

fizjoterapia polska

POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 3/2023 (23) KWARTALNIK ISSN 1642-0136



**Występowanie
zaburzeń w obrębie stawów skroniowo-
żuchwowych podczas zarażenia COVID-19**
**The occurrence of temporomandibular
joint disorders during COVID-19
infection**

Possibilities of physiotherapeutic treatment in the case of patients with pusher syndrome

Możliwości postępowania fizjoterapeutycznego u pacjentów z zespołem odpychania

ZAMÓW PRENUMERATĘ!

SUBSCRIBE!

www.fizjoterapiapolska.pl

www.djstudio.shop.pl

prenumerata@fizjoterapiapolska.pl





MATIO sp. z o.o.

to sprawdzony od 7 lat dystrybutor
urządzeń do drenażu dróg oddechowych
amerykańskiej firmy Hillrom

Hill-Rom.

The
Vest
Airway Clearance System

model 205



MetaNeb™



sprzęt medyczny do drenażu i nebulizacji dla pacjentów w warunkach szpitalnych
– ze sprzętu w Polsce korzysta wiele oddziałów rehabilitacji i OIOM

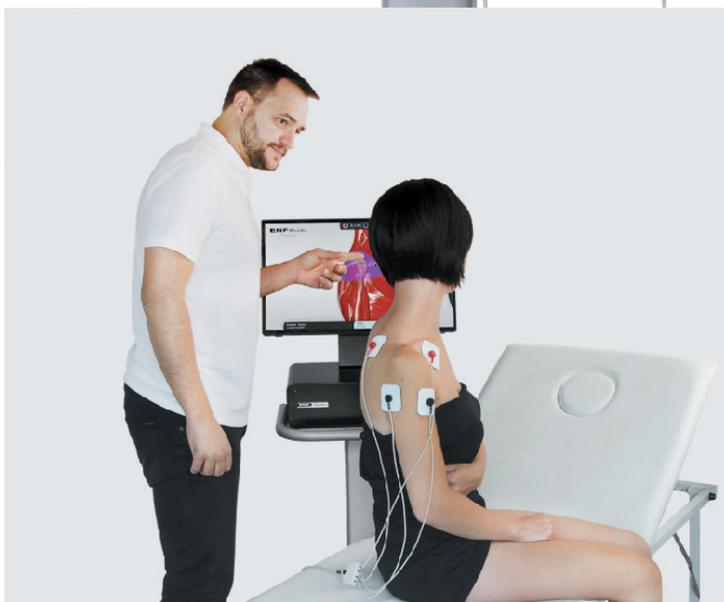
MATIO sp. z o.o., ul. Celna 6, 30-507 Kraków, tel./fax (+4812) 296 41 47,
tel. kom. 511 832 040, e-mail: matio_med@mukowiscydoza.pl, www.matio-med.pl

Terapia ENF

Kompleksowy system oceny i fizjoterapii

- autoadaptacyjna fizjoterapia
- obiektywna ocena stanu tkanek
- biofeedback w czasie rzeczywistym
- gotowe protokoły terapeutyczne
- wszechstronne zastosowanie
- anatomia 3D
- mapy 3D

www.enf-terapia.pl



Aktualna i praktyczna wiedza!



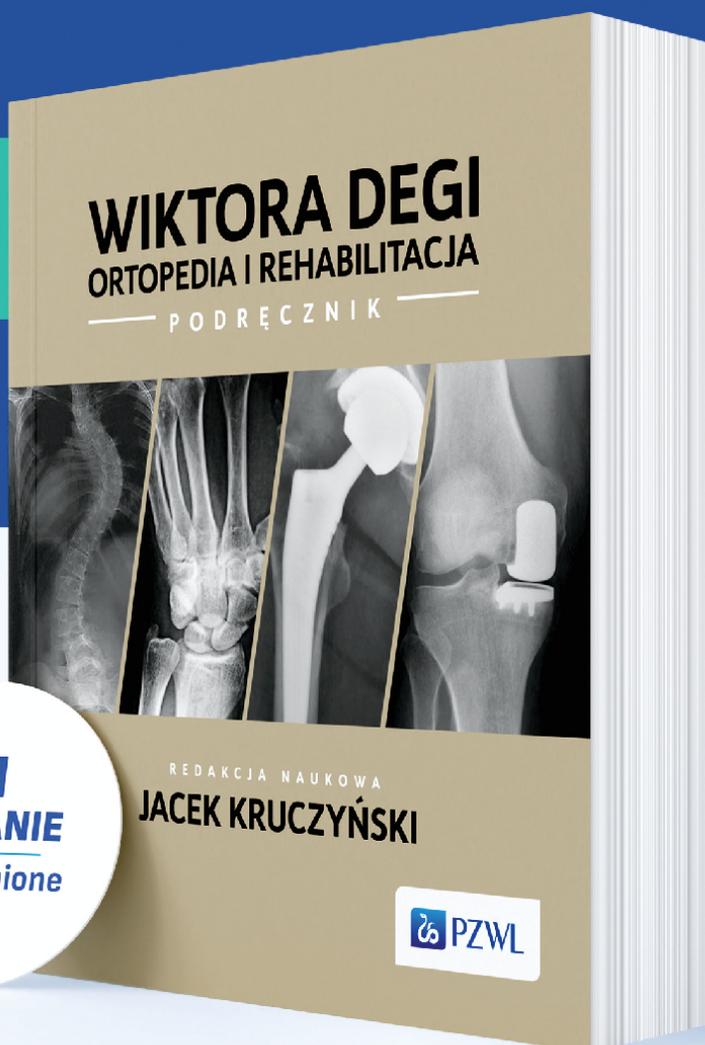
ponad
800 rycin
i 1 tys. stron

dotatkowe
materiały
multimedialne



szukaj na pzwl.pl

III
WYDANIE
uaktualnione



**POBIERZ
DARMOWY E-BOOK**
od PZWL w prezencie!



fizjoterapia polska



sklep internetowy:
www.djstudio.shop.pl

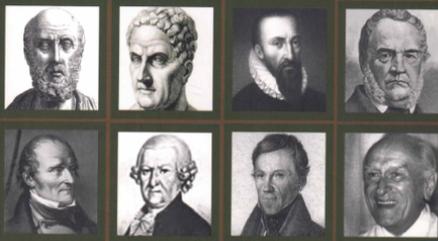
w sklepie dostępne między innymi:

- archiwalne numery *Fizjoterapii Polskiej* w wersji papierowej
- artykuły w wersji elektronicznej
- książki poświęcone fizjoterapii
- prenumerata *Fizjoterapii Polskiej*

PATRONAT MERYTORYCZNY
Komitet Rehabilitacji, Kultury Fizycznej
i Integracji Społecznej PAN

Sławomir JANDZIŚ, Mariusz MIGAŁA

Rys historyczny rozwoju rehabilitacji w Polsce i na świecie



Opole 2015



Międzynarodowy Dzień Inwalidy
„Życie bez bólu” (1991–2019)

Who's Who in the World in Physiotherapy

pod redakcją
Zbigniewa Śliwińskiego i Grzegorza Śliwińskiego
przy współpracy
Zofii Śliwińskiej i Lecha Karbowskiego

fizjoterapia polska

POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII
REHABILITACJI, KULTURY FIZYCZNEJ I INTEGRACJI SPOŁECZNEJ PAN

NR 3(202) (79) KWARTAŁ III 2015 146-151

Physiotherapeutic procedure in a patient after the first artificial heart implantation in Poland – SynCardia Total Artificial Heart (TAH)



Postępowanie
fizjoterapeutyczne
u pacjenta po pierwszej
w Polsce implantacji
sztucznego serca – SynCardia
Total Artificial Heart
(TAH)

The effect of hippotherapy on children with autism – physical and psychological factors
Wpływ hipoterapii na wybrane czynniki fizyczne i psychologiczne u dzieci z autyzmem

ZAMÓW PRENUMERATĘ!
SUBSCRIBE!

www.fizjoterapiapolska.pl
prenumerata@fizjoterapiapolska.pl



Rabat 15% na pojedyncze artykuły w j. polskim z czasopisma Fizjoterapia Polska w sklepie DJ Studio



djstudio.shop.pl
15% z kodem
FP3-2023-ART
do 30 września 2023



Rok założenia firmy 1996
www.butterfly-mag.com
tel. 85 743 22 21
kom. 603 299 035



BIOMAGNETOTERAPIA W WYROBACH MEDYCZNYCH „ORT BUTTERFLY”

- BEZ BÓLU, STRESU I BEZ TABLETEK!
- LECZYSZ SIĘ NATURALNIE
- ŚPIĄC, PRACUJĄC, WYPOCZYWAJĄC...
- USUWASZ BÓL I JEGO PRZYCZYNĘ!
- TERAPIA STARA JAK ŚWIAT!
- SPRAWDZA SIĘ I DAJE RADĘ W NIERÓWNEJ WALCE Z PANDEMIĄ – COVID 19!

REGULARNA BIOSTYMULACJA MAGNETYCZNA!

Ogromny potencjał Natury w zwalczaniu smogu energetycznego i autooksydacji, będącej główną przyczyną wszystkich chorób cywilizacyjnych!

Najstarsza Terapia Świata wspomagająca każdą formę leczenia!

Uważa się do dziś, że bez niej nie da się wyleczyć żadnej choroby do końca!

Naturalna Terapia Magnetyczna Twoje Zdrowie, Twoja Uroda, Odporność i Sprawność do późnej starości! **Wypróbuj** – gdy zawiodły już inne terapie!



Biomagnetoterapia inicjuje ożywienie komórkowe, oczyszcza i „odmładza” krew, podnosząc vitalność całego organizmu, który uruchamia intuicyjne procesy obronne, znosząc dyskomfort powodowany bólem, urazem lub stresem, bez konieczności ostrej dawki leków chemicznych...



DLACZEGO CHORUJEMY?

Natężenie sztucznych pól elektromagnetycznych zwiększyło się 100 tys. razy! Naturalne pole magnetyczne Ziemi zmniejszyło swą moc o połowę!



BIOMAGNETYZM - jako antidotum; jedyne i absolutne; na cancerogenną ekspansję „smogu energetycznego”

ZŁOTE LOGO Międzynarodowych Targów Rehabilitacja Łódź IX/2007



Jestem osobistym królikiem doświadczalnym! I żyję – realizując 25 lat wciąż nowe i śmielsze pomysły w wykorzystaniu tej boskiej energii naturalnych magnesów! Dzięki nim pokonuję dziś niezliczone przeszkody i przeciwności losu z nieznaną mi przedtem energią i determinacją! To moja pasja! I przeznaczenie!

Najnowsza opinia klienta:

Komentarz ten jest moim osobistym świadectwem zadowolenia z produktów biomagnetycznych „Ort Butterfly”, których używam od 20. lat! Zastanawiam się, zwłaszcza nad fenomenem poduszki (określenie nie jest przypadkowe) zwyczajnie; nie wyobrażam sobie snu i wypoczynku bez magnetycznej „Ort Butterfly” – pod głową! Jej ergonomiczny, przyjazny dla głowy i szyi kształt sprawia, że wysypiam się „po królewsku”. Zabieram ją również ze sobą w bliższe i dalsze podróże! Czyż gdyby była to zwyczajna poduszka, fundowałbym sobie dodatkowy bagaż? Wychwalam więc ją od zarania, polecam i rekomenduję, bo jest tego warta! Bez niej nie wyobrażam sobie prawdziwie relaksacyjnego snu i błogiego, kojącego wypoczynku! Dziękuję, że ją Pani stworzyła!

J. Szew. Działdowo (maj 2020)

PS Poduszki „Ort Butterfly” to prawdziwe arcydziełka robione z wyczuciem i sercem... jak rzeźby Michała Anioła... Polecam wszystkim!

ŚRODKIEM DO CELU

- pewność że dziecko jest nakarmione
- więcej czasu na wspólną zabawę z dzieckiem
- szansa na lepsze efekty rehabilitacji

Jeśli występują problemy z żywieniem (np. problemy z motoryką jamy ustnej, konieczność modyfikacji konsystencji diety, ograniczony apetyt), skonsultuj się z naszym Ekspertem.

Skontaktuj się z naszym Ekspertem i dowiedz się więcej na temat:

- konsekwencji wynikających z niedożywienia
- wskazań do żywienia dojelitowego
- dokumentów niezbędnych do rejestracji w poradni żywieniowej
- dokarmiania przez zgłębnik
- najbliższej poradni żywieniowej

Mgr Iwona Widera

Specjalista pielęgniarstwa psychiatrycznego.
Ekspert do spraw żywienia dojelitowego dzieci
oraz osób dorosłych.

Zadzwoń: 698-945-066



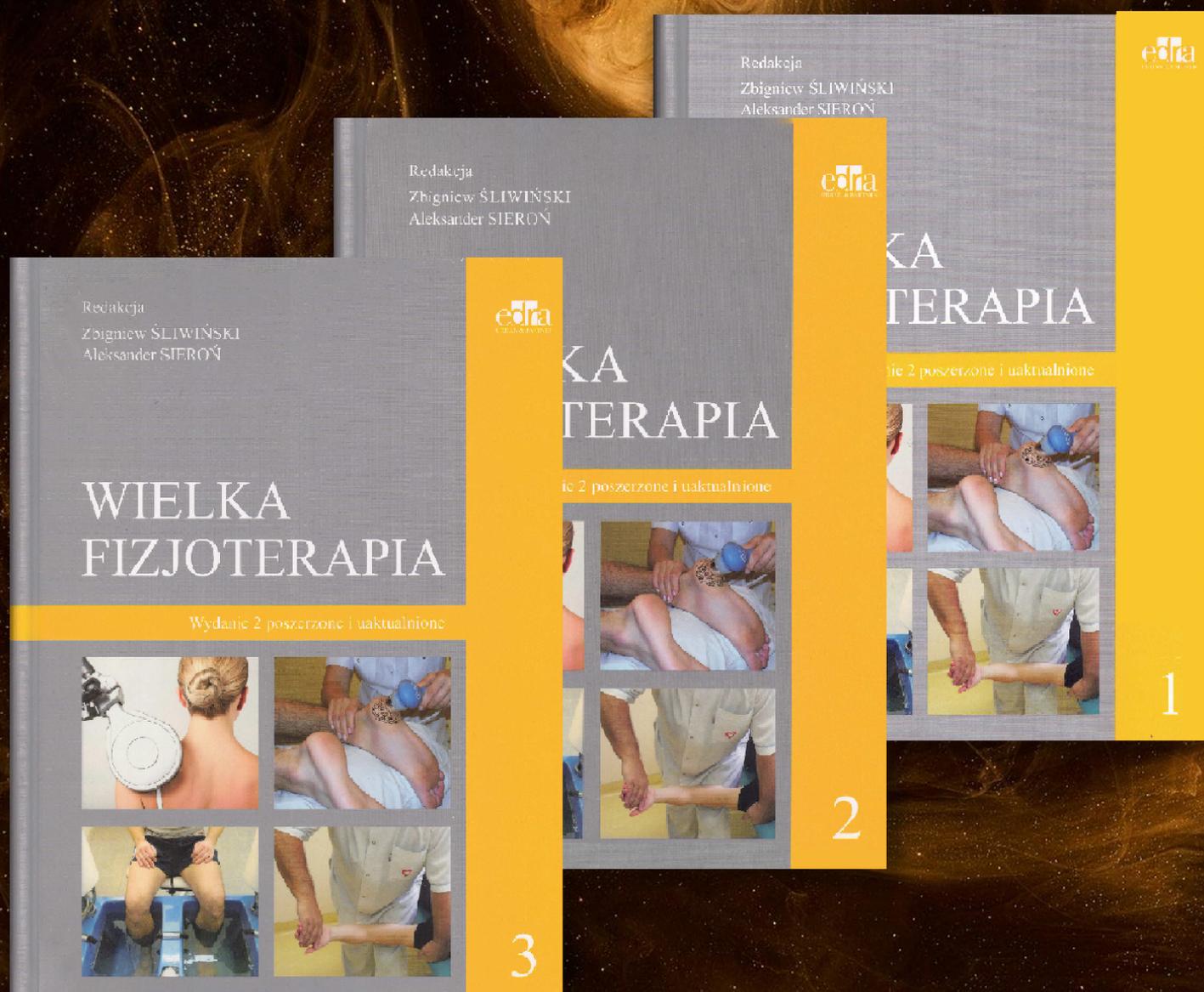
- Szczegółowa lista poradni żywieniowych, realizujących świadczenie żywienia dojelitowego w warunkach domowych na stronie: www.pelnaporcjaopieki.pl



WAŻNE:
Świadczenie
objęte pełną
refundacją NFZ



RABAT NA WSZYSTKIE KSIĄŻKI WYDAWNICTWA EDRA URBAN & PARTNER W KSIĘGARNI DJ STUDIO



w tym:

Wielka Fizjoterapia tomy 1-3
djstudio.shop.pl

10% z kodem FP-3-23-EDRA
do 30 września 2023



zabezpiecz się przed potencjalnymi **roszczeniami** **pacjentów**

program ubezpieczeń dla fizjoterapeutów
pod patronatem PTF

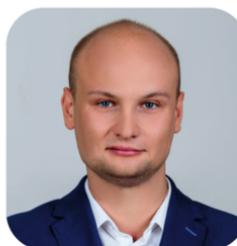
dla kogo?

Zarówno dla fizjoterapeutów prowadzących własną działalność w formie praktyki zawodowej, podmiotu leczniczego jak również tych, którzy wykonują zawód wyłącznie na podstawie umowy o pracę lub umowy zlecenie.

co obejmuje program ubezpieczeń?

- igłoterapie
- zabiegi manualne (mobilizacje i manipulacje)
- leczenie osteopatyczne
- naruszenie praw pacjenta i szkody w mieniu pacjentów

oraz szereg innych rozszerzeń ukierunkowanych na zawód fizjoterapeuty



kontakt w sprawie ubezpieczeń:

Piotr Gnat

+48 663 480 698

piotr.gnat@mentor.pl

[linkedin.com/in/piotrgnat](https://www.linkedin.com/in/piotrgnat)

ubezpiecz się **on-line** na **PTFubezpieczenia.pl**

Possibilities of physiotherapeutic treatment in the case of patients with pusher syndrome

Możliwości postępowania fizjoterapeutycznego u pacjentów z zespołem odpychania

Agnieszka Drozd^{1(E,F)}, Maja Nowacka-Kłos^{1(E,F)}, Rita Hansdorfer-Korzon^{1(G)}

Zakład Fizjoterapii Gdańskiego Uniwersytetu Medycznego, Gdańsk / Department of Physiotherapy, Gdańsk Medical University, Gdańsk, Poland

Abstract

The consequences of damage to brain structures often includes various types of perceptual and motor disorders. One of them is Pusher Syndrome (PS). It is defined as a disturbance in the perception of the body position in the frontal plane, which in turn makes it difficult to maintain a correct vertical posture. It occurs most often in patients after a stroke of the right hemisphere of the brain, in the posterolateral region of the thalamus, and its frequency is estimated at about 9–50%. However, it is still a little-known syndrome and too rarely diagnosed. Correct, early diagnosis of pusher syndrome and the introduction of appropriate physiotherapy allows us to shorten the patient's rehabilitation time and speed up his/her recovery. The objective of the study is to present the principles and possibilities of therapy for patients with pusher syndrome.

Key words:

pusher syndrome, diagnosis, principles of therapy, physiotherapy

Streszczenie

Następstwem uszkodzenia struktur mózgu często są różnego typu zaburzenia percepcyjno-motoryczne. Jednym z nich jest zespół odpychania (ang. *Pusher Syndrome*, PS). Jest on definiowany jako zaburzenie postrzegania pozycji ciała w płaszczyźnie czołowej, co w konsekwencji utrudnia utrzymanie prawidłowej pionowej postawy. Występuje najczęściej u osób po udarze prawej półkuli mózgu, w tylnobocznej okolicy wzgórza, a jego częstotliwość szacuje się na około 9–50%. Jest to jednak wciąż mało poznany syndrom i zbyt rzadko diagnozowany. Prawidłowe, wczesne rozpoznanie zespołu pushera oraz wprowadzenie odpowiedniej fizjoterapii pozwala skrócić czas rehabilitacji pacjenta i przyspieszyć jego powrót do sprawności. Celem pracy jest przedstawienie zasad i możliwości terapii osób z zespołem odpychania.

Słowa kluczowe:

zespół pushera, rozpoznanie, zasady terapii, fizjoterapia

Introduction

Pusher Syndrome (PS) is a cognitive-motor disorder that can occur in people suffering from brain damage. The name “Pusher Syndrome” was first used in 1985 by P. Davies, who described her patients in her book “Steps to Follow”. The syndrome is also defined as Pusher Behaviour (PB), Contraversive Pusher Syndrome or Ipsilateral Pushing [1–3].

Characteristics and epidemiology of pusher syndrome

The basic symptom of PS is active pushing of the patient with paresis with the indirectly affected side from the ground, in a vertical position (mainly sitting and standing, but also lying or walking), which results in tilting to the directly affected side and asymmetric body posture in the frontal plane. This occurs as a result of damage to the brain structures, causing the patient’s perception of the vertical position in relation to gravity to be distorted – the patient feels that he/she is vertical, but in fact he/she is tilted (usually by about 18–20°, in exceptional cases up to 35°) opposite to the damaged hemisphere. This results in active pushing with the apparently healthy side (upper and/or lower limb) to “keep the upright position”. The patient does not feel fear of falling, and reacts to attempts of correction from the outside with active resistance [1–6].

Symptoms of pusher syndrome occur independently of weakened muscle strength, sensory or coordination disorders. They are not identical to the symptoms of hemiparesis, especially in the first stage after a vascular incident when the patient has reduced strength and muscle tone, and in vertical positions (sitting, standing) the patient leans towards the paresis. A typical patient with paresis is aware of the loss of balance and tries to prevent it – he/she shifts his/her body weight to the side that is not paralyzed or grabs the side of the bed with his/her healthy hand so as not to fall over (pulls towards the side that is indirectly affected, and does not push away from it – Fig. 1a–b) [1, 2].



Fig. 1a,b. A patient with left-sided paresis without pusher syndrome

Vision or labyrinth disorders are excluded in PS patients. Despite problems with determining the vertical position of their body, such patients are able to determine the position of surrounding objects in relation to themselves by sight; they are also usually able to keep their head upright, even though their torso is significantly tilted [1–4, 7].

PS often occurs simultaneously with hemineglect syndrome; it is estimated to occur in 80% of PS cases [2, 8]. It may also coexist with aphasia, apraxia or anosognosia. All these disorders make it even more difficult to conduct effective therapy of patients with pusher syndrome [2].

In a study of 169 stroke patients, it was found that of those who had pusher syndrome but no other disorders (motor, proprioceptive, visuospatial or hemianopia), 90% recovered; while among those with additional disorders, especially when the stroke affected the right hemisphere, only 37% to 59% recovered [9].

The reasons for the formation of PS are still not fully understood. There are different views on this subject. The vertical position is possible thanks to signals coming from many sources, mainly vestibular, visual and proprioceptive. Their proper operation (reception and processing of stimuli) determines the acquisition of necessary information and the appropriate positioning of the body in space. Therefore, damage to any of these elements leads to posture disorders and loss of control over balance [2]. One theory to explain pusher syndrome is that it results from a conflict between the optic nerve intact despite brain damage and damaged vertical sensory perception. Another theory is that PS is a high-level disruption of processing sensory information from the affected body part. Research is still underway to explain it [1, 7, 10].

Most of the observed cases of PS are associated with stroke, but it has also been observed (< 1% of patients) in patients after craniocerebral trauma and after treatment of a brain tumour [3, 11]. The incidence of this syndrome in stroke survivors varies greatly according to different sources; it has been shown that it can affect from 9% to 43%, and even 63% of patients (after a severe stroke). Its incidence decreases over time - after 3 months it is observed in about 21% of patients [12–15]. PS occurs with damage to both the right and left hemispheres, but more often affects the right hemisphere – 65% of cases [8]. It usually occurs when the stroke affects the posterior part of the thalamus; it is associated with other areas, such as the posterior part of the insula, internal capsule or germinal gyrus less frequently [3, 4, 10, 11].

Symptoms associated with PS have a significant impact on the daily functioning of the patient and on the effects of therapy, therefore, the earliest possible diagnosis and properly selected targeted treatment has a significant influence on treatment progress. Failure to diagnose the syndrome or incorrect therapy may delay the rehabilitation process by 3 weeks, and even up to 2–3 months [1, 7, 12, 13, 15, 16, 17]. The extension of the rehabilitation period in patients with PS takes place regardless of the damaged hemisphere and gender; however, age and additional disor-

ders (e.g. poor physical fitness) may worsen the prognosis [5, 13, 18]. In an analysis that included more than 1,000 stroke survivors with symptoms of PS (1/3 of these patients also had symptoms of hemineglect), it was found that minor symptoms resolved after treatment in 69.4% of patients; moderate symptoms – in 49.3%, and severe symptoms – in 18.8% [13]. Another study, involving nearly 150 people, showed that after the end of therapy, PS was still observed in about half of the patients, regardless of the side of the stroke [18].

Diagnostics of pusher syndrome

Correct diagnosis of PS constitutes the basis for planning appropriate and effective therapy. In addition to the standard physiotherapeutic examination, including medical history, physical examination and functional examination, specific scales are used when PS is suspected. The most frequently used is the Scale for Contraversive Pushing (SCP) (Table 1), less frequently the Modified SCP and the Burke Lateropulsion Scale (BLC) [1, 2 11, 12, 16, 19, 20]. The conducted research confirms credibility and validity of the SCP scale [21, 22]. Recent analyses indicate that the Four-Point Pusher Score (4PPS) [13], which is reliable and comparable to the SCP scale [12], is also worth recommending.

Table 1. Scale for contraversive pushing (SCP) – examination form [11]

Scale of clinical symptoms in pusher syndrome (SCP)	Patient:			
	Sitting position		Standing position	
	Before therapy	After therapy	Before therapy	After therapy
<ul style="list-style-type: none"> • A. Spontaneous body position • 1 point = extreme to the side until falling • 0.75 point = extreme tilt but no fall • 0.25 point = slight lateral tilt without fear of falling • 0 point = sitting symmetrically 				
<ul style="list-style-type: none"> • B. Use of the non-affected limb • 1 point = sits and immediately pushes with the limb • 0.5 point = starts pushing when active • 0 point = does nothing with the limb 				
<ul style="list-style-type: none"> • C. Passive correction • 1 point = when corrected passively starts to push • 0 point = can be passively corrected • 				
Total A + B + C				

If the score of A + B + C is at least 2 points, pusher syndrome is diagnosed

In addition to the classic image of a PS patient with body orientation disorder in the frontal plane (lateral/contralateral pusher syndrome), symptoms of pushing in other directions can be observed – in the sagittal plane

(posterior pusher syndrome), when the patient pushes away from the front support plane and tilts back or, in the frontal-sagittal plane (posterolateral pusher syndrome) – when the patient tilts back and to the side of the affected side. In the case of these syndromes, the above scales can also be used to evaluate patients, with modification of the directions in which the patient is pushing [7, 23–25].

Pusher syndrome can be diagnosed not only in the acute period after the onset of the disease, but also in the chronic period. The syndrome can be suspected if therapy has been conducted for a long time, the patient has normal muscle strength, is properly motivated and has no coordination disorders, muscle contractures, and yet the expected effects are not observed. In this case, the patient should be evaluated for PS and pusher syndrome is diagnosed [20].

PS should be distinguished from other neurological syndromes in which postural disturbance is observed, e.g. from patients with thalamic astasia who have difficulty standing, but do not push on the healthy side, but try to grab objects to prevent falling. Also in Wallenberg's syndrome (e.g. after brain stem infarction) a tilt to one side and a tendency to fall are observed, but without active pushing, as in PS. Patients with pusher syndrome also differ from patients with damage to the posterior part of the insula, who have disorders in the subjective visual assessment of the vertical, but they do not tend to fall [1].

Objective

The objective of the study is to present the characteristics, principles and possibilities of therapy for patients with pusher syndrome.

Therapy of patients with pusher syndrome

Physiotherapeutic guidelines for patients with pusher syndrome

During therapy of patients with pusher syndrome, the basic principles of neurorehabilitation are applied, based on the neuroplasticity of the nervous system. As in other problems after a vascular brain injury, spontaneous improvement can be observed in PS. Appropriate stimulation accelerates this process. The primary goal is to re-teach the patient the correct orientation of the body in space and the mechanism of the postural reflex. Physiotherapy for patients with PS should include visual exploration of the environment and observation where the body is in relation to the environment; learning the movements necessary to assume the vertical position; maintaining this position while performing other activities and preventing pushing [1, 6, 11, 17, 20, 26, 27].

Initially, therapy is aimed at maximum stimulation and loading of the indirectly affected side, so it is the opposite principle to that used in patients with paresis, especially in the case of hemineglect. However, until pushing subsides, it is not possible to properly stimulate the directly affected side [8].

The side of damage does not affect the programming of therapy, however, other coexisting perceptual and cognitive disorders, e.g. hemineglect or aphasia, may hinder the rehabilitation process. It is advisable that therapy be regular, cover as much of the day as possible and a large number of repetitions, which is a prerequisite for proper stimulation of the nervous system. Exercises are

performed in different positions (from lower to higher positions), using multi-sensory stimulation (auditory, visual, tactile) and visual feedback (VF) in the form of external control and visual self-control (e.g. in front of a mirror), which is possible because there is no damage to the visual system or the labyrinth in PS. The basic principle of stimulation in PS is to determine the actual vertical in the patient's environment through verbal stimuli or a visual reference point. In the patient's environment and during therapy, there should be many points defining the correct vertical position. This goal can be achieved through the use of the therapist's hands, shepherd's crook, gymnastic cane, door frame, vertical stripes, drip stand, vertical blinds. In the initial stages of therapy, a lot of elements of hypercorrection are used in the form of excessive transfer of the body weight to the non-affected side and the use of loads on the side from which the patient pushes and the appropriate positioning of the patient's body to limit pushing (Fig. 2a–e) [2, 6, 7, 11, 15, 17, 20, 26, 27].

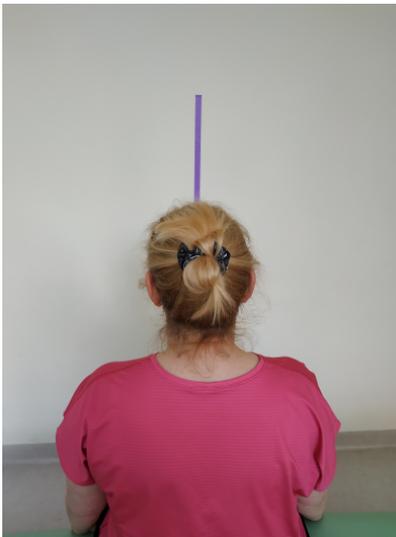


Fig. 2a. Vertical reference point – sticked line

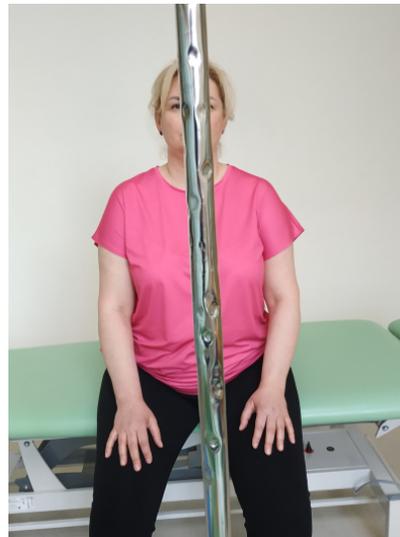


Fig. 2b. Vertical reference point – drip stand

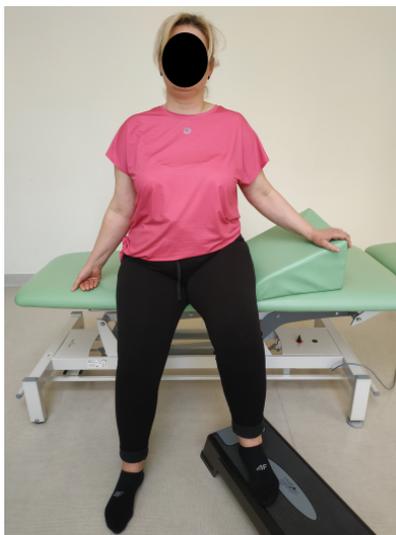


Fig. 2c. Hypercorrection in the sitting position



Fig. 2d. Loading the apparently healthy side



Fig. 2e. Positioning the apparently healthy side to prevent pushing

Possibilities of using physiotherapy in patients with pusher syndrome

Studies conducted on patients with PS show effectiveness of appropriately conducted therapy. Conventional methods are used, which may be supported by other techniques and orthopaedic devices used in neurorehabilitation [16, 28].

In the analysis carried out in 2021, the effectiveness of using various methods of rehabilitation in patients with pusher syndrome was compared. Standing therapies have been assessed to be unsuitable for early stroke patients – in the case of such patients simple visual cues in lower positions are most effective. Visual cues can also be supported by virtual reality and video games. In patients who qualify for therapy in a standing position, exercises can also be performed using a RAGT robot or equivalent platforms with visual feedback, which will increase treatment effectiveness [15]. One study reported treating 5 patients with PS for 3 weeks; 90-minute sessions were conducted five times a week, mainly using balance training in various positions, transfers, moving around in a wheelchair and gait re-education, resulting in improvement of the patients' condition [17]. Another article describes a patient with pusher syndrome, who improved after 3 weeks thanks to Bobath approach, supported by visual and auditory stimulation combined with biofeedback [29]. In another study, treatment effects of three patients with severe PS were presented, in which, apart from conventional therapy, they also sat on a special device with the seat tilted towards the paralyzed side by 10°, on which the patients were additionally secured with walls from the back and from the paretic side. Each sitting lasted 15–20 minutes; the intervention was conducted twice a day, and the patient reached out with an apparently healthy hand to the opposite side, then was seated on a straight surface. After therapy, there was an improvement in pushing symptoms, but not in trunk control, which indicates the need for further research [30]. In the patient after a stroke with PS, in addition to typical physiotherapy, walking sideways on a treadmill towards the side without paresis was successfully used to relieve pressure; therapy included 11 sessions. This forced the patient to lean towards the indirectly affected side and put

weight on it, which improved the patient's upright posture [5]. In another study, two patients with PS after a stroke of the right basal ganglia, in addition to traditional therapy, were additionally covered with a 30-minute blindfold of the left eye twice a day while exercising in a standing position. Their condition improved after the first training, and after 4 weeks the patients were able to cover distances of 150-200 m under supervision [10].

In addition to standard physiotherapy, there are more and more attempts to use complementary methods of therapy for people with PS in order to accelerate and increase treatment effects. Studies show effectiveness of the use of Robot-assisted Gait Training (RAGT) robots to assist walking, standers, Visual Feedback (VF) and Virtual Reality (VR) [16, 28]. One of the possibilities of supporting therapy of patients with PS is the use of a stander. In a patient with pusher syndrome, apart from conventional exercises, passive upright positioning in a stander was used, which covered 24.6% of the therapy time. This was to extend the time the patient was in the upright position, which led to faster restoration of the midline orientation and improvement [31]. In another study, a patient with PS was subjected to therapy using 3D images that were either upright or tilted in the plane by 20° to the side of the paresis. When looking at the vertical image, the patient showed typical active resistance to tilting towards the apparently healthy side. After tilting the image to the left, his/her pathological resistance decreased significantly. This shows that even short presentations of tilted images can reduce the symptoms of severe PS, which may make it possible to use more effective therapy [28].

In patients with PS, attempts are also made to use physical therapy treatments. Transcranial Magnetic Stimulation (TMS) and Galvanic Vestibular Stimulation (GVS) are used [16, 28]. PS patients were treated with Repetitive Transcranial Magnetic Stimulation (rTMS), which is used in stroke patients. During treatment, a high-frequency magnetic field was used to modulate excitability of the cerebral cortex [14].

Physiotherapy of patients with pusher syndrome

When programming exercises for patients with pusher syndrome, neurorehabilitation standards and specific principles described above should be followed. Pushing symptoms are observed in many positions, therefore therapy should be carried out in various activities and adjusted to the symptoms that the patient presents and to his/her functional and cognitive abilities.

Physiotherapy in the lying position

A patient with PS in the lying position assumes a slant position on the bed – he/she turns to the directly affected side and pushes from the bed with the indirectly affected side (Fig. 3). The patient prefers to lie on his/her back or on the affected side, and shows reluctance to lie on the non-affected side or even pushes him/herself from the ground when lying on that side. Therefore, it is advisable to position the patient on the apparently healthy side, and in the lying position, to cover the hyperactive side to minimize the pushing symptoms (Fig. 4a, b) [6, 11, 19, 20, 26, 27].



Fig. 3. Lying position of a patient with left-sided paresis with pusher syndrome



Fig. 4a. Proper lying position of a patient with pusher syndrome



Fig. 4b. Proper position of lying on the apparently healthy side of a patient with pusher syndrome

Physiotherapy in the sitting position

In the sitting position, a PS patient leans the trunk to the directly affected side in the frontal position, actively pushes with the indirectly affected upper limb in the opposite direction (may position the hand on the fingers), the indirectly affected lower limb assumes the extension position and on the toes. The patient shows no fear of falling and puts up active resistance during correction attempts and shows apprehension or reluctance during correction attempts (Fig. 5) [6, 11, 19, 20, 26, 27, 32]. During therapy in the sitting position, the patient should be properly positioned, e.g. when sitting in a wheelchair, providing sensory and visual stimuli; appropriate stimulation will also make it easier for the patient to move around in a wheelchair (Fig. 6a, b). During exercises, it is advisable to use visual stimulation, hypercorrection and weighting the apparently healthy side (Fig. 7a–d).



Fig. 5. A patient with left-sided paresis with pusher syndrome in the sitting position



Fig. 6a. Proper position on a wheelchair of a patient with pusher syndrome



Fig. 6b. Moving in a wheelchair by a patient with pusher syndrome

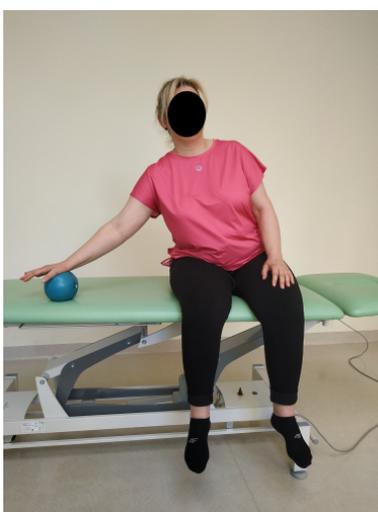


Fig. 7a. Rolling a ball in the sitting position without supporting the lower limbs on the ground

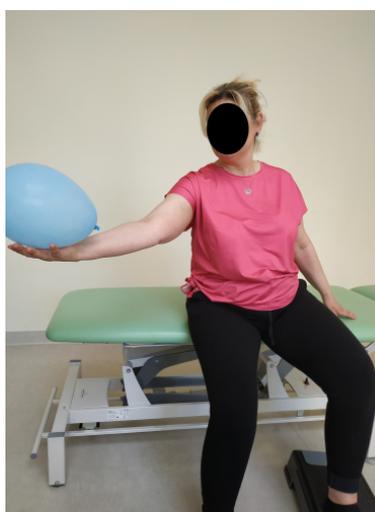


Fig. 7b. Asymmetric sitting position with an additional task

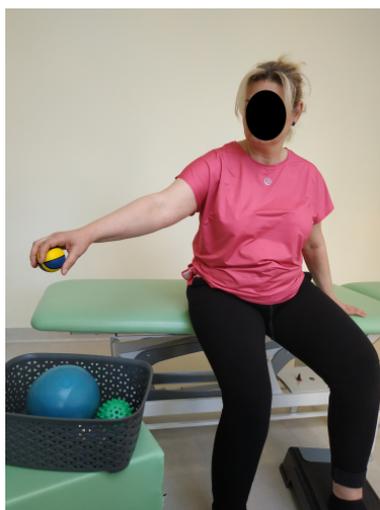


Fig. 7c. Asymmetric sitting position with an additional task



Fig. 7d. Asymmetric sitting position with additional stimuli

Maintaining a correct, upright body posture with additional tasks and everyday activities should be gradually introduced (Fig. 8a–e). Training in the sitting position should also include transfers, such as transfers along the bed, transfers to a wheelchair or from a wheelchair to a bed (Fig. 9a-c); due to pushing, it should be done through the apparently healthy side. Gradually, as stability and mobility while sitting are mastered, elements of preparation for higher positions and learning to stand up are introduced (Fig. 10a-b).



Ryc. 8a. Utrzymanie pionu z dodatkowym zadaniem

Fig. 8a. Keeping the upright position with an additional task



Ryc. 8b. Utrzymanie pionu podczas zadania przed lustrem

Fig. 8b. Keeping the upright position during a task in front



Ryc. 8c. Zadanie funkcjonalne przed lustrem z utrzymaniem pionu

Fig. 8c. A functional task in front of a mirror while keeping the upright



Fig. 8d. A functional task in front of a mirror while keeping the upright position



Fig. 8e. Butt walking



Fig. 9a. Transferring along the bed



Fig. 9b. Transferring from a bed to a wheelchair



Fig. 9c. Transferring from a wheelchair to a bed



Fig. 10a. Getting up at the table



Fig. 10b. Getting up with a crook

Physiotherapy in the kneeling position

In the kneeling position, the patient with pusher syndrome has difficulty maintaining the upright position and balance, he/she leans to the side that is indirectly affected. This is a difficult starting position for the patient to exercise, but it should be introduced if possible. During therapy, additional stimuli are used that will force the overactive side to be loaded, and then maintain the correct position and balance (Fig. 11a-c).

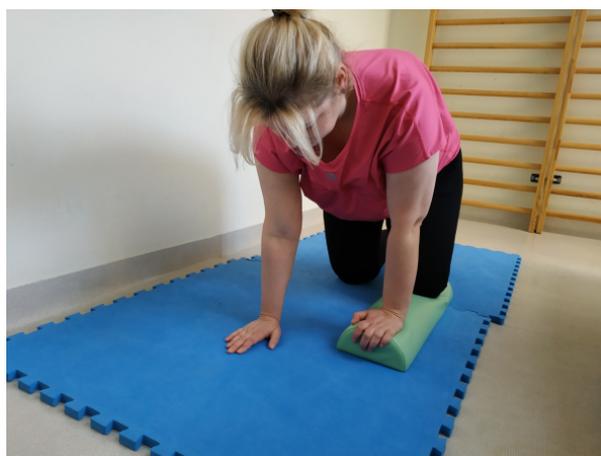


Fig. 11a. Exercising in a four-point kneeling position



Fig. 11b. Exercising in a kneeling position



Fig. 11c. Exercising in a one-leg kneeling position

Physiotherapy in the standing position

A patient with PS in the standing position leans towards the directly affected side, actively pushes with the upper limb from the point of support, when using a crook or a crutch - raises them up, also pushes towards the therapist protecting the paralyzed side, shows no fear of falling, and also shows apprehension or reluctance during correction attempts (Fig. 12) [6, 11, 19, 20, 26, 27, 32]. Exercising in the standing position for a person who has paresis and shows pushing is difficult, because the patient is highly exposed to loss of balance and falling. Tasks should be carried out in safe conditions and made gradually more difficult after mastering the previous level. Initially, the patient may stand in the corner of the room, which will provide the patient with physical and mental comfort (Fig. 13). Tasks at the rehabilitation bed are also recommended, e.g. standing sideways at a long distance, which will ensure stability and at the same time reduce pushing. Gradually, the distance from the bed and the support plane can be reduced (Fig. 14a-b). Elements of hypercorrection, additional load on apparently healthy limbs or a shepherd's crook and many vertical reference points are used. Additional and functional tasks are also introduced; if possible, the directly affected limbs are activated. Gradually, the number of stimuli and reference points should be reduced, and the vertical position should be automatically and steadily maintained (Fig. 15a-f).



Fig. 12. A patient with left-sided paresis with pusher syndrome in the standing position



Fig. 13. Standing in the corner



Fig. 14a. Standing sideways at the bed at a great distance



Fig. 14b. Standing sideways at the bed in the forearm support



Fig. 15a. Standing position at a crook



Fig. 15b. Exercising in the standing position with a crook



Fig. 15c. Exercising in the standing position with load on a crook



Fig. 15d. Exercising in the standing position with a drip stand



Fig. 15e. Exercising in the standing upright position



Fig. 15f. Functional exercise in the standing position

Physiotherapy during gait re-education

While moving, the patient with PS bends the torso towards the directly affected side, actively pushes the upper limb away from the place of support. When he/she moves with a crook, a crutch, a walker, he/she pushes away from it or lifts it (instead of supporting him/herself on it), he/she also “pushes” on the therapist who is protecting him/her from the paralyzed side. The patient shows no fear of falling and shows apprehension or reluctance during correction attempts [6, 11, 19, 20, 26, 27, 32]. Learning to move is the most difficult element of therapy, it should be introduced gradually after the patient has mastered lower and static positions. It is best to start gait re-education by moving sideways against the wall with the apparently healthy upper limb resting against it at a great distance, which will reduce pushing and at the same time ensure stability (Fig. 16a-b).



Fig. 16a,b. Learning to walk against the wall

Gait education can also be carried out sideways at the bed at first, emphasizing counterrotation movements of the upper and lower limbs (Fig. 16c–d). If necessary and when paresis is still observed in the directly affected lower limb, it should be supported in particular phases of gait with the therapist’s hands or with appropriate devices. The last element of locomotion is overcoming obstacles and stairs, in these tasks asymmetry and additional stimuli are also initially used (Fig. 17a-b).



Fig. 16c,d. Learning to walk by the bed



Fig. 17a,b. Learning to climb stairs

Conclusion

Pusher syndrome is a disorder most common in patients after a stroke, which consists in incorrect perception of body posture in relation to gravity, primarily in the frontal plane. This syndrome is often unrecognized, which may cause misinterpretation of the patient’s behaviour and wrong selection of exercises, thus extending the rehabilitation period. Correct diagnosis is crucial for programming effective physiotherapy. Appropriate therapy leads to improvement or complete recovery,

even in more severe cases of PS. The entire interdisciplinary rehabilitation team and the patient's caregivers should be involved in the treatment process in order to increase efficiency and ensure continuity of care [13].

There are still no unified therapeutic strategies for patients with pusher syndrome, but there is consensus that physiotherapy is the basic pillar of treatment for such patients. The overriding goal of therapy is to create correct postural reflexes by appropriate stimulation of the nervous system, using multi-sensory stimuli to stimulate correct postural patterns. The patient must re-learn to receive, perceive and feel the correct vertical body posture [20]. According to the hypothesis that PS results from a mismatch between visual and postural perception of the vertical, the use of visual feedback can be considered the most effective compensatory approach recommended in the treatment of PS patients [14].

Standard exercises used in neurorehabilitation, enhanced with visual stimuli controlled with feedback, are most commonly used, available and beneficial. They are delivered by simple visual cues or using modern technology. Exercises must be individually adapted to the stage of the disease and to the patient's cognitive and motor abilities. Therapy should include patient positioning, static sitting and standing positions, transfers, upright positioning, balance training, gait re-education, functional and daily activities [10, 15]. There are also attempts to use alternative, complementary methods of treating people with PS. All the authors emphasize that further research is needed in order to unify effective therapy methods for patients with pusher syndrome and to establish standards of treatment.

Adres do korespondencji / Corresponding author

Agnieszka Drozd

e-mail: agnieszka.drozd@gumed.edu.pl

Piśmiennictwo/ References

1. Roller M. L., „The Pusher Syndrome”, *Journal of Neurological Physical Therapy*, Vol. 28, No. 1, 2004
2. Karnath H.-O., Broetz D., „Understanding and Treating Pusher Syndrome”, *Physical Therapy*, Vol. 83, No. 12, Dec 2003
3. Grespan Dos Santos Pontelli T.E., Pontes-Neto O., M., Colafemina J.F., Barros de Araujo D., et al. „Posture control in Pusher syndrome: influence of lateral semicircular canals” *Rev Bras Otorrinolaringol* Vol. 71, No.4, 448-52, Jul./Aug. 2005
4. Johannsen L., Broetz B., Karnath H.O., „Leg orientation as a clinical sign for pusher syndrome”, *BMC Neurology* 2006, 6:30
5. Romick-Sheldon D., Kimalat A., „Novel treatment Approach to Contraversive Pushing after Acute Stroke: A Case Report”, *Physiother Canada* 2017; 69(4); 313-317
6. Mikołajewska E. „Metoda NDT-Bobath w neurorehabilitacji osób dorosłych”, Wydawnictwo Lekarskie PZWL, Warszawa 2022
7. Mikołajewska E. „Aktualne poglądy na temat etiologii i leczenia zespołu odpychania” *Ann. Acad. Med. Siles.* 2012, 66, 4, 29-33
8. Porzych P., Ratuszek-Sadowska D., Pyskir M., Nowacka K., i wsp., „Leczenie Zespołu Odpychania u pacjenta po rozległym zawałe mózgu wywołanym przez zator tętnic mózgowych - opis przypadku”, *Journal of Education, Health and Sport*. 2017; 7(8): 583-592
9. Babyar S.R., Peterson M.G.E., Reding M., „Time to Recovery from Lateropulsion Dependent on Key Stroke Deficits: a Retrospective Analysis”, *Neurorehabilitation and Neural Repair* 2015, Vol.29(3), 207-2013

10. Zhang Q., Zhang L., He W., Zheng X., et al., "Case Report: Visual Deprivation in Pusher Syndrome Complicated by Hemispatial Neglect After Basal Ganglia Stroke", *Frontiers in Neurology*, Sep. 2021, Vol.12, Article 706611
11. Mikołajewska E., „Rehabilitacja pacjentów z zespołem odpychania”, *Postępy Psychiatrii i Neurologii* 2011; 20(4): 291-296
12. Chow E., Parkinson S., Jenkin J., Anderson A., et al., "Rehability and Validity of the Four-Point Pusher Scale: An Assessment Tool for Measuring Lateropulsion and Pusher Behaviour in Adults after Stroke", *Physiotherapy Canada* 2019; 71(1); 34-42
13. Nolan J., Godecke E., Spilsbury K., Singer B., "Post-stroke lateropulsion and rehabilitation outcomes: a retrospective analysis", *Disability and Rehabilitation* 2022, Vol. 44, No. 18, 5162-5170
14. Meng L., Tsang R. C C, Ge Y., Guo Q., et al., "rTMS for poststroke pucher syndrome: study protocol for a randimised, patient-blinded controlled clinical trial", *BMJ Open* 2022; 12: e064905
15. Luque-Moreno C., Jimenez-Blanco A., Cano-Bravo F., Paniagua-Monrobel M., et al., "Effectiveness of visual feedback and postural balance treatment of post-stroke pusher syndrome. A systematic review", *Rev. Cient. Soc. Esp. Enferm. Neurol.* 53 (2021), 16-24
16. Thanaya S.A.P., Mardhika P.E., "Therapeutic Approches for Pusher Syndrome after a Stroke: a Literature Review", *Intisari Sains Medis* 2019, Vol.10, No.2: 452-458
17. Pardo V., Galen S., "Treatment interventions for pusher syndrome: A case series", *NeuroRehabilitation* 44 (2019), 131-140
18. Babyar S.R., Peterson M.G.E., Reding M., "Case-Control Study of Impairments Associated with Recovery from Pusher Syndrome after Stroke: Logistic Regression Analyses", *Journal of Stroke and Cerebrovascular Diseases*, Vol. 26, No.1 (January), 2017: pp 25-33
19. Tomaszewska E., Cichosz M., Kochański B., Plaskiewicz A., i wsp.: „Obecne spojrzenie na rehabilitację Zespołu Odpychania (Zespołu Pushera). Przegląd literatury oraz doświadczenia własne”, *Journal of Education, Health and Sport*. 2015; 5(2): 196-207
20. Miler A.: „Zespół odpychania – rola koncepcji Bobath”, *Medycyna Ogólna i Nauki o Zdrowiu*, 2015, Tom 21, Nr 3, 250-253
21. Lagerqvist J., Skargren E., "Pusher syndrome: Reliability, validity and sensitivity to change of a classification instrument", *Advances in Physiotherapy*, 2006; 8: 154-160
22. Baccini M., Paci M., Nannetti L., Biricolti C., et al., "Scale for Contraversive Pushing: Cutoff Scores for Diagnosing 'Pusher Behavior'and Construct Validity", *Phys. Ther.* 2008 Aug. 88(8): 947-55
23. Mikołajewska E., „Zespół odpychania tylnego – opis przypadku”, *Pielęgniarstwo Neurologiczne i Neurochirurgiczne* 2013, Tom 2, Nr 3: 125-129
24. Mikołajewska E., „Posterior pusher syndrome-case raport”, *Centr. Eur. J. Med.* 7(3), 2012, 354-357
25. Mikołajewska E., „Zespół odpychania tylnoboczny jako tylny zespół odpychania współistniejący z klasycznym (bocznym) zespołem odpychania – opis przypadku”, *Post. N. Med.* 2016; XXIX(12C): 42-44
26. Van De Rakt J., McCarthy-Grunwald S., "The 'Pusher' syndrome, assessment and treatment. Part 1", *Ita. J. Sports Reh. Po.* 2021; 8(18); 3; 3; 1904-1934
27. Van De Rakt J., McCarthy-Grunwald S., "The 'Pusher' syndrome, assessment and treatment. Part 2", *Ita. J. Sports Reh. Po.* 2022; 9 (21); 3; 4; 2170-2201
28. Nestmann S., Röhrig L., Müller B., Ilg W., et al., "Tilted 3D visual scenes influence lateropulsion: A single case study of pusher syndrome", *J. Clin. Expl. Neuropsychol.* 2022 Sep., 44 (7): 478-486
29. Paci M., Nannetti L., "Physiotherapy for Pusher Behaviour in a Patient with Post-Stroke Hemiplegia", *J. Rehabil. Med.* 2004; 36: 183-185
30. Fukata K., Amimoto K., Inoue M., Shida K., et al., "Effects of performing a lateral-reaching exercise while seated on a tilted surface for severe post-stroke pusher behavior: A case series", *Top Stroke Rehabil.* 2021 Dec., 28(8): 606-613
31. Gillespie J., Callender L., Driver S., "Usefulness of standing frame to improve contraversive pushing in a patient post-stroke in inpatient rehabilitation", *Bayl. Univ. Med. Cent. Proc.* 2019; 32(3): 440-442