań 3167/85/86.
- PhD in Physical Education 23.05.1996, 216/1996; Institute of Rehabilitation, Academy of Physical Education Kraków.

Title of doctoral dissertation: *Early recognition of psychomotor development disorders of risk children and the effectiveness of physical rehabilitation with the Vaclav Vojta method*

Dissertation supervisor: Prof. dr hab. n. med. Czesław Szmigiel,

Reviewers: Prof. dr hab. n. med. Irena Norska-Borówka,

Prof. dr hab. Tadeusz Kasperczyk.

Specialisations

- 19.04.1989 Kielce, I degree specialisation in motor rehabilitation Department of Health and Social Care (WZiOS) Kielce 14/420/1989 (mark: very good)
- 11-12.04.1994 Konstancin, II degree specialisation in motor rehabilitation CMKP 15073/34/I/1994 (mark: very good)

Postgraduate courses

- Health Protection Management at the School of Economics and Administration in Kielce 375/P/2002.

2.1. Additional professional qualifications (attested by an international diploma)

- 1992 Monachium: Deutche Akademie für Enwicklung–Rehabilitation e.v. Vojta-Methode (international certificate).
- 1997 Monachium: Internationale Vojta Gesellschaft; Vojta Refresher-Kurs für Angewandte Enwicklungskinesiologie von Bewegungsstörungen nach Vojta (international certificate).
- 2004/2005 Pabianice/Zgorzelec: Kinesio Taping Association; Kinesio Taping (international certificate).
- 2016 Wrocław: Promyk Słońca Foundation; Prechtl's Method on the Quantitative Assessment of General Movemets (international certificate).

2.2. Participation in clinical professional courses

- 1997/1998 Kielce; Diagnosis and treatment of spinal pain syndromes with the McKenzie method, courses A, B, C and D.
- 1999 Kielce; Neurobiological foundations of Sensory Integration.
- 2001 Kraków; MB1 dr J.H. Cyriax method.
- 2005 Kraków; IPNFA-Advanced Course (Level 3A) in PNF (PNF technique therapist).
- 2007 Zgorzelec; FED Method./FED method therapist.
- 2011 Kielce; Dynamic Neuromuscular Stabilization (A) according to Kolar a developmental kinesiology approach.
- 2013 Kielce; ICF.
- 2015 Kielce; MPBetrieb V §5, Absatz(1) DIERS Formetric III/ 4D motion/ pedoscan und pedpgate course.

2.3. Participation in clinical workshops

- Clinical workshops in cranio-sacrale tharapy, Munich 1997.
- Clinical workshops: Neural tube defects, Cracow 1998.
- Clinical workshops in Vojta therapy, Wrocław 2001.
- Clinical workshops in Vojta therapy, Siegen 2006.
- Clinical workshops: physiotherapy in neurology, Vancouver 2007.
- Clinical workshops: Treatment of idiopathic scoliosis, Zgorzelec 2007.

3. Information on previous employment in scientific units.

- From 01.10.2001 until 31.09.2017 I was an assistant professor (adiunkt) at the Institute of Medical Education at the Świętokrzyska Academy, after the transformation of the structure of the Academy (2014), at the Institute of Physiotherapy, Faculty of Medicine and Health Sciences, the Jan Kochanowski University.
- Since 01.10.2017 – present, I have been a senior lecturer at the Institute of Physiotherapy, Faculty of Medicine and Health Sciences of the Jan Kochanowski University. Since 2001, in my didactic activity I have been teaching two subjects mainly: *Clinical physiotherapy in neurology and pediatric neurology* and *General physiotherapy*, approximately 270 hours per year. During the course I aim to teach students to search for clinical problems which will be the subject of future scientific papers.

3.1. Information on professional and organizational activity.

- 1983–1986, I was a junior assistant at the Healthcare Centre (ZOZ) Wejherowo. In clinical activity, I observed the use of variable bronchial pressure techniques in respiratory diseases.
- 1986–1989, I was a junior assistant and then an assistant at the Provincial Integrated Hospital in Kielce. In clinical activity, I conducted observations of the PNF method use in central nervous system injuries of various etiologies and the McKenzie method in the treatment of spinal pain.

- 1989–2015, as an assistant and then a senior assistant I was Head of the Rehabilitation Unit at the Wladyslaw Buszkowski Provincial Specialist Children's Hospital in Kielce and a member of the Commission for the quality of service therein, and a member of a multidisciplinary Therapeutic Team. Since 2015, after the reorganization, I have been a Head of the Department of Physiotherapy and a scientific and clinical consultant at the multiprofile Provincial Integrated Hospital. In team-based clinical activities, I try to select optimum forms of functional diagnostics and therapy in musculoskeletal system disorders with various etiologies. On the one hand, these activities are based i.e. on my own findings, and, on the other hand, they provide inspiration to conduct further research.
- 1994–2000, I co-organised trainings on early diagnostics and early treatment of children with central coordination disorder for physiotherapists and physicians, under the auspices of Promyk Słońca Foundation in Wrocław and Kielce, in total over 600 attendees were instructed.
- 1995–2003, I revived the Polish Society of Physiotherapy and I served two terms as the president of the Świętokrzyskie branch. During that period I organized over 40 scientific meetings and professional courses on the following methods: McKenzie, SI and PNF.
- In 1999, as a rehabilitation consultant for Świętokrzyskie Regional Healthcare Fund, I developed, for the Świętokrzyskie Branch, algorithm for the settlement of services with medical facilities in the field of medical rehabilitation. Transparency and accuracy of proposed solution won recognition of the Health Insurance Supervisory Authority (Urząd Nadzoru Ubezpieczeń Zdrowotnych) in Warsaw and the aforementioned algorithm became the basis for settlements in medical rehabilitation, in the first years of operation of this system in Poland.
- 1999–2015, I was a member of the Main Board of the Polish Society of Physiotherapy. I dealt with issues in a commission for professional courses and a commission for co-operation with NHF (NFZ). I was also involved in the work on the Act on the profession of physiotherapy.
- 2001–2002, I developed the curriculum for the course of physiotherapy at the Institute of Medical Education, the Świętokrzyska Academy
- 2004–2008, I was a member of the Council of the Institute of Medical Education at the Świętokrzyska Academy, and then a member of the Faculty Board of Health Sciences Faculty at the Jan Kochanowski University.
- Since 2004, I have been a Voivodship Consultant in physiotherapy, as part of my duties I have supervised the process of specialization and I have held 52 control meetings at medical facilities. The scope of the control concerned substantive activity in therapeutic rehabilitation as regards the organization, access to medical equipment, planning and conducting diagnostic procedures, medical treatment, as well as training and scientific activities.
- In 2005, I received a subsidy for the purchase of research equipment to the Institute of Medical Education, Akademia Świętokrzyska in Kielce, based on the decision of the Ministry of Science and Information Technology No. 5074 / IA / 146/2005. The purchased equipment was used for the first quantified body posture tests with the moiré method.

- Since 2006, I have been a director of specializations in physiotherapy; in the process of specialization I emphasize the weight of scientific interpretation in clinical observations. So far, 14 physiotherapists have passed the specialization exam.
- 2006–2009, I was actively involved in the works of Agency for the Assessment of Medical Technology and Tariffs (Agencja Oceny Technologii Medycznych i Taryfikacji) on the basket of services in the field of Therapeutic Rehabilitation, as an expert of the Minister of Health
- 2007–2015, I was the originator and the president of the IXth edition of the Conference 'Świętokrzyskie Physiotherapy Days – Let us help live better.' Two editions had international character. For that activity I received a Co-author of Our Success award Targi Kielce, 2010. During the 9th conference, a total of 245 lectures were attended by over 2,100 participants. The sessions which indicated the interdisciplinary nature of physiotherapy were prepared. The issues related to immunology, endocrinology, cardiology, orthopedics, urology, radiology, neurology, paediatrics, sports medicine, physical medicine, psychology, prenatal surgery and treatment of burns were discussed. We invited lecturers from Poland, France, the Czech Republic, Germany, England and Russia. Social Pediatrics was a special session: "Consequences of central developmental disorders" during the International Scientific Congress "Let us help live better" (6-8 April, 2011). At that time, not only the leading representatives of Polish science, but also outstanding foreign representatives in this field had presentations, i.e.: Christa Einspieler from the Institute of Physiology and Developmental Neurology, the University of Graz and Prof. Milivoj Velickovic Perat from the Academy of Developmental Medicine, Ljubljana.
- Since 2010 I have been a scientific consultant in the Department of Rehabilitation in ŚCO Kielce
- Since 2010, I have been a scientific director of the Manual Therapy professional course, the organizer P.H.U. "REMEDICA," the course speakers Andrzej Sadowski MD, PhD and Vera Verchozinowa, MPT (the Czech Republic).
- 2011–2016, I was a member of the Team of Experts evaluating the applications of the units applying for the right to conduct specialization in Physiotherapy, appointed by the Director of the Medical Center of Postgraduate Education.
- Since 2011, I have been the author of expert opinions, including on the CEN BT C94 / 2011 resolution concerning osteopathy in the European healthcare system.
- Since 2012, I have been Executive Editor and a scientific reviewer for the scientific journal "Polish Annals of Medicine" (for this activity I got a Certificate of Excellence award, 2016, from Elsevier Publishing Company, Amsterdam).
- 2012–2013, I was the author of the program "Health promotion in the prevention of faulty postures in primary schools in Kielce,"for over 1300 children, under the auspices of UJK. During the meetings, I explained the issues of postural defects and propagated the reflex body posture correction through controlling the position of the sternum and the pelvis.
- Since 2014, I have been running a radio, television and press campaign, among strawberry growers, to counteract the incidence of peroneal nerve palsy as a complication of adopting wrong posture while picking strawberries
- In 2014, I held a position of a court-appointed expert for the Regional Court in Kielce.

- In 2014, I was a consultant for the preparation of the Polish version of the publication by prof. Philippe Souchard " Physiotherapeutic global postural patterns method" Elsevier 2014, Editor of the Polish edition, Marek Żak.
- Since 2015, I have been a member of the General Board of the Polish Society of Physiotherapy Specialists in which I act as a treasurer.
- In 2016, I was a member of the Organizing Committee of the Physiotherapy Self-Government, appointed by the Minister of Health (NS – ZM. 0762.10.2016), whose task was to prepare the First General Congress of Physiotherapists.
- Since 2016, I have been a member of the Voivodship Council for Health Needs in Kielce.
- In 2016, at the First General Assembly I was elected a Disciplinary Ombudsman for the National Chamber of Physiotherapy.
- In 2016, I was appointed chairman of the Anti-mobbing Committee by the Dean of the Faculty of Medicine and Health Sciences at the UJK.
- Since 2018, I have been auxiliary scientific supervisor of Arkadiusz Żurawski, MPT, in his doctoral thesis entitled "Evaluation of symmetry disorders in children aged 8-12 years, treated for postural defects in the Diers system image".
- I am the originator and the main author of the Code of Ethics of the Physiotherapist of the Republic of Poland, 2009, professional qualifications standard for the profession of physiotherapist in the Classification of Occupations and Specialties, at the request of the Labor Market Department of the Ministry of Labour and Social Policy (Departament Rynku Pracy Ministerstwa Pracy i Polityki Społecznej), 2007, and co-author of the Ethics of the Academic Teacher at the UJK (Order No. 22/2017) and legal regulations for the profession of physiotherapist, 2006.
- I have been a member of the scientific councils of 40 national and international scientific conferences. I have also been a member of the scientific councils of the "Promyk Słońca" All-Polish Foundation since 2011, and the publications "Medical Studies" (2001–2013) and Polish Journal of Physiotherapy ("Fizjoterapia Polska"), in the latter journal I have been a scientific coordinator for cooperation with the centres in Poland (Polish Scientific Coordinator) since 2013. Since 2012, I have been Executive Editor in the Polish Annals of Medicine published by Elsevier Urban & Partner.

4. Indication of achievement * resulting from art. 16 sec. 2 of the Act of 14 March 2003, on academic degrees and academic title, and on degrees and title in the field of art (Journal of Laws No. 65, item 595, as amended):

- After obtaining a doctor's degree, I have published as the author or co-author **93 papers** and **2 monographs** for the total number of **661 MNiSW** / KBN and **13.244 IF** points.
- **As the first author,** I have published **31** papers with a total of **237 MNiSW** / KBN and **3.267 IF** points.

Number of citations for July 25, 2018:

- According to **the Web of Science**, my papers were cited 66 times; without self-citations 58; **the Hirsch index 4.**
- According to **Scopus**, my papers were cited 219 times; without self-citations 177; without self-citations of all the authors, **the Hirsch index 8.**

4.1. Title of scientific achievement

Kiebzak W.P. Positioning of the sternum and the sacrum in relation to spine curvatures as a way of assessment of body posture while sitting. Kielce: the Jan Kochanowski University Publishing Company; 2018.

4.1.1. Introduction and scientific aim

Good health is one of the most precious human values and it determines the quality of life (Wnuk et al., 2013; Siwek-Jankiewicz & Bartosińska, 2011). Observation of social behaviour in public and private places raises the question whether the correct body posture could be the element which positively affects our well-being? Therefore, the problem is the ergonomic use of the musculoskeletal system while performing daily activities: walking, standing, and, especially, adopting a long-lasting sitting position. For centuries, proper, avoiding bending, upright posture has been a cultural sign of care for how others perceive us. It was not only an indicator of bodily discipline, but it even built an individual image of a person, also contributing to a positive image of one's own person (Gilman, 2014). A "good" or "natural" posture, in relation to the vertical line, distinguished "advanced" people from "primitive" ones and healthy people from the sick. English aristocracy, adopting an impeccable posture, promoted in this way the distinction from the loaded with work, ailing population, stooped, exploited people of the period of the industrial revolution. Thus, the adopted form of the body position, body posture can become an individual image of a person, an indicator of bodily discipline and a modern form of a perfect citizen (Gilman, 2014).

The correct way of sitting is recommended, i.a. for the following reasons: the improvement of the respiratory system function (Landers et al., 2003; Lin et al., 2006; Park & Han, 2015) even compression load on the fibrous ring and maintaining the cushioning properties of the spine (D.E. Harrison et al., 1999a; Scannell & McGill, 2003; Czaprowski et al., 2014), reducing pain in the heart area (Kiebzak et al. 2010; Peeters et al., 2013) and creating positive thoughts improving the quality of life (Wilson & Peper, 2004). However, it should be emphasized that maintaining the said sitting position requires regular education based on verbal and/or manual stimulation and feedback (Claus

et al., 2009; Green & Bavelier, 2008; Czaprowski et al., 2014). Awareness of the above information can be socially important because contemporary cultural changes encourage nonchalant behaviour, including the adoption of an incorrect position–body posture. They are especially pronounced as the dominant of forms of adopted body postures when sitting incorrectly.

In Polish terminology, do not exist terms similar to unambiguous terms derived from the English language such as *sagittal alignment* for spinal and pelvic positioning in the sagittal plane, *upright body position*, or the German *aufrechte Körperhaltung*, defining an active, corrected body posture. Likewise, there is no equivalent to the commonly known universal English term *slump position*, which defines a free, passive, incorrect posture. For the purpose of this work and as a contribution to general discussion, the concept of **body posture** was introduced as the determination of the mutual position of the body parts, i.e. chest, pelvis and spine while performing any activities, including while adopting a sitting position. Special interest should be aroused by a posture in a sitting corrected position as an optimum, physiological posture.

Reflections on "sedentary lifestyle" and the quality of adopting various forms of sitting, raise two basic questions:

1) is there an ideal–the most appropriate form of the posture while sitting (Claus et al., 2009; K. O'Sullivan et al., 2010; K. O'Sullivan et al., 2012; Czaprowski et al., 2014) and

2) is it beneficial to maintain the correct curvatures of the spine when maintaining the correct posture while sitting? (Claus et al., 2009).

The answer to these questions can be found in the comparison of the three forms of sitting posture (Caneiro et al., 2010). Of the three postures mentioned below, i.e. free with full bend of the spine, expressively upright, or neutral, i.e. adjusted to the natural spine shape, beneficial, maintained without excessive muscle tone, it is recommended to adopt the latter one more frequently (Czaprowski et al., 2014; D.E.Harrison et al., 1999a; Claus et al., 2009; K. O'Sullivan, P. O'Sullivan et al., 2012; K. O'Sullivan et al., 2010; K. O'Sullivan, McCarthy et al., 2012; D.D. Harrison et al., 1999; Panjabi, 1992; Dankaerts et al., 2006).

Sedentary lifestyle is a form of human behaviour with energy expenditure ≤1.5 of metabolic equivalent when taking a semi-recumbent or recumbent position and a sitting position (Tremblay et al., 2017). Spending time in a sitting position has increased significantly in recent years. The highest values of the median of spending time in a sitting position, i.e. 600 minutes, were recorded in Norway, Japan, Hong Kong and Taiwan (Bauman et al., 2011). The author's own observations of about 1,300 children in grades 1-2 primary school showed that the time spent in a sitting position fluctuates between 7 and 10 hours a day. These behaviours are becoming common, they are marked by adoption of a stooped posture, in which there is so-called passive "suspension on the spine. The reasons for this condition may be the consequence of many factors, including diseases, but the most common mechanism is sensorimotor disorders, changes in kinesthetic and proprioceptive perceptions (Solomonow, 2004) and loss of automatic postural control as a result of behavioural disorders, which results in the emergence of habitual behaviours (Redgrave et al., 2010) and the adoption of an incorrect posture. In search for the pathomechanism of the described disorders, the role of a protein deficit in neurotransmitters in strictly-defined regions of the brain and defects of the brain stem, thalamus and neocortex are enumerated (Lalonde & Strazielle, 2007). However, it should be emphasized that the determination of the cause of the defect is often possible only after

a combined clinical and instrumental assessment in specialist proceedings has been conducted (Kowalski, Kotwicki, et al., 2013).

The main image of the described disorders is the bend of the spine in the sagittal plane, which increases the pressure inside the spinal cord (D.E. Harrison et al., 1999c). It is the result of mechanical compression of the anterior structure of the spinal canal, pressure of the spinal cord on the spinal canal and stretching the spinal cord. As a result of this state, a decrease in blood flow and blood perfusion in the spinal cord and disorders of oxidative metabolism in the neuron mitochondria follow (D.E. Harrison et al., 1999c). An incorrect posture results in abnormalities in the microcirculation of nerve fibers, axonal transport irregularities and nerve conduction (Shacklock, 1995). The described condition of spinal overload is directly recorded by the nervous system which, under these circumstances, may generate pain in the spinal area and/ or pain radiating to other body parts (Shacklock, 1995; Butler, 1989; K. O'Sullivan et al., 2010; D.E. Harrison et al., 1999a).

As a result, accompanying overload of the spine structures may result in: change in respiratory kinematics (Lee et al., 2010), decrease in breathing capacity, minute volume of lung ventilation (Landers et al., 2003), reduction of forced expiratory volume in 1 second and forced vital capacity (Lin et al., 2006; Melam et al., 2014), lumbar spine pain (Chen et al., 2009, Al-Eisa et al., 2006; Morvan et al., 2011), especially in men (Kluszczyński et al 2017), intercostal neuralgia (Kiebzak et al., 2010), fatigue and depression (Peeters et al., 2013), deterioration of social interactions due to inadequate perception of the environment caused by head movement limitations (Roussouly & Nnadi, 2010), vision deterioration (Peeters et al., 2013), malocclusion (Gogola et al., 2015), problems with swallowing food (Simão, Sináira et al. 2013), intestinal motility disorders (Peeters et al., 2013; P.W. Hodges & Gandevia, 2000) and intestinal gas passage (Dainese et al., 2003), as well as musculoskeletal pain of the upper body quadrant, which is a common health problem in young people (Brink et al., 2015).

In the planning of preventive and curative treatment, various factors with varying degrees of effectiveness are considered. In consequence, detailed instructions with the given angles of the lower limbs, upper limbs and upper body position, which muscles should be shaped and flexed, recommendations to have a perfectly matched chair with a desk and continuous conscious control of the posture turn out to be ineffective. Especially, the commonly recommended "sit up straight" with upper body activity, the so-called "drawing the shoulder blades together," causes improper reactions in the form of less activation of local stabilizing muscles with increased co-activation of phase muscles (P. O'Sullivan et al., 2002; P. O'Sullivan et al., 2006; Czaprowski et al., 2014; Kiebzak et al., 2017). Contrary to the above, the following fact should be considered. Correction of the sagittal plane in preventive and curative activities needs to be a key element in the control of the correct posture (Lee et al., 2010). An important role in this aspect is played by the methods based on neurophysiological mechanisms that enable the creation of global motor models of physiological positioning (in three planes of the body) of the pelvis, head, chest and spine (Vojta & Peters, 2007; Ha & Sung, 2016; Souchard, 2014; Hillier & Worley, 2015; Henry et al., 2016; Wojtkiewicz et al., 2012) and providing simple recommendations facilitating maintainance of a good posture (Kiebzak et al., 2010).

The author's own clinical observations enable clear reflections that the disorder of the spine positioning in the sagittal plane during an individual's activity affects a significant number of people. The disorders can be recognized both in people who are considered healthy and in people who are ill. This fact is associated with changes in the sternal angle and the sacrum positioning, as well as the curvatures of the spine. The point of reference for reflections on the quality of the posture should be its detailed diagnostics and assessment.

In order to properly address the above assumption, I have reviewed 618 literature items. I have qualified 280 items for this monograph, including 265 original articles and 15 books and books chapters. Most often, I referred to the scientifically significant names of Peter O'Sullivan, Paul Hodges, Wim Dankaerts–the authors of numerous studies on the issues of musculoskeletal disorders and postural control. Among Polish authors I would enumerate Dariusz Czaprowski, whose three valuable works were cited 15 times in the discussed monograph.

Based on the literature review, I pointed out that different test methods, different criteria and different tools to assess the body positioning in the saggital plane (*saggittal alignment*) are used. The most frequently used are tests in a standing position using X-rays (Liang et al., 2016; Mac-Thiong et al., 2011; Ghandhari et al., 2013; Labelle et al., 2011; Mac-Thiong et al., 2007; Asai et al., 2017). Roussouly and Pinheiro-Franco in their observations propose lateral x-ray for the assessment of the sagittal plane of the body and finding any disturbances that may occur. The analysis of the collected literature shows that in the radiological assessment of *saggittal alignment*, angles of the pelvis positioning: *pelvic incidence* (PI), pelvic tilt (PT), *sacral slope* (SS), and lumbar lordosis angle – *lumbar lordosis* (LL) are mainly tested in relation to various combinations of assessed parameters (Liang et al., 2016; Mac-Thiong et al., 2011; Ghandhari et al., 2013; Labelle et al., 2011; Mac-Thiong et al., 2007; Asai et al., 2017; Roussouly & Pinheiro-Franco, 2011; Cho et al., 2015; Lazennec et al., 2013).

An important element of the literature review analysis is the conclusion that in the diagnostic assessment of the spine or the spine and the pelvis, reductions in X-ray exposure should be used (Hui et al., 2016; Roobottom et al., 2010; Leroux et al., 2000; Buchbinder et al., 2013; Ghasemi et al., 2016). The form of non-invasive examination is currently the commonly used 3D / 4D, i.e. three-dimensional assessment of the posture and its movements using the photogrammetric method. It is recommended that the BMI scores should be considered in the diagnostic procedure, since overstating this parameter may have a negative impact on the quality of the measurement (Peeters et al., 2015).

The Formetric 4D system used in this monograph uses the surface topography to measure the dimensions of the upper body. The measurements show a high repeatability of the obtained results, and the mean standard deviation is +/-3° (Knott et al., 2010). The Saunders digital inclinometer is another basic or supplementary system in the examination of the positioning of the body sections, including the spine and pelvis while sitting. An inclinometer is a tool which is now widely used in diagnostic procedures. The advantage of the inclinometer is that it is inexpensive, gives reliable measurement results and is easy to use in practice. Assessment of anterior-posterior spine curvatures using a Saunders inclinometer by a single researcher gives the possibility of obtaining good repeatability and reliability of measurements, i.e. $0.9 > \alpha \geq 0.8$, and the measurement error is within the interval of 2.8°-3.8° (Czaprowski et al., 2012).

The analysis of the literature on discussed issues and the results of the author's own research (Kiebzak et al., 2010; Kiebzak et al., 2017) indicated the necessity of search for biomechanical parameters along with the existing dependencies that will allow to describe the posture while sitting. Consequently, the parameters discovered in the process of the author's own clinical observations and this scientific study allow to show a close dependence of simultaneous movements of particular body parts, i.e. the sternum body and the sacrum, as well as thoracic kyphosis and lumbar lordosis in relation to each other. The Euclidean geometry helped to solve the set tasks (Isayama & Yasukouchi, 1995; Kordos, 2010; Łuczyński & Opal, 1964). On its basis it was shown that common relationships

between the specified parts of the body, the so-called "unifying sense" (Kosztołowicz 2001; Wierciński 2011) can be a method of posture assessment while sitting.

The concept of the unifying sense was introduced by Michał Kosztołowicz in 2001. The unifying sense is understood as a common concept for two different concepts which leads to the justification for creation of a different quality of observations (Kosztołowicz, 2001). The exemplification of this concept took place in a publication prepared by Wierciński in Cambridge in 2011 (Wierciński, 2011).

In the author's own studies, in order to define the posture while sitting, simplifying assumptions were made which remain in a specific interdependence. The simplifying assumptions are: the sternum body angle, the sacrum angle, thoracic kyphosis angle and the lumbar lordosis angle. For these assumptions, existing relationships were defined by the concept of the unifying sense. An important element in this concept is the fact that the lines derived from the sternum body and the sacrum can be "inscribed" in a triangle, and the movement of one part of this system triggers the movement of its other parts. The bone of the sternum body in relation to the horizontal line, the sagittal axis of the body "a" forms angle α and the sacrum in relation to the horizontal line, the sagittal axis of the body "b" forms angle β. Angle (γ) is the unifying sense for the sternum body angle (α) and the sacral angle (β) (Fig. 1).

Based on the author's own analytical search for the unifying sense for the angles of the sternum body and the sacrum, their dependencies were illustrated (Fig. 1). Straight lines a and b are the lines parallel to the horizontal line. The author's own observations show that the ABC triangle was constructed by drawing the straight line AC as the extension of the sacrum bone line to the intersection with the AB line as the extension of the sternum body line forming the BAC angle, i.e. angle γ. The base of the triangle is the horizontal line. The ACD angle, i.e. β is the exterior angle of the ABC triangle. By virtue of the theorem of the Euclidean geometry, the exterior angle of a given triangle equals the sum of the interior angles not adjacent to it, hence, we get: $\beta = \alpha + \gamma$, hence $\gamma = \beta - \alpha$ (1), where γ is the unifying sense for the angle of the sternum body and the angle of the sacrum β as the difference between the positioning of the angles β and α. It follows from the above that the γ angle has a connotation with both angle α as well as angle β, showing common relationships, the so-called unifying sense.

Angle measurements were taken using the Saunders inclinometer. Measured angles are denoted by: α, i.e., the ABC angle for the positioning of the sternum body and β, i.e. the ACD angle for the positioning of the sacrum. Both angles were measured in relation to the horizontal line, the sagittal axis of the body (Fig. 1)

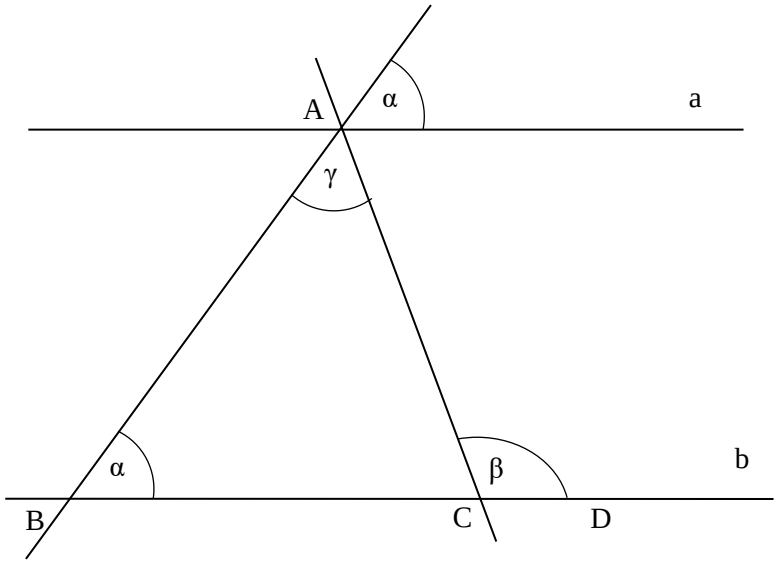


Fig. 1. The arrangement of the line of the sternum body AB and the line of the sacrum AC in the triangle

The consequence of the co-dependence of the sternum body movements in relation to the sacrum is the influence on the changes in the curvature of the thoracic spine ω_1 and lumbar spine ω_2. In this way, relationships of the unifying sense of the sternum body angle and thoracic kyphosis, i.e. γ_1, and sacrum bone and lumbar lordosis, i.e. γ_2 are formed (described in the monograph).

Aim of work

Analysis of the relationship between the positioning of the sternum body and the sacrum, and the changes in the curvatures of the thoracic and lumbar spine in the sagittal plane.

Five research hypotheses were formulated for the purpose of the work:

1. The relation of the unifying sense: $\gamma = \beta - \alpha$, i.e. the body sternum body position and the sacrum position (β), is the basis for the interpretation of the research results.
2. The arithmetic mean of the measurement and the median are fixed values in the test of the skewness of distribution of measurement results.
3. The results of the unifying sense of the corrected posture:
   a. $\gamma = \beta - \alpha$, are close to the normal distribution regarding the sternum body and sacrum positioning,
   b. $\gamma_1 = 180^o - (\alpha + \omega_1)$ are close to the normal distribution regarding the positioning of the sternum body and thoracic kyphosis,
   c. $\gamma_2 = 180^o - (\beta + \omega_2)$ are close to the normal distribution regarding the positioning of the sacrum and lumbar lordosis.
4. The corrected posture constitutes a model for the assessment of the measurement results while sitting.
5. Constrained and passive postures are anti-models for evaluating the measurement results while sitting.

4.1.2. Subjects of the research, methodology and research results

Material, subjects of the research

The observations were conducted on 277 students of the Jan Kochanowski University (UJK), the Faculty of Medicine and Health Sciences (WLiNoZ), aged 19-23. Eventually, healthy people were qualified for the study, 20<BMI<30, without any reported pain, with the proper structure of the chest and spine. Exclusion criteria were: pregnancy, back pain, difficulties in establishing the location of the sacroiliac joint, neuromuscular diseases, participation in a specialized treatment of postural disorders, diagnosed scoliosis, previous surgical procedures in the spinal area and taking painkillers. Each subsequent person consenting to participate in the experiment was informed about the course of the proceedings. The purpose of the research, security issues and privacy issues, including the use of photographs, and the research procedure were explained to the participants. All individuals expressed their voluntary written consent to participate in the experiment.

Based on the inclusion and exclusion criteria, 159 individuals were qualified for the research, including 83 males, 76 females, first and second year students at the Faculty of Medicine and Health Sciences (WLiNoZ), UJK, aged 19 to 23. The research was conducted in 2015–2017. In Annex 1 of the monograph, it was shown that the given number of men and women included in the statistical study are a representative sample of the population.

Test methods

During the physical examination, the examined individual was in a sitting position, evenly loading the ischial tuberosities, on the horizontally positioned seat of variable height, with the lower limbs bent in the hip and knee joints up to the 90 angle. The feet were set flat on the floor to the width of the hips. Upper limbs were set loosely with palms placed on thighs. The examined individuals adopted each position threefold in order to choose the optimum position, according to the Mork and Westgaard protocol (Mork & Westgaard, 2009).

Using the Saunders inclinometer, angle measurements were taken: α – sternum body position and β – sacrum bone position. The measurements of the kyphosis angle ω_1 and the angle of lumbar lordosis ω_2 were conducted using the DIERS Formetric 4D system. The measurements were taken in three positions: (1) passive, free, without back support and active muscle involvement, with pelvic retinopathy; (2) constrained, active, without back support, following the command "sit up straight – draw your shoulder blades together" and (3) corrected, active, without back support, adopted under the control of the researcher, assessed as a complete, active, physiological spine extension, obtained by lifting the sternum, change of anteversion of the pelvis, retraction of the head with the mandible placed parallelly to the ground and slight leaning forward of the upper body. All of the subjects performed the same activities. The tests were approved by the Bioethical Committee of WLiNoZ UJK in Kielce, No. 17/2016. Inclusion of the subjects in the study was random.

Statistical methods

Statistical analysis of the measurement results was performed in the range of the following calculations: reliability of measurements, basic descriptive statistics, percent error calculation, skewness of distribution, study of significance of differences between mean scores of measurements, study of correlation between variables and study of confidence interval for mean scores. The calculations were made using the Statistica 13.1 StatSoft. The level of statistical significance was assumed for $p < 0.05$.

Results

The full scope of the results in the form of basic computational statistics is provided in Table 1 in the monograph. In line with the assumptions of the Euclidean geometry and the relation of the unifying sense, it was assumed that the sternum body and the sacrum lines can be "inscribed" in the shape of a triangle. The unifying sense for the angle of the sternum body (α) and the angle of the sacrum (β) is the angle (γ) as the difference between the position of the angles β and α, recorded as an arithmetic operation $\gamma = \beta - \alpha$. The consequence of the co-dependence of movements of the sternum body in relation to the sacrum is the effect on changes in the curvature of the thoracic spine and lumbar spine. The unifying sense for the kyphosis (ω_1) and sternum body (α) angles is the angle: $\gamma_1 = 180^o - (\alpha + \omega_1)$, while the unifying sense for the angles of the sacrum (β) and lumbar lordosis (ω_2) is the angle: $\gamma_2 = 180^o - (\beta + \omega_2)$.

The correctness of measurements was observed for all of the tested body postures adopted while sitting: passive, constrained and corrected, in the aspect of the unifying sense γ_1 and $(\alpha + \omega_1)$ and γ_2, as well as $(\beta + \omega_2)$, it was also observed that correlation coefficient is very high and amounts to (-1). Based on the above, it was concluded that if the appropriate sum of angles increases, the corresponding unifying sense γ_1 or γ_2 decreases and vice versa (Table 8 in the monograph).

Statistical analysis of test results showed that only the kyphosis angle ω_1 undergoes correction both in the corrected and the constrained position (Tables 5, 6, 9, 10 in the monograph). This fact is confirmed by the test of significance of the mean scores for the ω_1 chest kyphosis angle, which shows that the U test value is lower than the U_α critical value in both women and men. The score obtained for men: $u = 0.08 < 1.974 = u_{\alpha,\ 0.05;\ 164}$ (Table 5 in the monograph) and for women: $u = 0.27 < 1.976 = u_{\alpha,\ 0.05;\ 150}$ (Table 6 in the monograph). Based on the above, the H_0 hypothesis was accepted. In the assessment of the other angles in the constrained posture, there is a statistically significant difference compared to the corrected posture. Due to these results the H_0 hypothesis was rejected. This condition causes the lack of harmony, i.e. the complementation of the elements of the chest, spine and pelvis in achieving the desired, effective corrected posture while sitting.

Adoption of passive posture while sitting was recognized as incorrect behaviour. This is confirmed, i.a. by the calculated values of the correlation coefficient between γ_1 and α, which are: for men -0.914 and for women -0.960, and between γ_1 and ω_1 which are: for men -0.957 and for women -0.941, as well as between γ_2 and β for men -0.989 and for women -0.996, and for γ_2 in relation to ω_2 for men -0.964 and for women -0.957 (Table 8 in the monograph). This is interpreted as high correlation which constitutes the image of the lack of differentiation of the angle α of the sternum body position in relation to the unifying sense γ_1, and γ_1 in relation to ω_1, as well as the lack of differentiation of the angle of the sacrum bone β position in relation to the unifying sense γ_2, and γ_2 in relation to ω_2.

The constrained posture, similarly to the passive posture, was assessed as incorrect. This is substantiated, e.g. by the calculated correlation coefficient between γ_1 and α for men -0.980 and for women -0.902, and γ_1 and ω_1 for men -0.927 and for women -0.933, as well as between γ_2 and β for men -0.970 and for women -0.941, for the correlation γ_2 in relation to ω_2 for men -0.946 and for women -0.971 (Table 8 in the monograph). This is interpreted as a very high correlation which decides about the lack of differentiation of the unifying sense of γ_1 in relation to α and γ_1 in relation to ω_1 and the lack of differentiation of the angle of the sacral bone β in relation to the unifying sense γ_2, and γ_2 in relation to ω_2 (Table 8 in the monograph). The constrained posture is characterized by a significantly statistical

p = 0.006555 bigger difference in the range of the sacrum bone position in women than in men (Table 7 in the monograph).

The observed irregularity of the passive and constrained postures is also confirmed by the higher results of error in the calculation of the empirical median in comparison to the theoretical median. These results, in the assessment of the unifying sense γ_1, e.g. for men indicate that the error in the passive posture is 57.55% and in the constrained posture 32.30%, while in the corrected posture it is 0.34% (Table 2 in the monograph).

The corrected posture as opposed to passive and constrained postures was assessed as proper. This is evidenced by the fact that there is moderate correlation differentiation between γ_1 and α for men -0.412 and for women -0.457, as well as between γ_2 a β for men -0.458 and for women -0.433, in relation to a very high correlation of γ_1 to ω_1 for men -0.936 and for women -0.979, and for γ_2 to $\omega_1$for men -0.950 and for women -0.941 (Table 8 in the monograph). The fact of the correct features of the corrected posture is also confirmed by the lowest result of the calculation error of the empirical median compared to the theoretical median, which, e.g. for the unifying sense γ_1 for women in the corrected posture is 0.08%, while in the passive one is 9.85% and constrained one 1.63% (Table 2 in the monograph).

In the conditions of the research, while determining the posture in the corrected position, a high repeatability of obtained measurements was observed, including for the angle of the sternum body and the sacrum (Table 1 in the monograph). Moreover, the proposed corrected sitting posture includes the assumptions of the correct positioning of the body in space.

4.1.3. Discussion of the research results

Based on the bibliography review, the author's attention was drawn to the diversity of assessment of the body positioning in the sagittal plane – *saggittal alignment*. In the search for a reference point to the author's own results, his attention was drawn to similar forms of posture measurements. Thus, one paper was found for the angle of the sacrum positioning, but the parameter measured with the inclinometer was conducted in a standing position (Prushansky et al., 2008). Also, the scientific works were found describing the positioning of the sternal angle, but the measurements differed from the conditions set out in this paper (Hirose, 2005), (Lee et al., 2010), (Suzuki et al., 2016). In the papers review describing the use of non-invasive methods, without X-ray radiation, the authors present various diagnostic solutions for body posture assessment while sitting (Phimphasak et al., 2016), (Brink et al., 2013) (Claus et al., 2016). The tested parameters, due to different diagnostic assumptions, did not allow comparison of the presented results with the results of the author's own study. The literature review indicates that only the parameters of thoracic kyphosis and lumbar lordosis can be a reference to the author's own studies, despite the fact that the results are presented mainly for the standing position. Considering the obtained results, I found that the subjects in the corrected posture while sitting mostly obtained good and very good scores. However, outside the confidence interval and the extended confidence interval, there remained: for the relationship the sternum body against the sacrum – γ and the relationship the sternum body against thoracic kyphosis – γ_1 4 people in each, for the relationship the sacrum bone and lumbar lordosis – γ_2 5 people in the group of men (Table 11 in the monograph) and for the sternum body against thoracic kyphosis – γ_1 and the relationship the sacrum bone against lumbar lordosis – γ_2 3 people in each in the group of women (Table 12 in the monograph). This fact proves that the presented theoretical way of calculating the common relations of the sternumbody, sacrum, thoracic kyphosis and

lumbar lordosis is a form of verification of clinical trial results. At the same time, it allows you to obtain information on the quality of adopting the body posture while sitting. The method of analysis based on Tables 11, 12 and 13 (in the monograph) may be used in diagnostic, preventive and therapeutic procedures of adopting the correct body posture while sitting.

The research conducted for the purposes of the presented study and daily clinical activities enable non-invasive monitoring of the simultaneousness of the movement of the sternum and the sacrum bone, as well as the thoracic and lumbar sections of the spine. Recommended in this study determinants of the corrected posture while sitting are characterized by homogeneity of the results (Table 1 in the monograph). These are the parameters developed for a homogeneous healthy population. A common feature of the discussed issue is the fact that the described disorders happen in the sagittal plane (Mac-Thiong et al., 2011; Phimphasak et al., 2016; Czaprowski et al., 2014; Dankaerts et al., 2006; Roussouly & Nnadi, 2010; D.E. Harrison et al., 1999a; Scannell & McGill, 2003; Lee et al., 2014; Le Huec et al., 2011; Straker et al., 2009; Quek et al., 2013; Caneiro et al., 2010; Liang et al., 2016; Kiebzak et al., 2017; Kiebzak et al., 2010), and the arrangement of the individual sections of the spine in relation to each other creates a system of connected vessels. This phenomenon is confirmed by Brügger's observations stating that the alternate course of the centres of gravity of particular parts of the spine, thorax, as well as head and pelvis, leads to the fact that the displacement of any segment entails simultaneous displacement of adjacent sections in opposite directions (Pavlu et al., 2007). This kind of chain reaction is compared to the action of "cogwheel" (Pavlu et al., 2007). The physiological positioning in this plane plays an important role in eliminating shear and compressive forces acting on the spine (Oh & Eun, 2015). Scheduled and prepared calculation models have shown that forces in the lower spine section given in newtons (N) significantly increase, from 550 N in physiological conditions, to values exceeding 5,000 N under overload conditions. At the same time shear forces increase from 200 to 2,000 N. The increase in the forces involved is associated with the prolonged adoption of the bent, passive position of the body – *slump position*. These circumstances become particularly dangerous when, while maintaining defective positions with an incorrect body posture, a sudden, dynamic movement of deep bend appears, often connected to the twist of the upper body (Dreischarf et al., 2016, Rohlmann et al., 2013).

In the process of my observations, I noticed that for an examined person, the angle α of the sternum body position in relation to the sagittal axis of the body is easily controlled and easy to measure. It should be emphasized that for the majority, i.e. 86.67% of the subjects, it is considered easy to adopt (Kiebzak et al., 2017). Considering this observation and considering the simultaneoussness of movements of the aforementioned system, positioning the sternum body to the value of angle α should provide an indication for the way to control body posture. In practical behaviour, the attention of the concerned person is turned away from the determination to "sit up straight" and turned to a specific task.

Concentration of attention of the person undergoing corrective action, on the slight – in the opinion of the subject – elevation of the sternum body to the angle of about 65° in relation to the sagittal axis of the body becomes this specific task. In addition, pelvic retraction is included along with a slight leaning forward of the upper body in conditions without support of the spine (Wolańska & Wolański, 2005; Kiebzak et al., 2010; K. O'Sullivan, McCarthy et al., 2012; Kiebzak et al., 2017), and a slight leaning backward in conditions when the spine is supported (Schüldt et al., 1986).

In most cases, the achievement of active correction of body posture is determined by two opposite features, it is indicated that it is easy and uncomfortable (O'Sullivan,

McCarthy et al., 2012; Kiebzak et al., 2017). Encountering these opposing concepts in the author's own clinical practice makes a great challenge for obtaining the desired effects of preventive and curative treatment. This state results from difficulties in creating motivation to work on the body posture (Kiebzak et al., 2017).

In practical actions to strengthen the meaning of provided information, it should be emphasized that the posture is perceived by others (Amoruso et al., 2011) and may reveal the state of mind of the observed person (Ramalingam et al., 2017). Therefore, all corrective actions with proper qualification should be considered from the biopsychosocial perspective in which changes in the parameters of biomechanical factors constitute only one of the elements of the procedure (O'Keeffe et al., 2013, Prins et al., 2008). The aforementioned qualification should exclude from the described procedure the individuals with root pain, special difficulties in maintaining the corrected posture while sitting and in whom the shallowing of thoracic kyphosis is observed. However, it turns out that the consistent "implementation of α angle" in the individual's activity can result in good practical solutions. These solutions may concern the body posture correction while performing various daily activities.

In attempts to position the sternum body to an angle of about 65° in relation to the sagittal axis of the body, it is recommended to frequently practise the positioning of the chest to obtain the desired effect, extended and physiological positioning of the sections of the spine and the entire spine. It should be emphasized that elimination of incorrect behavioral habits is connected with discomfort which, in young people, decreases only after 3-4 months of systematic work (Nowotny-Czupryna et al., 2013). The basis for such activities, i.e. postural control is muscle synergy which depends on the function and structure of the nervous system (Ting & McKay, 2007). It is based on complex processes which involve reflexive segmental reactions and phase activity, precisely adapting to various types of external stimuli (Freyler et al., 2015).

Considering the above, the presented results, the determinant of the sternal angle position may be an accurate proposal for the diagnostics and correction of the posture in the sagittal plane while sitting. This is very important because the data show that the correction of the sagittal plane while sitting may be of fundamental importance for the body's functioning (Lee et al., 2010).

Prevalence of postural disorders being the fact indicates the necessity for raising awareness about body posture, especially among students and teachers (Ramalingam et al., 2017). In skilful planning of preventive and curative activities in the discussed health issue, social media should be used (Lee et al., 2016). Early postural examination will help prevent or at least reduce spine diseases in the subsequent years of life (Ramalingam et al., 2017). Neglection to popularise corrective actions reinforces changes that may have large implications for general fitness in mature life (Lee et al., 2014; Skaf et al., 2011; Asai et al., 2017).

From the author's own observations and studies, it appears that sedentary lifestyle creates conditions for further developing of thoracic kyphosis and loss or reduction of lumbar lordosis. This condition is a determinant for the development of postural defects, especially of the round back syndrome and overload of the spine structures. Therefore, searching for the right solutions for diagnostics and body posture correction while sitting requires constant research in this area. The results presented in this monograph should have an impact on the implementation and propagation of a new form of scientific reflection on the body posture, and thus on the shaping of body awareness (Danner et al., 2017; Judycki, 2010). One of the elements of this procedure should be learning the image of one's own body posture while sitting and creating a "good" image of one's own body. In addition,

it will be valuable to determine how long and how often the corrected position should be adopted and whether the use of corrected posture gives good long-term clinical results.

Reeducation of the body posture, recommended already at an early stage of life (Mikołajczyk et al., 2015) clearly plays an important role in the treatment of spinal pain (Czaprowski et al., 2014; K. O'Sullivan et al., 2012; K. O'Sullivan et al., 2010). However, the results of scientific works concerning the adoption of the "corrected posture" – the physiological extension of the spine in the treatment of various musculoskeletal disorders, i.e. headache, neck and upper chest pain (Caneiro et al., 2010), hip joints (Kiebzak et al., 2016); toe walking (Szopa et al., 2016) or severe cranial and cerebral injuries (Kiebzak et al., 2015) should encourage further in-depth, multidirectional research, i.a. in the assessment of equivalent responses (Wilczyński, 2014).

4.1.4. Practical conclusions of research results

1. According to the properties of the Euclidean geometry and the relation of the "unifying sense", the sternum body and the sacrum lines can be "inscribed" in the shape of a triangle, documenting the co-dependence of their position.
2. Co-dependent movements and the positioning of the sternum body and the sacrum produce the changes in the values of thoracic kyphosis and lumbar lordosis angles. This fact should be an important component of a clinical observation of the body posture while sitting.
3. The constructed model of the "unifying sense" γ (the sternum body in relation to the sacrum), γ_1 (the sternum body and thoracic kyphosis) and γ_2 (the sacrum and lumbar lordosis) enables assessment of the body posture while sitting.
4. Out of the three examined positions, the corrected one showed the interdependence of measured parameters. It was the basis for discovering the pattern defining optimal parameters of body posture while sitting.
5. Implementation of the sternal angle position in relation to the sagittal axis of the body, amounting to about 65º in clinical practice as one of the goals of postural education, can be a target solution for the correction of the body posture while sitting.

Presentations of general assumptions of the discussed subject

- **Wojciech Kiebzak**, Małgorzata Domagalska, Andrzej Szopa, Ireneusz M. Kowalski, Halina Protasiewicz-Fałdowska, Zbigniew Śliwiński, 2011, The importance of physiological extension of the spine in motor development, IV International Scientific Congress "Let's help live better", Kielce.
- **Wojciech Kiebzak**, Ireneusz M. Kowalski, Krzysztof Kassolik, Anna Opuchlik, Daniel Zarzycki, Marek Kiljański, Zbigniew Śliwiński, 2011, The impact of pelvis position on heart-related ailments, Congress on the occasion of the fifteenth anniversary of the McKenzie Institute Poland XXI century – controversy about skeletal-muscular medicine, Warsaw.
- **Wojciech Kiebzak**, 2013, The consequences of physiological disorders spine extension, International Scientific-Practical Conference A Modern Approach To Children's Physical Medicine And Rehabilitation, Wilno (Lithuania).
- Zuzanna Siekańska, Julia Miszczuk, Nikodem Pochopień, Maciej Majcher, Mikołaj Lipiński (Uczniowie SzP nr 8 w Kielcach), 2016 Sit up straight. Disorders of body

posture in the sagittal plane in school-aged students. IV Symposium of a young scientist UJK Kielce. **Wojciech Kiebzak** scientific consultant of the project.

- **Wojciech Kiebzak**, Arkadiusz Żurawski, Anna Zmyślna, Justyna Pogorzelska, Zbigniew Śliwiński, Grzegorz Śliwiński, 2017, Evaluation of the influence of physiotherapy in children with defects of posture on changes in the shape of the spine. XII Autumn Physiotherapy, Physiotherapy in practice, Polańczyk Zdrój. **– Polish Society of Physiotherapy(PTF) Main Prize for the best presentation.**

5. Discussion of the remaining scientific and research accomplishments

5.1. Implemented research topics

5.1.1. Search for mathematical solutions for the interpretation of clinical observations

The results of a regular literature review of my scientific studies and my own experience in the preparation of the scientific works indicate the need to improve the use of statistical methods. This improvement should consider the need to show changes in the parameters of clinical observations made at a specific time, as well as referring the results of the tests and conducted experiments to a normal distribution.

5.1.1.1. T_1 Scale

Mathematical analysis of T_1 scale constitutes the proposal for new solutions. In this study the fact is emphasized that in every therapeutic procedure the highest number of positive scores is assumed. This state is represented by a normal distribution whose analytical form is expressed by the formula:

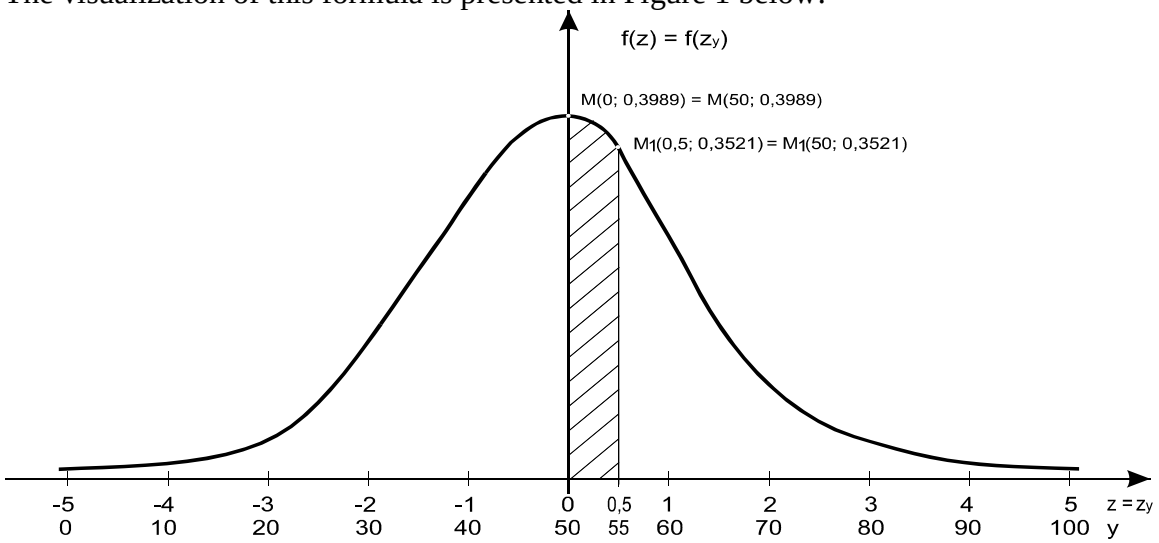
$$f(z) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}z^2} \qquad (1)$$

where: z – the standardized score was defined:

$$z = \frac{x_i - x_m}{\sigma} \qquad (2)$$

where x_i–ith-empirical score
x_m–mean value of scores
σ–standard deviation.

The visualization of this formula is presented in Figure 1 below:



Values on the axis of abscissa are standardized scores from -5 to 5 (Fig. 1). These scores are equivalent to the values expressed in T_1 scale as a dependence score (y = 10 z + 50) and amount respectively to:

0↔10·0+50=50; 1↔10·1+50=60; 2↔10·2+50=70; -1↔10·(-1)+50=40; -2↔10·(-2)+50=30, etc.

Dependence: f (zy) = f (z) means that the values of the standardized scores are equal to the standardized scores in T scale, and thus in T_1 scale. These values can be calculated from dependence (1) and, e.g. for 0 standardized score we get:

$$f(0)=\frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}0^2}=\frac{1}{\sqrt{2\pi}}e^{0}=0.3989$$

This is the highest value which is marked in Fig. 1. The other values f (zy) = f (z) are included in the table according to the dependence (1). Table 1 shows certain values starting from the highest, i.e. standardised score 0 and the value 0.3989. In the last column T_1 scale scores are presented. The values were calculated on the ordinate, according to formula (1).

Table 1. Values for $f(z_y) = f(z)$

Standardized score	Value of the function $f(z_y) = f(z)$	Score in T_1Scale
0	0.3989	50.0
0.05	0.3984	50.5
0.10	0.3970	51.0
0.15	0.3945	51.5
0.20	0.3910	52.0
0.25	0.3867	52.5
0.30	0.3814	53.0
0.35	0.3752	53.5
0.40	0.3683	54.0
0.45	0.3605	54.5
0.50	0.3521	55.0

In any therapeutic procedure, the goal consists in helping the highest possible number of the sick people to achieve a good health condition. For this reason, standardized scores were taken into account, on the abscissa $z \geq 0$

Due to the fact that the standardized score (+1) deviates from the mean standardized score, i.e. zero (0) o (+1) and o (-1), by referring it to the critical value at the confidence

level α = 0.05 i.e.: $t_{0,05,\infty}$=1.96 (value read from the charts of Student's t-distribution) we get:

$$z_{+} = \frac{1}{1{,}96} \approx 0{,}5$$

$$z_{-} = \frac{-1}{1.96} \approx -0.5$$

These values in T_1 scale in accordance with the dependence y = 10 z + 50 respectively amount to:

$y_{+}=10\cdot 0.5 + 50 = 55$

$y_{-}=10\cdot(-0.5) + 50 = 45$

In this way, the interval was obtained for positive and negative scores [45; 55]. The interval for positive scores is [50; 55], and for negative ones is [45; 50).

Hence, the diversified intervals for positive scores were interpreted like this:

[50-50.5) as very certain scores,

[50.5-51.5) as certain scores,

[51.5-52.5) as average certain scores,

[52.5-55] as correct scores.

To demonstrate the dynamics of long-term therapy, the best score obtained by individual patients was assessed, i.e. when they were allocated number 2. The results of clinical observations of individual components of the test in T1 scale, according to the following dependence: y = 10 z + 50 are shown in Table 2.

The score of the first test for assessment of social contacts and analogously the remaining scores of the tests in patients with central coordination disorders in each of the four kinds of the test were obtained as follows:

In this study, the mean score for the population is x_m = 0.498, and the standard deviation is σ = 0.779, based on dependence y = 10 *z* + *50* we got $y = 10\frac{2-0.498}{0.7793} + 50 = 69.27$ (test 1 for the assessment of the level of social contacts Table 2)

Table 2. Dynamics of assessment of changes in treatment process of children with central coordination disorders

Test	Level of social contacts	Spontaneous motor activity	Postural reactions according to Vojta	Neurological reflexes
1	69.27	88.15	88.01	67.08
2	62.33	70.97	67.92	61.11
3	59.11	61.12	63.31	56.47
4	54.12	56.07	56.42	54.01
5	52.77	54.03	53.55	52.21

Table 2 scores provide the following information:

1. In test 1 for all samples, the score deviated from the interval [50-55].
2. The worst scores in test 1, i.e. the moment the treatment was implemented, were found in the children with central coordination disorders, in the assessment of spontaneous motor skills – 88.15 and in the assessment of postural reactions according to Vojta – 88.01.
3. The children with central coordination disorders achieved different pace of changes in each of the assessed types of tests, in T_1 scale.
4. The subjects achieved the fastest-awaited interval [50-55] in test 4 in the assessment of neurological reflexes – 54.01 and in the assessment of social contacts – 54.12.

Practical conclusion:

T_1 scale enables testing the dynamics of therapeutic process, including the course of treatment of an individual patient in relation to the population. Therefore, in the analysis of clinical results, it is possible to express empirical results through the standardized scores in T_1 scale which are positive scores facilitating the interpretation of changes in the treatment process. Thus, in the treatment process divided into stages, it is possible to study the dynamics of treatment effects in groups of patients and to determine the degree of effectiveness as: very certain, certain, average certain, correct in the interval [50-55]. Due to T_1 scale, it is possible to observe when and at what pace the general criteria were satisfied, i.e. when the patients' results reached the interval [50; 55] in T_1 scale, and the subjects achieve the optimum level of fitness. The basis for consideration of the discussed topic was J.P. Guliford's scientific work [Fundamental Statistic in Psychology and Education NY, London, Mc.Graw – Hill Company 1942].

Kiebzak W, Kosztołowicz M, Zaborowska-Sapeta K, Kiebzak M, Dwornik M. Application of T1 scale in evaluating effects of long-term therapy. Polish Annals of Medicine 2016; 23(2):118-122.

MNiSW 14

My contribution: concept preparation, data collection, data interpretation, statistical analysis, material preparation, literature search, manuscript preparation.

I estimate my percentage contribution at 60%.

Good perception of this work describing the introduction of T_1 scale for clinical observations in the global scientific community results in invitation of my person to the 9th World Gene Convention 2018 Singapore as a chair/speaker.

Recommended by International Journal of Clinical Medicine Research, American Journal of Clinical and Experimental Medicine and American Journal of Internal Medicine.

5.1.1.2. Relation Index Wr

Clinical trials are often analyzed in a variety of ways, in particular, using correlation coefficients. The method of statistical analysis proposed in this study is part of an alternative approach based on simple calculations. Thus, the analysis of T_1 scale showed obtaining the correlation dependencies of a single (each) patient for two tested variables.

Relation Index Wr was defined: $Wr = \frac{y_{ik}}{y_{ik_1}}$

where: $y_{i,k}$ – score of variable – k for i-patient in T_1 scale,

y_{i,k_1} – score of variable – k_1 for i-patient in T_1 scale,

for y_i, $k_1 = 10z_1 + 50$, where z – standardized score.

Because the mean value of standardized scores always equals zero (0), the mean value of the scores in the T_1 scale always equals 50, since $y_m = 10 \cdot 0 + 50 = 50$

In order to determine the effective interval for the Wr relation index, i.e. for neighbourhood 1, the following operational definition was adopted:

1. The standardized score (1), which deviates from zero by (+1), and the standardized score (-1), which deviates from zero by (-1), was taken into account.
2. Standardized scores 1 and -1 were referred to the critical value at the confidence level $\alpha = 0.05$ which was read from the charts of Student's t-distribution, namely:

   $t_{0.05,\infty} = 1.96.$

   We got $z = \frac{1}{1.96} = 0.5102 \approx 0.5$

The last value was substituted in the formula y = 10z + 50 obtaining y = 10·0.5 + 50 = 55
Analogical procedure was applied for (-1) value:

$z = \frac{-1}{1.96} = -0.5102 \approx -0.5$ hence , we got y = 10·(-0.5) + 50 = 45

3. Results in T_1 scale: 45 i 55 were referred to the mean value in this scale, i.e. 50 and we got: $\left[\frac{45}{50}; \frac{50}{50}; \frac{55}{50}\right] = [0.9; 1; 1.1] = 0(1) = 0.1$ denotes the neighbourhood of point 1, which is a middle point of a circle with 0.1 radius and crossing points: 0.9 and 1.1. Thus, if: $Wr \in 0(1) \Leftrightarrow Wr \in [0.9; 1.1]$.

   From the above correlation it follows that for Wr relation index three intervals were created: Wr < 0.9; Wr ∈ [0.9;1.1] and Wr > 1.1

It is concluded that in the case when Wr ∈ [0.9; 1.1], the correlation in this interval is the highest for the tested variables. In the preparation of the publication, the scores obtained in radiological examinations were used, where the variable k – is the score obtained in the X-ray examination, and the score k_1 – the score obtained with HRCT method. Each patient underwent both RTG and HRCT. The calculated correlation coefficients for the type of variables were denoted by m_1, m_2, m_3, m_4 and m_5. The results are shown in the table below for Wr ∈ [0.9; 1.1].

Variable types	Correlation coefficient value	Decision H_0
m_1	0.957	rejected
m_2	0.962	rejected
m_3	0.974	rejected
m_4	0.971	rejected
m_5	0.984	rejected

From the results of the table above, it can be clearly read that for the tested variables k and k_1 and for the types of these variables m_1, m_2, m_3, m_4 and m_5 the correlation is very certain.

The introduction of a new form of mathematical interpretation of clinical observations gives the chance to avoid errors in statistical analysis. This fact will affect the patient's accurate diagnosis and accurate establishment of the treatment program, including physiotherapeutic treatment considering the patient's expectations.

Practical conclusion:

The value of relation index Wr belonging to the interval [0.9; 1.1] allows to determine high correlation between the tested variables in each patient.

Kiebzak W, Książkiewicz B, Kosztołowicz M, Kiebzak M. Using Relation Index Wr in Radiologic Diagnosis. Fizjoterapia Polska 2016;16(3): 34-41.

MNiSW 10

My contribution: research project preparation, statistical analysis, data interpretation, literature search, manuscript preparation.

I estimate my percentage contribution at 60%.

5.1.2. Axiological approach to the cultural good, culture and ethics in physiotherapy

Physiotherapy is a new field of medicine in institutional terms which requires determination of its identity. This may be of special importance, as currently its dynamically developing structure concerns a group of over 50,000 people with different levels of education and with different awareness and different expectations. Thus, the physiotherapists are faced with the need to create – improve the description and concept of the development of this profession. In this sense, axiological considerations on physiotherapy seem to be right. These considerations refer to values belonging to the order, which takes into account the achievement of the Platonic Triad: Beauty, Justice and Truth. In the detailed description, the development of physiotherapy is conditioned by the relationship between those conducting the treatment process and their patients. The result of this dependence should be the achievement of optimum treatment effects which will stimulate the constant development of physiotherapy. Therefore, it is necessary to create an "ethical space" by propagating the code of ethics, description of the profession and legal provisions in relation to the Act on the profession of physiotherapy. At the same time, the

correct interpretation of the concepts included in the documents should be facilitated. This facilitation refers to the methodology of scientific research and an illustrative approach to the problem.

With the above in mind, I became the originator and the main author of the Code of Ethics of the Physiotherapist of the Republic of Poland, 2009, professional qualifications standard for the profession of physiotherapist in the Classification of Occupations and Specialties, at the request of the Labour Market Department of the Ministry of Labour and Social Policy in 2007, and the co-author of the legal provisions of the physiotherapist profession in 2006, the Act on the profession of physiotherapy in 2015, the Code of Ethics of the Academic Teacher at the Jan Kochanowski University (Order No. 22/2017), as well as scientific publications. My motive to undertake such actions was the awareness of the necessity to describe this profession and to show the importance of physiotherapy in the society which assumes the tasks of caring for the patient.

Care for human dignity and the good of the community requires maintaining important values, ethical standards and attitudes resulting from them. The Code of Ethics of the Physiotherapist of the Republic of Poland showing the relationship between the physiotherapist and the patient determines the professional-moral attitude in the relationship between these individuals. Among the seven chapters are those that set the path of responsible preparation for this profession, as well as of incessant training. Therefore, the Code deserves to be implemented into professional activities. Its first sentence referring to the physiotherapist's life and work: "To respect the rights and dignity of every human being" is the soul and fundamental message of this Code [5].

The Code of Ethics was approved by a group of physiotherapists and physicians, theologians and ethicists after extensive consultations. Art. 3 states that "In his professional activities, a physiotherapist puts the good of a human being above all other goods" [5]. Disturbed health requires from a physiotherapist to properly use appropriate therapeutic methods, i.e. cultural goods. The moment he or she evaluates the effects of the treatment plan, determined by the examination, the culture of the physiotherapist is evaluated, i.e. the adjudication about his ethics.

In this way, the application of certain standards and instructions in medical treatment increases the quality of provided services and minimizes the possibility of professional error [2]. In this approach, the standard is a single document which defines the scope of knowledge, skills, determines professional tasks and the scope of professional responsibility confirmed by the statistical elaboration [1,4].

Being based on the patient’s constant need for individual treatment makes the grounds for the modern model of therapeutic improvement. Personal involvement of medical personnel, characterized by deep humanism, is an indispensable condition for effective rehabilitation [3]. In this process, attention should be drawn not only to the patient, but also to the condition of the physiotherapist, in order to mitigate his professional overload [7]. These overloads may result from different attitudes of the physiotherapist, including the attitude of social discipline or social openness [8].

The following concepts should be used in shaping the identity of physiotherapists: the cultural good, culture and ethics; they constitute a specific "whole," which was assigned the common name "ethical triad of a human being." It should be emphasized that the ethical triad of a human being without the concept of the cultural good is an empty concept. It results from the following fact: the cultural good (including legalized methods of treatment) serves people in a positive sense through the existence of the said ethical triad which should lead to an effective human-human relation [10].

Ethical culture of the professional group of physiotherapists is made up of their attitudes and ethical beliefs at every stage of education and professional career. The culture of the profession is a derivative of personal and collective culture, as well as spiritual and material one [9]. The culture of the profession can be created by implementation of the appropriate ethical program [10]. The initial period of academic education should be considered in shaping professional identity. Thus, it turns out that humanities play an important role in teaching physiotherapy students the correct ethical attitude if: a. "interpersonal communication" based on personality psychology is activated, b. reasoning shall be based on ideal utilitarianism, approximated through personality psychology, pedagogy and ethics [11]. The development of noble attitudes among physiotherapists is important because people with disabilities are particularly vulnerable to mental strain, so they should be given special care [12].

As a result of the above and the fact that scientific research, created organizational units educating in the field of physiotherapy, research issues and adapted conceptual scope are the premises proving that physiotherapy can be an independent scientific discipline and have a place in the system of science [6].

Bibliography according to the order of publication dates.

1. **Kiebzak W**, Dwornik M. National Standard of professional qualifications– Physiotherapeutist (223903). Ministerstwo Pracy i Polityki Społecznej. Instytut Technologii Eksploatacji–PIB Radom, ISBN 8372045038[49]; 2006.

MNiSW 25

My contribution: concept preparation, data collection, data interpretation, statistical analysis, material preparation, literature search, manuscript preparation.

I estimate my percentage contribution at 60%.

2. **Kiebzak W**, Starczyńska M, Śliwiński Z, Kowalski I.M, Robak L, Kiljański M, Woszczak M. The importance of quality in the practice of physiotherapy. The case of the Regional Specialised Paediatric Hospital in Kielce. Fizjoterapia Polska 2007; 7(2): 133-144.

MNiSW 4

My contribution: research project preparation, data collection statistical analysis, data interpretation,manuscript preparation.

I estimate my percentage contribution at 60%.

3. **Kiebzak W**, Kowalski I.M, Kiebzak M. Model of therapeutic rehabilitation. Rehabilitacja Medyczna 2008; 12(2): 31-33.

MNiSW 2

My contribution: work project preparation, data collection, literature search, manuscript preparation, raising funds.

I estimate my percentage contribution at 60%.

4. **Kiebzak W**, Szczegielniak J, Butkiewicz M, Dwornik M, Frańczuk B, Starczyńska M, Śliwiński Z. Standards of competence in physiotherapist profession. Fizjoterapia Polska 2009; 9(1): 84-96.

MNiSW 4

My contribution: research project preparation, data collection, data interpretation, manuscript preparation.

I estimate my percentage contribution at 60%.

5. **Kiebzak W**, Gieremek K, Florczyk M, Kiljański M. Ethical Code of Physiotherapist of Polish Republic. Fizjoterapia Polska 2009; 9(3): 266-272.

MNiSW 4

My contribution: concept preparation, data collection, data interpretation, material preparation, literature search, manuscript preparation.

I estimate my percentage contribution at 70%.

6. Starczyńska M, Błaszkiewicz E, **Kiebzak W**, Śliwiński Z. The profession of physiotherapist in the assessment of a professional group. Fizjoterapia Polska 2011; 11(3): 227-239.

MNiSW 5

My contribution: data collection, data interpretation, manuscript preparation.

I estimate my percentage contribution at 20%.

7. Makara-Studzińska M, Kryś-Noszczyk K, Starczyńska M, **Kiebzak W**, Śliwiński Z. Occupational burnout in female physiotherapists, Fizjoterapia Polska 2012; 12(4): 327-339.

MNiSW 5

My contribution: data interpretation, literature preparation, manuscript preparation.

I estimate my percentage contribution at 15%.

8. Rusin M, **Kiebzak W**, Kiljański M, Dwornik M, Śliwiński Z. Shaping ethical attitude of physiotherapist. Fizjoterapia Polska 2013; 13(4): 51-56.

MNiSW 6

My contribution: concept preparation, data collection, data interpretation, literature search, manuscript preparation.

I estimate my percentage contribution at 40%.

9. **Kiebzak W**, Rusin M, Śliwiński Z, Dwornik M, Kiljański M. Professional culture versus physiotherapist's culture. Fizjoterapia Polska 2013; 13(4): 44-50.

MNiSW 6

My contribution: concept preparation, data collection, data interpretation, literature search, manuscript preparation.

I estimate my percentage contribution at 60%.

10. **Kiebzak W**, Kosztołowicz M, Rusin M, Kiljański M, Kiebzak M. Cultural Good as the Basis of Culture and Ethics. Fizjoterapia Polska 2016; 16(4): 48-60.

MNiSW 10

My contribution: research project preparation, data collection, statistical analysis, data interpretation, literature preparation, manuscript preparation.

I estimate my percentage contribution at 60%.

11. **Kiebzak W**, Michał Kosztołowicz M, Magdalena Rusin M, Marek Kiljański M, Kiebzak M. Methodology of Assessing Certain Statements Regarding the Formation of Attitudes in Students of Physiotherapy on the Basis of Metaethics. Fizjoterapia Polska 2016; 16 (4): 61-70.

MNiSW 10

My contribution: research project preparation, data collection, statistical analysis, data interpretation, literature preparation, manuscript preparation.

I estimate my percentage contribution at 70%.

12. Sierant A, Łętocha M, Grzybek P, Pytowska K, Wiśniewska-Małek A, Kiljański M, **Kiebzak W.** How to Help Persons with Disabilities to Improve Their Everyday Life? – Report from Study with the Rational Behavior Therapy Application,, Fizjoterapia Polska 2016; 16(4): 40-47.

MNiSW 10

My contribution: statistical analysis, data interpretation, literature preparation, manuscript preparation, fund raising.

I estimate my percentage contribution at 20%.

5.1.3. Scolioses – results of experimental research

Nowadays, when modern diagnostic technologies and various treatment concepts are available, care for children with idiopathic scoliosis (IS) makes an interesting clinical challenge. It is estimated that globally this problem concerns from 0.3 to 15.3% of the population, depending on the research method and the region [2]. In Poland, the incidence of this disease varies from 2 to 14%, while in Western Europe it concerns from 2 to 3% of the population. The majority (80-90%) of reported spinal deformities is idiopathic scoliosis [2]. Progressive IS may have a negative impact on the development and functioning of adolescents, with health consequences and economic costs, placing the disease at the center of attention of developmental medicine [5].

IS may be associated with a significant lowering of the patients' quality of life. The reason for this are often pain syndromes co-ocurring with IS. It was found that the most frequent locations of back pain were: lumbar segment in 28 people (51.9% of the studied population) and thoracic segment of the spine in 21 individuals (38.9% of the studied population). The studies showed that patients with pain syndrome located in the lumbar region of the spine were in a sitting position for a longer period. The lifestyle of the patients included in the study and lack of awareness of posture control may influence the type and intensity of pain [3].

The said incidence of IS ranges from 0.3% to 15.3% in the general population. The aim of the study was to develop and compare three different IS screening tests in terms of their effectiveness and costs. The Delphi method was used to evaluate the effectiveness of the screening algorithm in detecting IS in the population. An economic analysis of this diagnostic procedure was also conducted [9].

Diagnostic algorithm 1 for IS included a screening test developed by the nurses and a primary care physician, verified by the specialists. The unit cost of performing diagnostics for IS Algorithm 1 was 94 € for the examination of one child. Algorithm 2 required the use of the moiré computer method and then verification by a specialist. The lower unit cost of 86 € for each test was due to fewer stages compared with Algorithm 1. The highest efficiency at the highest cost was found for Algorithm 3, with only one stage, i.e. a specialist consultation (cost 153 € per child). The results of the study indicate that the number of steps in the algorithm does not correlate positively with effectiveness or cost. The recommended scheme is Algorithm 3, in which the children are examined by rehabilitation or physiotherapy specialists using a skoliometer and an inclinometer. The use of the most expensive scheme (Algorithm 3) should result in reduction of the costs of treatment of idiopathic scoliosis and in the long-term perspective, turn out the most cost-effective solution for the health care system [9].

One of the methods used for conservative treatment of idiopathic scoliosis is FED (Fixation, Elogation, Derotation), created by Professor Santos Sastre. Based on the results of the research, it turns out that the FED method should be included in the therapy of children with II° scoliosis due to higher therapeutic efficacy than the standard treatment. Further comparative studies on the larger study group should be conducted on the effectiveness of various therapeutic methods in idiopathic scolioses [11].

Idiopathic basis of scoliosis hinders medical treatment of cause and effect nature. In the clinical procedure, good treatment results of Scoliosis II° with the FED method are observed. The study included girls aged 11 to 15 years (the mean 13.5 ± 1.4) with diagnosed II° idiopathic scoliosis. In all the subjects, the measurement of angle of the trunk rotation of primary, secondary curve, cervical segment was performed and measurement of the scoliosis coefficient was performed. The parameter of the Two-Rotation Sum (SDR) was also analyzed. The test was carried out with the Zebris system, before and after a three-week FED therapy. After applying the FED therapy, a statistically significant decrease in the mean value of the angle of the trunk rotation was observed at the primary, secondary curve and cervical segment. Similar observations were made in the case of scoliosis coefficient and Sum of Two Rotations [10]. In the conclusion of the study it is stated that the treatment of idiopathic scolioses with the FED method over a 3-week period leads to significant improvement in the tested parameters [10]. However, it is worth emphasizing that in the IS diagnostic procedure using the Zebris system, the achieved results should be analyzed skillfully [8]. In the overall planning of IS conservative treatment, the use of Chêneau corset and physiotherapy are encouraged. These actions have effectively stopped the progression of scoliosis (20°-45°) in 48.1% of patients. The results of this study suggest that well-planned treatment reduces effectively the frequency of IS surgical treatment [5].

Good respiratory therapy should also be included in the aforementioned well-planned treatment. This form of therapy improves the functional parameters of the respiratory system in patients with IS II°, becoming an important element in comprehensive treatment. The use of respiratory kinesiotherapy in children with II° idiopathic scoliosis contributes statistically significantly to the improvement of all functional indicators, including FEV1 and FVC [7].

Treatment of idiopathic scoliosis is difficult due to a variety of aetiology, age of onset and a long period of intensive treatment. Therefore, the effect of Lateral Electrical Surface Electrostimulation (LESS) was examined in an animal model of experimental scoliosis (ES). The number of motor end plates (MEP) in the latissimus dorsi muscle (LDM) was assessed. A significant increase in the number of motor end plates in LDM was observed. Short-term correction electrostimulation caused an increase in the number of motor end plates within 3 months. However, their decrease was observed in animals treated for 6 months compared with the ES group and the control group. Therefore, the results of this study clearly show that short-term LESS can affect both the number of motor end plates and the effectiveness of adaptation of muscle correction in a more effective and harmless manner than in the case of long-term treatment [6]. It should be emphasized that the results of clinical observations as well as morphological changes indicate the presence of adaptive stress in short-term stimulated rabbits [4].

Clinical trials on the use of Lateral Electrical Surface Electrostimulation (LESS) were conducted in a group of children and youth showing progression of SI curvature above 5^0 on an annual basis acc. to Cobb. The study included 450 patients, aged 4 to 15 years, divided into 3 groups (n = 150). In group I, a 2-hour LESS therapy was used, in group II – a 9-hour therapy, and in group III (control) – only treatment with corrective exercise performed for 30 minutes twice a day. LESS-type electrostimulation was used in a 24-month period of treatment with a pacemaker SCOL-2. LESS electrostimulation shortened to a 2-hour treatment a day produced similarly beneficial results to those achieved during an all-night (9-hour) electrostimulation, which was confirmed by the analysis of the Harrington factor. The results of the treatment in group I and II were significantly better compared to the group in which the treatment was applied using corrective exercise [2].

Activities seeking the causes of IS formation are extremely important. In the experiment, it turned out that in the examined group hip anomalies diagnosed during infancy did not show any relationship with the diagnosed idiopathic scoliosis [12]. The search should be continued, aimed at assessing the influence of various factors on the emergence of idiopathic scoliosis, as well as creating models of effective treatment [1]. One of the elements of this procedure should be the assessment of the implementation of control of the axis of the body position in three planes while performing any activities during the day. In these activities, analysis of IS parameters may provide interesting results, including control of the sternum and sacrum bone positioning. Such a thesis is justified, say, by the aforementioned fact that the lack of posture control awareness in individuals with IS may affect the type and intensity of spinal pain [3].

Bibliography according to the order of publication dates.

1. Śliwiński Z, Kufel W, Halat B, Michalak B, Szczegielniak J, **Kiebzak W**, Senderek T. Kinesiotaping applications in children with lateral curvature of the spine. Fizjoterapia Polska 2007; 7(3): 370-375.

MNiSW 4

My contribution: data collection, statistical analysis, data interpretation.

I estimate my percentage contribution at 10%.

2. Kowalski I.M, Torres M.A, **Kiebzak W**, Paśniczek R, Szarek J. The effect of lateral electrical service stimulation [LESS] on spinal deformity in idiopathic scoliosis. Journal of Elementology 2009;14(2): 289-297.

MNiSW 6

My contribution: data interpretation, literature search, manuscript preparation.

I estimate my percentage contribution at 20%.

3. Kowalski I.M, Protasiewicz-Fałdowska H, Jóźwiak-Grabysa D, **Kiebzak W**, Zarzycki D, Lewandowski R, Szarek J. Environmental factors predisposing to pain syndromes among adolescent girls with diagnosed idiopathic scoliosis. Journal of Elementology 2010; 15(3): 517-530.

MNiSW 9; IF 0.354

My contribution: research project preparation, data interpretation, material preparation, literature search, manuscript preparation.

I estimate my percentage contribution at 15%.

4. Szarek J, Kowalski I.M, Wojtkiewicz J, Babińska I, **Kiebzak W**, Gesek M, Szweda M. Effect of a short term lateral electrical surface stimulation of paravertebral muscles on body mass and morphology of the adrenal glands in rabbits. Bull Vet Inst Pulawy 2010; 54 (4): 661-664.

MNiSW 20; IF 0.321

My contribution: data interpretation, material preparation, literature search, manuscript preparation.

I estimate my percentage contribution at 15%.

5. Zaborowska-Sapeta K, Kowalski I.M, Kotwicki T, Protasiewicz-Fałdowska H, **Kiebzak W.** Effectiveness of Chêneau brace treatment for idiopathic scoliosis: prospective study in 79 patients followed to skeletal maturity. Scoliosis 2011; 6:2 http://www.scoliosisjournal.com/content/6/1/2.

MNiSW 10

My contribution: concept preparation, data collection, literature search, manuscript preparation.

I estimate my percentage contribution at 20%.

6. Wojtkiewicz J, Kowalski I.M, Kmieć Z, Crayton R, Babińska I, Bladowski M, Szarek J, **Kiebzak**, Majewski M, Barczewska M, Grzegorzewski W, Kloc W. The effect of lateral electrical surface stimulation (LESS) on motor end-plates in an animal model of experimental scoliosis. Journal of Physiology and Pharmacology 2012; 63(3): 285-291.

MNiSW 25; IF 2.476

My contribution: data interpretation,material preparation, literature search, manuscript preparation.

I estimate my percentage contribution at 10%.

7. Walenda I, Trzcińska S, Kiljański M, **Kiebzak W**. Use of respiratory efficiency therapy in patients with idiopathic scoliosis. Fizjoterapia Polska 2013; 13(4): 6-11.

MNiSW 10

My contribution: research project preparation, data collection, data interpretation, literature preparation, manuscript preparation.

I estimate my percentage contribution at 30%.

8. Kowalski I.M, Protasiewicz-Fałdowska H, Dwornik M, Pierożyński B, Raistenskis J, **Kiebzak W.** Objective parallel-forms reliability assessment of 3 dimension real time body posture screening tests. BMC Pediatrics 2014; 14:221.

MNiSW 35; IF 1.930

Recommended on Pubadvanced by an Associate Research Scientist

My contribution: research project preparation, data collection, statistical analysis, data interpretation, literature search, manuscript preparation.

I estimate my percentage contribution at 70%.

9. Kowalski I.M, Dwornik M, Lewandowski R, Pierożyński B, Raistenskis J, Krzych Ł.J, **Kiebzak W.** Early detection of idiopathic scoliosis–analysis of three screening models. Archives of Medical Science Online publish date: 2015-01-14, 11:6.

MNiSW 25; IF 1.812

My contribution: research project preparation, data interpretation, literature search, manuscript preparation.

I estimate my percentage contribution at 70%.

10. Trzcińska S, **Kiebzak W**, Wiecheć M, Śliwiński Z. Comensation Mechanism in Treatment of Idiopathic Scoliosis with the FED Method–Preliminary Results. Fizjoterapia Polska 2017; 17(2): 6-14.

MNiSW 10

My contribution: research project preparation, data interpretation.

I estimate my percentage contribution at 25%.

11. **Kiebzak W**, Dwornik M, Kiljański M, Trzcińska S. Efficacy of FED therapy in grade 2 idiopathic scoliosis. Fizjoterapia Polska 2017; 17(2): 140-147.

MNiSW 10

My contribution; research project preparation, data collection, statistical analysis, data interpretation, manuscript preparation, literature preparation.

I estimate my percentage contribution at 55%.

12. Stępień A, Guzek K, Czubak J, Surowińska J, Stępowska J, **Kiebzak W.** Early childhood anomalies of the hip occur at a similar frequency in patients with idiopathic scoliosis and in healthy individuals – questionnaire for parents, Postępy Rehabilitacji 2017; 31(4): 5-18.

MNiSW 8

My contribution: editing the final version.

I estimate my percentage contribution at 15%.

5.1.4. The effects of using neurokinesiological concept of treatment

In the proper course of the first year of an individual's life an important transformation takes place. An infant modifies psychomotor behaviour in a genetically planned development process, defying the force of gravity. The behaviour of a newborn dependent on the environment changes to behaviours enabling independent acquiring experience and implementation of planned activities. At that time, the infant's apedal stage of development gradually transforms into a vertical position typical of an adult, enabling exploration of the environment in the most ergonomic way for the osteoarticular system. The efficiency of this system depends, i.a. on the distribution of muscle tone, and thus depends in this sense on the neuromuscular control of the central nervous system (cns) [2]. The cns maturation process has a significant impact on psychomotor development. There are many factors which affect the child's development in the early stages of pre-, perinatal and postnatal life, but some of these factors pose a potential threat to the developing cns [3].

Thus, the course of the discussed process may be limited or blocked. The exemplification of these difficulties may be the persistence of activity in low positions or the incomplete development of psychomotor performance as a result of cns damage. The aforementioned damage appears most often as a complication of different traumatizing factors occurring individually or combining in various ways. The course of the improvement process and its effects depend on the degree of maturity of the cns, which is conditioned by the birth weight and fetal age. The most vivid difference in the pace and quality of changes in fitneess is seen in the comparison of a group of mature children born full term with a group of premature-dystrophic children with a birthweight below 1,500 grams [2].

Early recognition of significant disorders of spontaneous psychomotor activity, Vojta's body posture response and primary reflexes in infants in the first months of life, as well as early launch of improvement therapy lead to the expected effects of improving the condition of children with central coordination disorders [2]. In assessing therapeutic effects of CCD,

visible improvement of neurological reflexes and social contacts precedes and conditions the improvement of postural reactions according to Vojta and the child's spontaneous motor activity. Accurate monitoring of these processes is possible using T_1 scale [6]. Examination was conducted in 198 at-risk children diagnosed with Central Coordination Disorders (CCD), diagnosed with the Vojta method. This examination makes the empirical grounds on the basis of which one can calculate the level of risk in the development of cerebral palsy (CP). It concerned a retrospective assessment of the impact of anamnestic and symptomatic risk factors on the child's development. The aim of this experiment can be expressed in the form of the following two questions: 1) Which of the risk factors – anamnestic or symptomatic – indicates CP development? and 2) Which elements of the examination are the most important in forecasting CCD? Analysis of the results suggests that single anamnestic risk factors do not correlate with the incidence of cerebral palsy. It is symptomatic factors that play an especially important role in the diagnosis and prognosis of psychomotor development disorders. Symptomatic indicators, that is primary reflexes in neurological examination were the most important [3].

One of more common congenital defects in children with CCD is developmental hip dysplasia causing functional and structural disorders. Such circumstances especially require the optimization of therapeutic effects and the maximum shortening of the duration of therapy. The diagnosis of congenital hip dysplasia should be made by a physiotherapist who, in addition to an orthopedist, a neurologist and a pediatrician, will examine the child's neuromuscular coordination. Muscle tone disorders could be the main cause of hip joint dysfunction. Thus, neurokinesiological therapy of developmental disorders of the hip should include the application of Vojta global motor patterns. It should be emphasized that children with congenital hip dysplasia should commence physiotherapy as early as possible. The above assumptions enable radical shortening of the time of achieving a good result of therapy [1, 7].

Damage to the central nervous system in early life causes both quantitative and qualitative disorders of psychomotor development. Late consequences of these complications could include visual impairment disorders which not only affect the ability to read and write, but also generally affect the child's intellectual development. The aim of the study was to determine whether central coordination disorder (CCD) in early life treated with the Vojta method with elements of SI and NDT Bobath methods influence the development of visual perception later in life. 44 subjects aged 15-16 participated in the study. In this group there were 19 individuals diagnosed with medium and severe CCD in the neonatal period, as a complication of encephalopathy and 25 healthy individuals without developmental psychomotor disorders in the neonatal period. The test tool was the 14+ test with visual perception including 96 graphic tasks. The results of the test indicate that youth with a history of CCD in the neonatal period did not differ in terms of the level of visual perception from their peers who did not show psychomotor development disorders in the neonatal period. Thus, early treatment of children with CCD gives the opportunity to normalize their psychomotor development early enough to prevent the consequences in the form of visual perception disorders later in life [4].

Over the last 20 years, in cooperation with the centres in Olsztyn, Katowice and Vilnius, I have been observing the use of a combination of therapeutic methods, including the Vojta method in the treatment of various disorders of motor organs with a neuromotor basis. These are therapeutic solutions similar to the ones which are used in CCD therapy. The basis for these solutions is the team work of many medical specialties, earliness of activities, and the use of neurophysiological methods of therapy. Especially bright and beneficial results can be achieved in severe craniocerebral injuries. Therefore,

skilful physiotherapeutic actions play an important role in restoring the cognitive and emotional functions and in achieving the optimum level of psychomotor efficiency [5]. A common feature of these activities is the assessment and stimulation of the physiological spine extension.

Bibliography according to the order of publication dates.

1. **Kiebzak W**, Szmigiel Cz. Application of Vojta's neurophysiological method in the treatment of hip dysplasia. Postępy Rehabilitacji 1999; 13(4): 47-51.

KBN 2

My contribution: concept preparation, data collection, material preparation, literature search, manuscript preparation.

I estimate my percentage contribution at 70%.

2. **Kiebzak W**, Szmigiel Cz, Błaszczyk B. Monitoring the process of rehabilitation in children with disorders of central coordination, Fizjoterapia Polska 2003; 3(3): 243-249.

KBN 2

My contribution: research project preparation, data collection, data interpretation, statistical analysis, material preparation, literature search, manuscript preparation.

I estimate my percentage contribution at 70%.

3. **Kiebzak W**, Szmigiel Cz, Kowalski I.M, Śliwiński Z. The importance of risk factors in the assessment of psychomotor development disorders in infants in the first year of life, Postępy Rehabilitacji 2008; 22(4): 29-33.

MNiSW 4

My contribution: research project preparation, data collection, data interpretation, statistical analysis, material preparation, literature review, manuscript preparation.

I estimate my percentage contribution at 70%.

4. **Kiebzak W**, Kowalski I.M, Domagalska M, Szopa A, Dwornik M, Kujawa J, Stępień A, Śliwiński Z. Assessment of visual perception in adolescents with a history of central coordination disorder in early life – 15 year follow-up study, Archives of Medical Science 2012;8(5): 879-885.

MNiSW 25; IF 1.067

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My contribution: research project preparation, data collection, data interpretation, statistical analysis, material preparation, literature search, manuscript preparation.

I estimate my percentage contribution at 75%.

5. **Kiebzak W**, Wysocka A, Żurawski A, Kiljański M, Justyna Pogorzelska J. Application of the Polysensory Stimulation and the General Movement Patterns in Patients with the Serious Traumatic Brain Injury. Fizjoterapia Polska 2015; 15(2): 6-20.

MNiSW 10

My contribution: research project preparation, data collection, data interpretation, manuscript preparation.

I estimate my percentage contribution at 70%.

6. **Kiebzak W**, Kosztołowicz M, Zaborowska-Sapeta K, Kiebzak M, Dwornik M. Application of T1 scale in evaluating effects of long-term therapy, Pol.Ann.Med., 2016; 23(2): 118-122.

MNiSW 14

Recommended by International Journal of Clinical Medicine Research, American Journal of Clinical and Experimental Medicine and American Journal of Internal Medicine

My contribution: concept preparation, data collection, data interpretation, statistical analysis, material preparation, literature search, manuscript preparation.

I estimate my percentage contribution at 60%.

7. **Kiebzak W**, Żurawski A, Dwornik M. Vojta method in the treatment of developmental hip dysplasia – a case report. Therapeutics and Clinical Risk Management 2016; 12:1271–1276.

MNiSW 20; IF 2.200

My contribution: concept preparation, data collection, data interpretation, literature search, manuscript preparation.

I estimate my percentage contribution at 80%.

5.1.5. Book publication

Progress in medicine in recent years has been visible, mainly due to the development of modern diagnostics and treatment methods. The achieved and constantly improving level of patient care enables optimizing the dynamics of children's development, including effective rescuing them from critical disease conditions. These conditions are often life threatening as a result of failure of basic vital functions, mainly respiration, circulation and central nervous system functions. In this situation, many children overcome critical life threatening states, which in the past did not give them a chance to survive. It is obvious that this group of children requires permanent medical and rehabilitation care. Suffice it to mention that in Poland, 800-1,200 babies with cerebral palsy are born every year, slightly fewer children with meningomyelocele. The number of children after craniocerebral trauma is also increasing. In developmental medicine, a health issue requiring rehabilitation is also generated by the children with low birth weight and shortened age of fetal life, whose number reaches up to 8% of the general live-birth population. Thus, the number of children with disabilities is not small and it should be assumed that it will continue growing, and with it, the need for the development of rehabilitation, pediatric physiotherapy.

A two-volume publication (volume I, 341 pages, volume II, 283 pages, II edition) is devoted to the description of selected developmental age diseases and early diagnosis of disability in children, including disorders of psychomotor development, using neurophysiological diagnostic methods. Early diagnostics of disabled children is closely related to the implementation of early rehabilitation and physiotherapy. In the publication, diagnostic methods and improvement of high-risk children based on neuromotor development are broadly discussed.

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Volume I

1. Children and youth with disabilities; 2. Physical development of the child and his/ her disorders; 3. Psychomotor development of a small child and his/ her disorders; 4. A high-

risk pregnancy, a high-risk infant and risk factors; 5. Basics of diagnosis and sensory integration therapy; 6. Disorders of the body build and posture in children; 7. Disorders of motor development of a child in nervous system diseases.

Volume II

8. Neurophysiological methods of motor improvement of high-risk children with cerebral palsy; 9. Selected neuromuscular diseases as a reason for motor development in children 10. The specificity of osteoarticular injuries in developmental age; 11. Motor organs diseases of developmental age; 12. Respiratory diseases in children and respiratory rehabilitation; 13. Rheumatic diseases of developmental age and rehabilitation proceedings – selected issues; 14. Glossary of specialized medical and rehabilitation terms

Review of the publication "Fundamentals of diagnosis and rehabilitation of children and young people" edited by Czesław Szmigiel and Wojciech Kiebzak

Irena Norska-Borówka emeryt. prof. zw. dr hab. n. med. Medical University of Silesia in Katowice, paediatric diseases and neonatology specialist. Antropomotoryka 2011; 21(53):123-124.

"The book reviewed by me presents an example of modern cooperation and integration of many specializations falling within the scope of diagnostics and therapy of congenital and acquired disorders in children and youth with disabilities. The greatest value of this book is the knowledge and experience of its Editors, which led to the inclusion of the main issues from both medical and rehabilitation points of view."

Szmigiel Cz. i **Kiebzak W.** Fundamentals of diagnosis and rehabilitation of children and young people Volume I and II, II edition AWF Kraków; 2010.

MNiSW 25

My contribution: concept preparation, data collection, data interpretation, material preparation, co-operation with the co-authors, literature preparation, manuscript preparation.

I estimate my percentage contribution at 50%.

5.2. Reviewing publications in international and national journals

- As a reviewer, I have reviewed 54 scientific articles, including 34 reviews for Fizjoterapia Polska (acknowledgements from the Editor-in-Chief of Fizjoterapia Polska for many years of work for the quarterly on the occasion of the 15th anniversary of the journal), 10 reviews for Polish Annals of Medicine (Certificate of *Excellence in Reviewing* / Outstanding Reviewer Status, 2016 ELSEVIER. Amsterdam), 6 reviews for Studia Medyczne, 2 reviews for Rehabilitacja Medyczna, 1 review for Postępy Rehabilitacji, 1 review for the American Journal of Case Reports (acknowledgements for my contribution to the American Journal of Case Reports) and 1 editor's review of the book: Methodology guide to selected physical procedures, 2nd edition. Aleksandra Bauer, Marek Wiecheć; Markmed – Rehabilitacja s.c. 2015.
- As an Executive Editor of the Polish Annals of Medicine, I have conducted the editorial proceedings of 10 scientific papers.

5.3. Participation in scientific congresses and rehabilitation trade fairs

1. Presentation of papers at international and national thematic conferences:58 – as the first author.
2. Active participation in international and national scientific conferences: 59 – as co-author.
3. Participation in the organizational committees of international and national scientific conferences: 21, including 9 as the chairman of the organizing committee and 1 as the organizer.
4. Moderator of scientific sessions: 42.
5. A member of the scientific committee: 39.
6. Participation in the works of the REHMED Trade Fair Competition Commission: 9, including 4 as the chairman of the commission.

5.4. Internships in foreign and national scientific or academic centers

1. The Children's Hospital, Affiliate of Vilnius University Hospital Santariskiu Klinikos, is located at numbers 4 and 7 Santariskiu Street, Vilnius, 12.05–18.05.2013, clinical-scientific internship.
2. The Children's Hospital, Affiliate of Vilnius University Hospital Santariskiu Klinikos, is located at numbers 4 and 7 Santariskiu Street, Vilnius, 29.06–15.07.2015, clinical-scientific internship.

5.5. Managing international and national research projects and involvement in such projects

1. Assessment of the level of met-enkephalin in blood plasma after systemic cryostimulation in patients of the Rehabilitation Department of Independent Public Health Care Facility (SP ZOZ) in Zgorzelec, project symbol 077S, 2009–2012, Ministerstwo Nauki i Szkolnictwa Wyższego, team member.
2. Contemporary trends in physiotherapy in the field of professional preparation, physioprophylaxis and the use of combined physiotherapy methods in multi-organ dysfunctions, project symbol 615503.00, 2013–2015, Ministerstwo Nauki i Szkolnictwa Wyższego, team member.
3. The state of health and nutritional status of pregnant women and the level of somatic development and the state of health of newborns, project symbol, 615523.00, 2014–2015, Ministerstwo Nauki i Szkolnictwa Wyższego, team member.
4. Distant assessment of central coordination disorders in children, project symbol, 615538.00, 2015–2017, Ministerstwo Nauki i Szkolnictwa Wyższego, team member.
5. Distant assessment of central coordination disorders in children, project symbol, 615538.00, 2015–2017, Ministerstwo Nauki i Szkolnictwa Wyższego, team member.
6. The significance of reflex control of the body axis position in shaping the sitting posture, project symbol, 615555.00, 2017–2017, Ministerstwo Nauki i Szkolnictwa Wyższego, project manager.

5.6. Awards

In 2008, 2012, 2015, I received the Individual III degree award of Rector of Jan Kochanowski University.

In 2015, I was awarded with the Medal of the National Education Commission and the distinction: Outstanding Academic Teacher, Scientific Leader of the Jan Kochanowski University, for very good scientific accomplishments.

Additionally, I received successively: The Bronze Cross of Merit – 2005, PSP Golden Badge-2007, Co-author of Our Success award Targi Kielce 2010), the title of the PSP Honorary Member – 2011, The Ministry of Health and Social Care 'For Outstanding Service in Health Care' award – 2012, Purple Heart award from Polish Society to Combat Disability – 2014, the Golden Badge TWK 2/III/2015 – 2015, the Golden Badge TWK 65/2018 – 2018.

Signature

Kielce, 15th August, 2018

Wojciech Kiebzak