

## Back pain – part IV. Physical rehabilitation

Edward Zderkiewicz

Vincent Pol University in Lublin, Poland

---

### Abstract

The management strategies in patients suffering from chronic lower back pain have evolved from long-term bed rest in the recumbent position advocated earlier to early motor rehabilitation, which is becoming increasingly common. In kinesitherapy, it is essential to strengthen the muscles which most frequently become stretched and weakened and to stretch the pathologically shortened and tense muscles. Stretching of contracted muscles and other soft tissues should be long and slow without sudden movements that could induce protective responses and increase muscle tension.

**Key words:** early rehabilitation, rules of kinesitherapy

---

### Introduction

The treatment of patients with chronic back pain is often a difficult problem for therapists. The management strategies often depend on the speciality of a physician the patient is referred to. Over time, the opinions of therapists have evolved from complete lack of movement until the subsidence of symptoms recommended earlier to early motor rehabilitation, whose use is increasingly common.

### Rehabilitation of patients with chronic lumbar spine pain

With ageing of societies in developed countries, the incidence of skeletoarticular problems increases. One of the common issues is chronic back pain, especially in the lumbosacral region. Pain is predominantly caused by degenerative-productive changes. The pathogenesis of pain, diagnosis and theoretical basis of rehabilitation were discussed in the previous papers [49, 50, 51].

Some therapists dealing with back pain still believe that patients with such problems should stay in bed until the pain episode has completely subsided [9]. Such opinions were opposed by Allen and Waddel already in 1989 - it is tragic that

contrary to the best intentions to relieve pain, in most cases the entire management of patients with lumbar spine pain leads to failure. Thus, too long bed rest which is recommended results in disability [1].

Treatment outcomes following several-day and several-month bed rest are of interest. It has been found that the time of complete subsidence of symptoms was similar in both groups while longer bed-cure was associated with negative effects, i.e. impaired spine stability [39].

Long-term bed rest induces regressive changes in the musculoligamentous, fascial - articular, skeletal or even nervous system [16, 20].

The study findings have demonstrated that in cases of unilateral pain in the lumbosacral region, atrophic changes in the multifidus muscle on the affected side are observed relatively quickly and persist even after the subsidence of pain unless appropriate exercises are applied [8,22,23].

The old maxim of Descartes “Let pain be your guide” is applicable in the acute stage of disease. According to modern physiotherapy, rehabilitation, mainly kinesitherapy, should be started as early as possible. Exercises were recommended already in Ancient times; Klaudiusz Galen (120-210 AD)

included exercises among six recommendations regarding healthy lifestyle [45]. At present, early kinesiotherapy is appreciated by the vast majority of therapists [2, 4, 7, 9, 10, 12, 15, 18, 24, 26, 27, 29, 31, 32, 33, 35, 36, 43].

The role of therapists is to convince patients that they should be actively involved in rehabilitation as fear of inevitability of diseases increases their muscle tension, which intensifies pain. Moreover, patients should be certain that their symptoms are caused by potentially controllable factors [3, 19, 20, 30, 38]. It is essential to transform a pain avoider into a pain manager [20]. Exercises can eliminate fear associated with returning to physical activity [36]. The patient should be instructed to feel the “neutral” position alleviating pain. In some cases, it is advocated to change the entire lifestyle, including postures, movements, load lifting, or even sleep positions [47].

The efficacy of therapy should be evaluated based on symptoms, functionality and quality of life. From the clinical point of view, treatment outcomes should be assessed considering endurance, muscle strength, range of motion, elasticity and everyday activity. The frequency, loads applied and duration of endurance trainings should be increased [9, 24].

In cases of low back pain, the general rule accepted during kinesiotherapy is to strengthen the muscles that are often weakened, i.e. of the anterior abdominal wall, gluteal, thigh abductors as well as the tibialis anterior muscle and to stretch those that most commonly affected by contractures and become shortened: iliac flexors, paravertebral muscles, hamstrings, thigh adductors, and the tensor fascia latae. Moreover, contractures often affect the quadratus lumborum muscle, which closes posteriorly the abdominal cavity, attaches to the last rib, iliac crest and spine and is one of the main lumbar spine stabiliser. The muscles of the anterior abdominal wall supporting the abdominal

prelum form three layers. The straight muscle of the abdomen located most superficially is considered the main lumbar spine stabiliser. It functions together with the oblique muscles, flexing the lumbus and enabling torsional movements. The deepest transverse abdominal muscle is also the major respiratory muscle. This muscle is essential when the strength of the sacroiliac joint is lessened [37].

The iliac flexors affected by contractures include the iliopsoas and rectus femoris, while the spine extensors include the longissimus dorsi, iliocostalis and multifidus. The above mentioned muscles were discussed in the previous paper [51].

The spine stability depends also on the condition of respiratory muscles as in the majority of cases they also stabilise the spine [17, 34]. When oxygen requirements suddenly increase, e.g. during multiple forward bends or weight lifting, the central nervous system naturally selects the respiratory function at the expense of the stabilising function. In such cases, the stabilising muscles become more vulnerable [25].

In cases of chronic respiratory failure, patients assume a specific posture with the head and then the entire body leaning forward. However, it appears that such a posture can also be assumed as a consequence of long-term improper positioning, e.g. prolonged lotto watching [11], which increases thoracic kyphosis [34].

The elimination of the most common errors in respiration is a difficult task for therapists. The thoracic respiration with perpendicular elevation of upper ribs, commonly observed, can be corrected using long-term exercises aimed at proper abdominal pathway, with a predominance of diaphragmatic action. The inspiration should start from the lower parts of abdominal muscles, then lower ribs, which should move horizontally enabling the thorax to increase its volume as an inflated balloon [34].

Patients should be instructed that exercises are purposeful. The correction of improper breathing should be associated with proprioception. The patient should feel and cooperate with the therapist's hands which induce proper respiratory movements. To involve the patient in rehabilitation, he/she can be ordered to place one hand over the thorax and the other one over the abdomen and control the sequence of the respiratory movements, which should be ascending (Fig. 13).

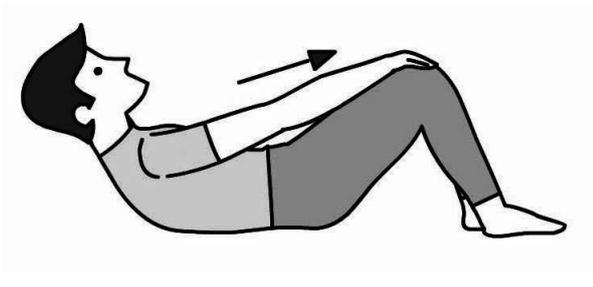


Fig. 1. Strengthening of the straight abdominal muscles.

The supine position, with legs bent in the iliac and knee joints. Hands with elbows straight moved along thighs towards knees, the upper trunk elevated, expiration - hold the position for several seconds and return to the supine position, inspiration. Repeat 6-10 times (drawn by Wojciech Stachyra)

When the hands are placed on the lower ribs, their horizontal elevation can be felt (Fig. 14). Expiration should be twice longer than inspiration and deepened.

Long-term exercises are to ensure that proper "cortical" respirations become automatic and subcortical [34]. The recommended exercises should mainly provide spine stability and protect against potential injuries [26]. The exercises described below illustrate these goals (Fig. 1-14).

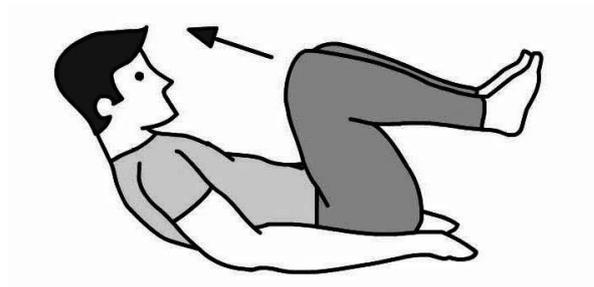


Fig. 2. Strengthening of the anterior abdominal wall muscles and stretching of the paravertebral muscles.

The supine position - elevate bent legs and the head approximating the knees to the forehead - expiration, hold for several seconds and return to the supine position - inspiration. Repeat 6-10 times (drawn by Wojciech Stachyra)

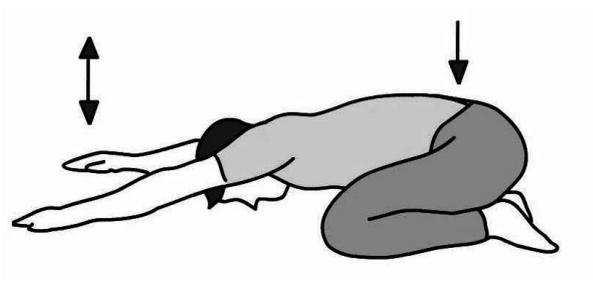


Fig. 3. Stretching of the paravertebral muscles.

The initial position - supported kneeling. Sit back leaving the hands with straight elbows on the ground. Hold for 1-2 minutes (drawn by Wojciech Stachyra)

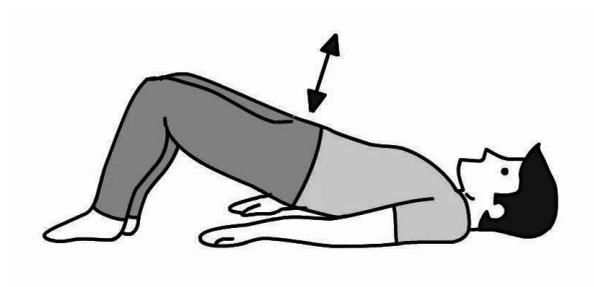


Fig. 4. Stretching of the iliac flexors.

The supine position - elevate the hips to align them with the thighs and thorax. Hold as long as possible - up to several minutes. Repeat several times. The best exercises to protect against or correct hyperlordosis.

They stretch the straight thigh and iliolumbar muscles and strengthen the gluteal muscles (drawn by Wojciech Stachyra)



Fig. 5. Stretching of the paravertebral muscles.

The supine position- get hold of the bent lower legs with both hands and pull them towards the forehead with the head elevated - expiration. Push back on the hands with the legs to enable inspiration and pull the knees again to the forehead- expiration. Repeat 6-10 times (drawn by Wojciech Stachyra)

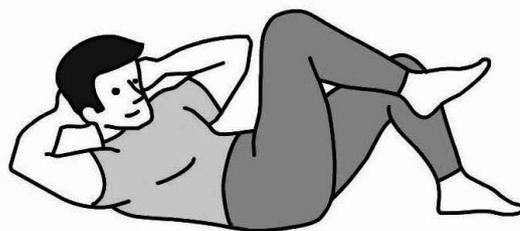


Fig. 6. Strengthening of the oblique abdominal muscles.

The supine position - place the hands behind the head and elevate the upper thorax to press the contralateral bent knee with the elbow - expiration. Return to the supine position- inspiration. Repeat the exercise with the opposite limbs. Repeat the sequence 6-10 times (drawn by Wojciech Stachyra)

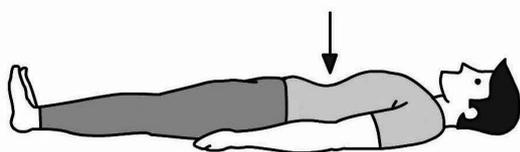


Fig. 7. Strengthening of the transverse abdominal muscle.

The supine position - "hollowing" -with expiration. Hold for several seconds, inspiration (drawn by Wojciech Stachyra)

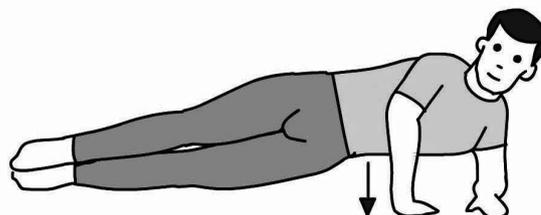


Fig. 8. Stretching of the trapizius muscle.

The lateral recumbent position. Rise the body supported on the elbow and the other straight upper limb so as the thighs can go downwards. Stay in this position for several dozen seconds and repeat the exercise on the other side. Repeat the sequence 3-5 times (drawn by Wojciech Stachyra)

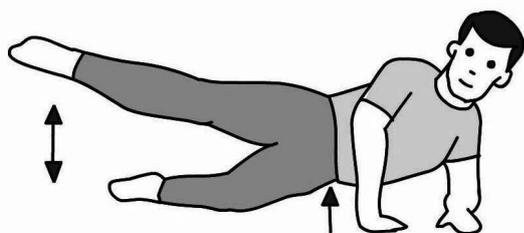


Fig. 9. Strengthening of the thigh abductors.

The lateral recumbent position with the lower hand under the head and the upper one placed on the ground in front of the thorax . Slowly lift up the upper leg and hold for several seconds. Repeat 6-10 times (drawn by Wojciech Stachyra)

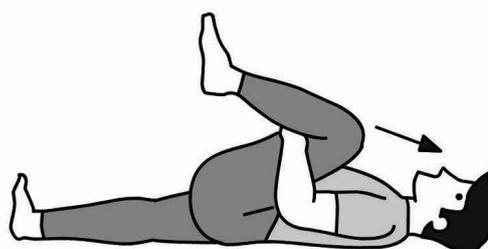


Fig. 10. Stretching of the hamstrings.

The supine position with the legs bent in the hip and knee joints and the feet placed on the ground; lift one foot as high as possible, holding the thigh with both hands from behind. Hold for 10-30 seconds. Repeat the exercise with the other leg. Repeat the sequence 3 times (drawn by Wojciech Stachyra)

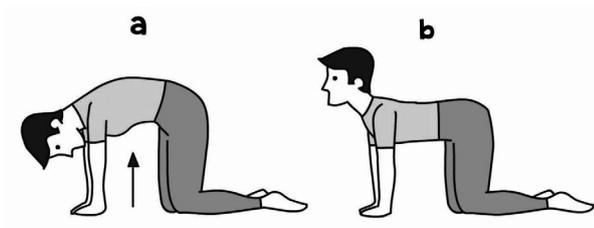


Fig. 11. Cat-camel.

McGill suggests to do this exercise as a warm-up, especially for beginners. Supported kneeling - the back bent upwards - cat (the expiratory position) and then the back lowered - camel (the inspiratory position) [26]. However, my experience shows that patients with discopathic pain do not always tolerate well such exercises. Thus, much caution should be exercised and maximum forced movements should be avoided (drawn by Wojciech Stachyra)

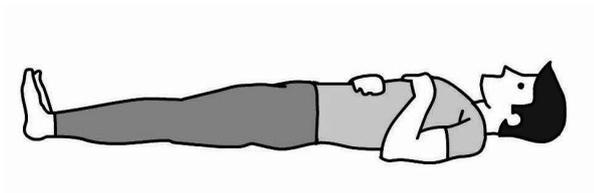


Fig. 13. Learning how to breathe properly.

The supine position - one hand placed on the abdomen and the other one on the sternum; the patient is instructed that during inspiration the “abdominal” hand should lift first (drawn by Wojciech Stachyra)

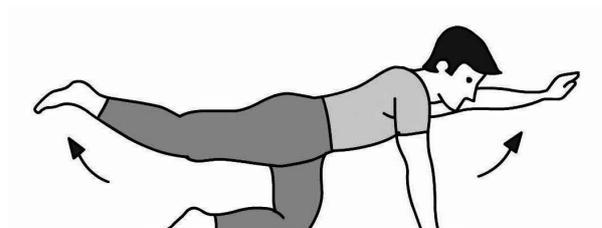


Fig. 12. Strengthening of the back extensors.

The exercise recommended by McGill [26]. Supported kneeling - lift the upper limb with the straight elbow to the level and simultaneously lift up the contralateral straight lower limb. I seldom recommend this exercise. Patients with lower back pain usually have increased tension of the paravertebral muscles, especially in hyperlordosis, and additional straining of these muscles can worsen their condition (drawn by Wojciech Stachyra)

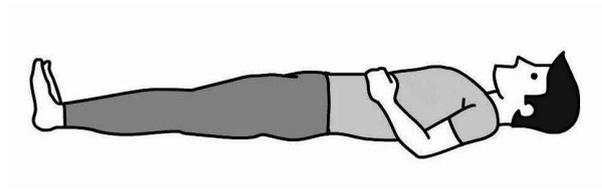


Fig. 14. Respiratory exercises.

The supine or sitting position - the patient places the hands on both sides of lower ribs and should be able to feel that the lower part of the thorax expands horizontally during the final stage of inspiration [34]

## Conclusions

1. Early kinesitherapy is advocated in cases of chronic lower back pain.
2. Long-term immobilisation causes atrophic changes in the spine-stabilising muscles.
3. Respiration-associated disorders are likely to result on improper respiratory pathways, which should be corrected with exercises as the respiratory muscles also stabilise the spine.

## References:

1. Allan DB., Waddell G. A historical perspective on low back pain and disability. *Acta Orthop Scand Suppl* 1989; 60: 1
2. Back Exercise for Pain Relief [Internet]. Mooney V. Spine-health. Veritas Health, LLC; 2006 Nov 21 [cited 2017 Aug 3]. Available from: <https://www.spine-health.com/treatment/physical-therapy/back-exercise-pain-relief>
3. Carayannopoulos AG. Identification of the Pain Patient. In: Falowski S., Pope J., editors. *Integrating Pain Treatment into Your Spine Practice*. Springer, Cham 2016. p. 3-10.
4. Chou R, Loeser JD, Owens DK et al.; American Pain Society Low Back Pain Guideline Panel. Interventional therapies, surgery, and interdisciplinary rehabilitation for low back pain: an evidence-based clinical practice guideline from the American Pain Society. *Spine (Phila Pa 1976)*. 2009 May 1;34(10):1066-77.
5. Cole AJ. Lower Back Stabilization Exercises for Back Pain [Internet]. Spine-health. Veritas Health, LLC; 2015 May 13 [cited 2015 Nov 21]. Available from: <https://www.spine-health.com/wellness/exercise/lower-back-stabilization-exercises-back-pain>
6. Čumpelik J, Věle F. Yoga-Based Training for Spinal Stability. In: Liebenzon C, editor. *Rehabilitation of the Spine: A practitioner's manual*. 2nd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2007. p. 566-84.

7. Curyło M, Bielańska A, Raczkowski JW. Ocena częstotliwości występowania zespołów bólowych kręgosłupa lędźwiowego wśród pracowników biurowych i fizycznych / Evaluation of the lumbar spine pain syndromes frequency of occurrence among office and physical workers. *Fizjoterapia Polska* 2017; 17(1); 28-36.
8. Demoulin C, Crielaard JM, Vanderthommen M. Spinal muscle evaluation in healthy individuals and low-back-pain patients: a literature review. *Joint Bone Spine*. 2007 Jan;74(1):9-13.
9. Dreisinger TE. Exercise in the management of chronic back pain. *Ochsner J*. 2014 Spring;14(1):101-7.
10. Gallert-Kopyto W, Knapik A, Wasiuk-Zowada D. Fizjoterapeuta – predyspozycje zawodowe. Poziom gibkości / Physiotherapist – occupational predispositions. Level of flexibility. *Fizjoterapia Polska* 2016;16(4);130-140.
11. Gonzalez HE, Manns A. Forward head posture: its structural and functional influence on the stomatognathic system, a conceptual study. *Cranio*. 1996 Jan;14(1):71-80.
12. Hestback L, Leboeuf - Yde C, Manniche C. Low Back Pain : What is the long-term cause? A review of studies of general patient populations. *Eur spine J* 2003; 12:149-65.
13. Hooten W.M. Inerdisciplinary pain rehabilitation. *Pain Medicine* 2011; 12:152-153.
14. Hruska J. Influence of dysfunctional respiratory mechanics on orofacial pain. *J Orofacial Pain Related Dis*. 1997; 41: 21-27.
15. Jókai E, Hárságyi Á. Developing Deep Water Exercise Equipment for Low Back Pain (LBP) Patients: medical validation experiences. *Stud Health Technol Inform*. 2015;217:498-505.
16. Kamper SJ, Apeldoorn AT, Chiarotto A et al. Multidisciplinary biopsychosocial rehabilitation for chronic low back pain: Cochrane systematic review and meta-analysis *BMJ* 2015; 350 :h444.
17. Kendall FP, McCreary EK, Provance PG, Rodgers MM, & Romani, W. A. (1993). *Muscles, testing and function: with posture and pain*. Vol. 103. Baltimore, MD: Williams & Wilkins, 1993:325-9.
18. Koes B.W., Tulder M., Lin C.C. et al. An updated overview of clinical guidelines for the management of non-specific low back pain in primare care. *Europ Spine J* 2010; 19: 2075-2094.
19. Kuciel-Lewandowska J, Paprocka-Borowicz M, Laber W et al. Ocena poziomu lęku i depresji oraz napięcia bólu u pacjentów z chorobą zwyrodnieniową układu ruchu / Assessment of the level of anxiety, depression and pain intensity in patients with osteoarthritis of the limbs through spa treatment. *Fizjoterapia Polska* 2016;16(2);64-72.
20. Liebenson C. Active care: its place in the management of spinal disorders. In: C. Liebenson (ed) *Rehabilitation of the spine*. Lippincot Wiliams & Wilkins. Baltimoren2007: 3-29.
21. Liebenson C. Putting the biopsychosocial model into practice. In: C. Liebenson (ed) *Rehabilitation of the Spine*. Lippincot Williams & Wilkins . Baltimore 2007: 72-90.
22. MacDonald D, Moseley GL, Hodges PW. Why do some patients keep hurting their back? Evidence of ongoing back muscle dysfunction during remission from recurrent back pain. *Pain*. 2009 Apr;142(3):183-8.
23. Mattila M, Hurme M, Alaranta H, Paljärvi L, Kalimo H, Falck B, et al. The multifidus muscle in patients with lumbar disc herniation. A histochemical and morphometric analysis of intraoperative biopsies. *Spine (Phila Pa 1976)*. 1986 Sep;11(7):732-8.
24. McFarland CM. How a Physical Therapist Can Help with Exercise [Internet]. *Spine-health*. Veritas Health, LLC; 2000 Jun 16 [cited 2017 Aug 7]. Available from: <https://www.spine-health.com/treatment/spine-specialists/how-a-physical-therapist-can-help-exercise>
25. McGill SM, Sharratt MT, Seguin JP. Loads on spinal tissues during simultaneous lifting and ventilatory challenge. *Ergonomics*. 1995 Sep;38(9):1772-92.
26. McGill SM. Lumbar spine stability: Mechanism of injury and restbilization. In: Liebenson C, editor. *Rehabilitation of the Spine: A practitioner's manual*. 2nd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2007. p. 93-111.
27. Greenwood J, McGregor A, Jones F, Mullane J, Hurley M. Rehabilitation Following Lumbar Fusion Surgery: A Systematic Review and Meta-Analysis. *Spine (Phila Pa 1976)*. 2016 Jan;41(1):E28-36.
28. Mense S, Simons D, Russell IJ. Pain associated with increased muscle tension. *Muscle pain: understanding its nature, diagnosis and treatment*. Baltimore, MD: Lippincott Williams & Wilkins. 2001:99-130.
29. Mooney V. Rehabilitation and exercise for a healthy back [Internet]. *Spine-health*. Veritas Health, LLC; 2006 Nov 21 [cited 2017 Nov 2]. Available from: <https://www.spine-health.com/treatment/physical-therapy/rehabilitation-and-exercise-a-healthy-back>
30. Moraszczyk M. Kręgosłup: 4 najczęstsze przyczyny bólu pleców [Internet]. *PoradnikZdrowie*. pl TIME S. A. [cited 2018 Jun 07]. Available from:

- [http://www.poradnikzdrowie.pl/zdrowie/kregoslup/kregoslup-4-najczestsze-przyczyny-bolu-plecow\\_35737.html](http://www.poradnikzdrowie.pl/zdrowie/kregoslup/kregoslup-4-najczestsze-przyczyny-bolu-plecow_35737.html).
31. Oosterhuis T, Costa LO, Maher CG, et al. Rehabilitation after lumbar disc surgery. *Cochrane Database Syst Rev*. 2014 Mar 14;(3):CD003007.
  32. Opara J. *Neurorehabilitacja*. red M. Chubala, Elamed Katowice 2011:303-322.
  33. Ostelo RW, Costa LO, Maher CG, et al. Rehabilitation after lumbar disc surgery: an update Cochrane review. *Spine (Phila Pa 1976)*. 2009 Aug 1;34(17):1839-48.
  34. Perri M. Rehabilitation of the breathing pattern disorders. In: C. Liebenson (ed) *Rehabilitation of the Spine*. Lippincot Williams & Wilkins . Baltimore 2007:369-387.
  35. Pieber K, Herceg M, Csapo R, et al. Effects of a multidisciplinary programme on postural stability in patients with chronic recurrent low back pain: preliminary findings. *Eur Spine J*. 2016 Apr;25(4):1219-25.
  36. Rainville J, Hartigan C, Martinez E, et al. Exercise as a treatment for chronic low back pain. *Spine J*. 2004 Jan-Feb;4(1):106-15.
  37. Richardson CA, Snijders CJ, Hides JA, et al. The relation between the transversus abdominis muscles, sacroiliac joint mechanics, and low back pain. *Spine (Phila Pa 1976)*. 2002 Feb 15;27(4):399-405.
  38. Rolving N, Sogaard R, Nielsen CV, et al. Preoperative Cognitive-Behavioral Patient Education Versus Standard Care for Lumbar Spinal Fusion Patients: Economic Evaluation Alongside a Randomized Controlled Trial. *Spine (Phila Pa 1976)*. 2016 Jan;41(1):18-25.
  39. Rozenberg S. French multicenter prospective randomized, open study comparing advice to stay active and bed rest in acute low back pain. Annual Meeting of the International Society for the study of the Lumbar Spine. Edinburgh 2001.
  40. Scoco A., Miller J.P., Sweet J.A. Revision surgery and alternative treatment options fo recurrent pain following spinal surgery. In: S.M. Falowski, J.E. Pope (ed) *Integrating pain treatment into your spine practice*. Springer Internat Publ. Switzerland 2016: 45-57.
  41. Stanek A, Cholewka A, Gadula J, et al. Can Whole-Body Cryotherapy with Subsequent Kinesiotherapy Procedures in Closed Type Cryogenic Chamber Improve BASDAI, BASFI, and Some Spine Mobility Parameters and Decrease Pain Intensity in Patients with Ankylosing Spondylitis? *BioMed Research International*. 2015;2015:404259. Epub 2015 Jul 26.
  42. Stryła W, Pogorzała AM. Wady postay u dzieci. In: Stryła W, Pogorzała AM, editors. *Rehabilitacja medyczna*. Poznań: PZWŁ; 2012. p 156–65.
  43. Tomanova M, Lippert-Grüner M, Lhotska L. Specific rehabilitation exercise for the treatment of patients with chronic low back pain. *J Phys Ther Sci*. 2015 Aug;27(8):2413-7. Epub 2015 Aug 21.
  44. Townsend CO, Bruce BK, Hooten WM. The role of mental health professionals in multidisciplinary pain rehabilitation programs. *J Clin Psychol* 2006; 62: 1433-43.
  45. Tipton CM. *People and Ideas: Exercise Physiology*. Oxford: Oxford University Press. 2003; p. 1–38.
  46. Ullrich Jr PF. *Stretching for Back Pain Relief* [Internet]. Spine-health. Veritas Health, LLC; 2009 Jun 15 [cited 2017 Aug 7]. Available from: <https://wayback.archive.org/web/20170810100859/https://www.spine-health.com/wellness/exercise/stretching-back-pain-relief>
  47. Ullrich Jr PF. *Physical Therapy Benefits For Back Pain* [Internet]. Spine-health. Veritas Health, LLC; 2014 Mar 21 [cited 2017 Nov 2] <https://www.spine-health.com/treatment/physical-therapy/physical-therapy-benefits-back-pain>.
  48. Zborowski A. *Masaż w wybranych jednostkach chorobowych. Część 1*. Kraków: Firma Wydawniczo-Handlowa A-Z Adam Zborowski. 2010.
  49. Zderkiewicz E. Back pain Part I: causes, symptoms, immediate treatment. *Arch Physiother Glob Res*. 2016;20(4):7–16.
  50. Zderkiewicz E, Bielecka K. Back pain. Part II: Diagnosis and pathogenesis of chronic cases. *Arch Physiother Glob Res*. 2017;21(3):39-45.
  51. Zderkiewicz E. Back pain. Part III: anatomical and biomechanical bases of kinesiotherapy. *Arch Physiother Glob Res* 2018;22(1):7-11.

**Corresponding author address:**

Edward Zderkiewicz  
Vincent Pol University, Lublin  
Choiny Street 2, Poland  
edzder@wp.pl

*Received: 15.08.2018*

*Accepted: 15.10.2018*