

Comparative Effects of Vojta Therapy and Standard Physical Therapy on Pain Level and Functional Ability in Working-Age Patients with Non-Specific Low Back Pain

Dadane Thaothong¹ and Thanyawat Homsombat^{2*}

¹Department of Physical Therapy, Udon Thani Hospital, Udon Thani Thailand

²Lecturer, Faculty of Sports Science and Health, Thailand National Sports University, Udon Thani Campus, Thailand

Received September 19, 2023
Accepted November 1, 2023
Published December 31, 2023

***Corresponding author:**

Thanyawat Homsombat, Lecturer, Faculty of Sports Science and Health, Thailand National Sports University, Udon Thani Campus, Thailand

E-mail:
cmu_kku@hotmail.com

©2023, Thaothong, D and Homsombat, T

This is an Open Access article published under a Creative Commons (CC BY-NC-ND 0.4) license.



ABSTRACT

Introduction: The standard physical therapy plays a role in reducing low back pain and increasing functional ability. Vojta therapy helps strengthen the deep muscles of the trunk, beneficial effect on patients with back pain. However, there is a lack of studies on vojta therapy in working-age back pain patients. The study aimed to compare the effects of vojta therapy combined with standard physical therapy and standard physical therapy alone on pain and the functional ability in working-age patients with non-specific low back pain.

Methods: The participants were 50 working-age patients with low back pain and were divided into 2 groups: the experimental group received vojta therapy combined with standard physical therapy (n=25), and the standard physical therapy alone group (n=25). The vojta therapy is 30 minutes and standard physical therapy treatment is 45 minutes, 2-3 times per week, for 4 weeks. Assessment of pain levels and functional ability before and after 4 weeks of treatment or 10 complete treatments. Descriptive statistics include mean, percentage, and standard deviation to describe characteristics, and inferential statistics was an independent t-test to compare pain level and functional ability between the experimental group and the control group. The statistical significance level was set at the 0.05 level.

Results: Within both the experimental and control groups, a significant reduction in pain scores (mean=1.00±0.00) and an improvement in functional ability (mean=1.92±1.45) were observed between pre-test and post-test assessments. When comparing the groups, the experiment exhibited significantly reduced pain scores (mean=1.00±0.00; 95% CI= -1.52 - 0.32) and improved functional ability (mean=4.72±3.62; 95% CI=-8.1-1.74) compared to the control.

Conclusion: Both groups are effective in managing pain and improving the functional ability of low back pain patients. However, vojta therapy combined with standard physical therapy has had better results than the standard physical therapy alone group.

Keywords: Standard Physical Therapy, Working-Age Patients, Pain level, Rehabilitation Non-Specific low-back pain, Vojta therapy

Introduction

Low back pain is a common musculoskeletal disorder and has an impact on both physical and mental health, affecting the ability to work in daily life. Approximately 60–80% of the world's population suffers from low back pain. Currently, approximately 619 million people suffer from low back pain; most of them have non-specific low back pain. It is expected that this number will increase to 843 million in 2050 [1-4].

The cause is due to increasing age, hard work, improper movement, obesity, smoking, and a lack of exercise. In particular, increasing age increases the risk of low back pain, which is caused by deterioration of the spinal structures [1-2, 4-5]. In Thailand, it was found that lower back pain is most commonly found in illnesses of the musculoskeletal system. The majority, 50.5%, had low back pain from their occupation, and 90% were of a non-specific type [5-6]. Low back pain is a major health problem. It is the cause of absenteeism, decreased work

performance, and physical ability. In cases of chronic back pain, it often affects mental health and social interaction, creating a burden on health services and causing economic loss [4-7]. In summary, there is no known reason for the illness known as low back pain. All ages and genders are susceptible to it, affecting day-to-day living; in extreme situations, it could result in a loss of mental and physical health as well as society.

There are many approaches to treating low back pain, such as using drugs to reduce pain and inflammation and not using drugs such as physical therapy, alternative medicine, exercise, and surgical treatment is used in cases when the disease is severe or other treatments are ineffective [5, 8-9].

Physical therapy is the standard treatment for patients with low back pain. Its main purpose is to reduce pain and increase the ability to do daily activities. It consists of main methods such as using electrical tools (electrotherapy modalities), the use of manual therapy techniques such as mobilization or massage, and the provision of therapeutic exercise programs to increase the strength and flexibility of muscles and joints, including counseling, advice, and knowledge about the disease. In addition, appropriate postures for daily living, working, and exercising prevent disease and reduce the occurrence of recurring low back pain [9-10]. The theory of reflex locomotion stimulation of the neurophysiological system underlies the physical therapy method known as 'vojta therapy'. Reflex locomotion can be used therapeutically to help patients whose central nervous systems and locomotor systems have been compromised regain some of their basic movement patterns, or at least make them more accessible. The reason for the beginning (starting position) and stimulation of pressure in a specific direction and according to specific spots or zones, which results in the muscle's ability to relax the motor and sensory nerves. The supporting point of the muscles used for sucking and excretory system management is crucial, resulting in movement. The work of various muscles and automatic balance control work better and promote more correct movement of the body, such reactions are caused by movements that are not produced by the patient. The initial posture consists of two main postures: reflex rolling, which involves lying on the back and sides; and reflex creeping, which involves lying on the stomach or in a position with the back on top, such as the crawling position. The 10 key stimulating points or zones are breast zone, trunk zone, acromial zone, ASIS (anterior superior iliac spine) zone, medial epicondyle of femur zone, radial epicondyle zone, gluteal zone, medial border of scapular zone, medial epicondyle of the humerus. Selecting a starting position and the location of the trigger point are chosen according to the purpose of treatment. Multiple zones can be stimulated at the same time; this should be done regularly; the duration is at least 1 minute per zone, and it should be stimulated four times a day because the

effects of vojta therapy will last for about 2–3 hours after treatment [11-12]. During the initial stage, vojta therapy is used for treatment and to stimulate locomotion activity in cerebral palsy pediatric patients [11-14]. Later, it was used for treatment in various disease groups of all ages, such as neurological patients with stroke, spinal cord injury, shoulder pain, low back pain, and scoliosis. The fundamental idea behind vojta reflex locomotion is the preservation of postures by isometric muscle contractions during point (breast zone) stimulation. This approach ensures consistent patterns of muscle contraction and stimulates muscles, joints, ligaments, and tendons. Additionally, it is known that the exteroceptors and exteroceptors are connected to the vojta reflex movement, which serves as a source of afferent stimulation for the brain [8, 16-20]. The vojta reflex locomotion has been shown to stimulate the deep muscles of the spine and the trunk muscles to control spinal rotation force and regulate trunk stability, improving postural control capacity [1, 21-23]. The ability of the core, which is at the body's center of gravity, to maintain or modify internal conditions in response to changes in the external environment is referred to as trunk stability. Particularly, the trunk muscles are crucial for maintaining postures since they function as a corset to anchor the body and spine regardless of whether the extremities move or not. The trunk muscles also keep the body aligned while in the sitting and standing positions and serve as supports for carrying out tasks. Additionally, during whole-body activity, the trunk muscles function as tonic or postural muscles and are crucial for the segmental stability of the lumbar spine and postural control [3-6]. A recent study indicated that vojta therapy helped limbo-sciatica patients experience less discomfort and impairment as well as improved muscle flexibility and weakness. Patients with low back pain have abnormal transverse abdominal muscle contraction patterns or timing, as well as a reduced cross-sectional area. The diaphragm and transverse abdominis are crucial muscles for supporting the trunk and they have an impact on spinal stiffness either directly through muscle contraction or indirectly through increased internal abdominal pressure. Recent studies on the effectiveness of physical therapy for patients with disc herniations have greatly improved our knowledge of these treatments; nevertheless, data on the advantages of vojta therapy for patients with non-specific low back pain are scant. Since low back pain is the most typical symptom of worker age, vojta therapy and conservative physical therapy are frequently utilized to reduce pain and disability in patients. The vojta approach involves applying goal-directed pressure to certain areas of the patient's body by the therapist. Reflex rolling and reflex creeping are two movement complexes that are spontaneously and involuntarily triggered by such stimuli, regardless of the age of the patient.

However, there hasn't been research that puts these two treatments side by side [2], and there is a lack of research focusing on the effects of vojta therapy on a wide range of measures of variables relevant to non-specific low back pain. The present study aims to test the hypothesis that the combination of vojta therapy and standard physical therapy will result in a statistically significant reduction in pain levels and improved functional ability compared to standard physical therapy alone in working-age patients with low back pain.

Methodology

Participants

Randomized controlled trials (RCT) in 50 working-age patients with low back pain were divided into 2 groups: the experimental group received vojta therapy combined with standard physical therapy (25 patients), and the control group received standard physical therapy treatment (25 patients) by simple random sampling and lottery methods. The patient had non-specific low back pain that was diagnosed by modern medicine between March and August 2022 at the Physical Therapy Department, Rehabilitation Medicine Center, Udon Thani Hospital. Patients were aged between 20 and 60 years old, and non-specific low back pain lasting more than 2 weeks was used as a criterion for inclusion. Patients who have undergone spinal surgery, congenital heart disease, osteopenia, osteogenesis imperfecta, cancer, pregnancy, spinal tumors, spinal fractures, epilepsy, hemophilia, and patients who did not complete the treatment according to the prescribed program were all considered exclusion criteria. Sample size calculation, according to previous study found that the average ODI values were 39.09 and 32.15. Standard deviation= 8.83, 7.89, error value= 0.05, $r = 1$ [12]. Using the t-two dependent means formula of the N4 studies 17 application, the sample size was 46. Set the significance level, statistically, at alpha (α) = 0.05. To prevent dropouts, the researcher increased the sample size by another 10 percent, resulting in a sample size of 50 people. This study was approved by the Institutional Review Board of Udon Thani Hospital (REC No. 8/2565) on February 18, 2022, in Thailand and was conducted following the Declaration of Helsinki.

Intervention

All patients will be evaluated on a personal characteristic assessment form and assessed on their functional ability before and after week 4 treatment. After that, both groups will receive advice on proper behavior and posture in daily life. Each group will receive the treatment program 2-3 times per week, 1-3 days apart, for 4 weeks, or a total of 10 treatments. The standard physical therapy is 45 minutes; pelvic traction is 20 minutes; and the formula for calculating traction weight is 10-25% of a patient's body weight. Transcutaneous electrical nerve stimulation (TENS);

conventional high-frequency TENS was applied using two electrodes (5x8 cm) on the lower back with a pulse duration of 60 μ sec x a frequency of 60 Hz and a total treatment time of 20 min. Ultrasound diathermy involves the therapeutic application of low-radiofrequency 1-MHz continuous ultrasound with a half-value depth of approximately 1.3 watt/m¹ on the paravertebral muscle in the low back area or gluteal muscle for a total treatment time of 5 minutes [7].

Vojta therapy (consisting of 3 positions, stimulating both sides alternately for 10 minutes on each position, sustained pressure for 2–5 minutes for each point, reflex rolling, and the first position stimulating two points at the same time, total time 30 minutes). While receiving vojta therapy, the patient will have involuntary muscle reactions such as abdominal contractions, chest expansion, and pelvic tilting. The patient may feel abdominal muscle spasms, twitching of the corners of the mouth, and feeling tired (mild to moderate) after therapy [31, 32].

Reflex rolling (side lying). Starting in the side-lying position, lie on your side with shoulder flexion 90 degrees, the lower arm bent at the elbow 90 degrees, and the other arm placed at the side of the body. Hands placed on the same side of the hip. The upper legs on the floor, hips and knees, are bent 90 degrees, and the lower legs are slightly bent. Stimulate location at the gluteal area (gluteal zone) and trunk zone; the area is in line with the lower edge of the scapula bone (Figure 1).

Reflex creeping (prone) [6, 27]. Starting in the prone position. The head and neck are the same as the spine; the head and neck are aligned with the spine; the arm is on the facial side, raised at an angle of 120 degrees to the body; the hand facing down; the other arm on the side; shoulder blade rotated; hand facing up (forearm pronation); leg on the same side as the facial side; rest comfortably. The leg opposite the face (occipital leg) has hip joint flexion of 40–45 degrees with external rotation and knee flexion of 45 degrees. Stimulation location: calcaneus bone, lower outer edge (heel zone) (Figure 2).

First position. Starting in the crawl position. The coccyx between the feet places the forehead on the floor, and the head and neck rotate 30 degrees. Turn your head to the same side as the raised arm (facial arm), lift the facial arm, and place it at a 120-degree angle to the body, hands facing down on the floor. The opposite arm (occipital arm) is placed at the side of the body, the hand is placed at the side of the body, and the hand is facing up (forearm pronation). Stimulation locations are the calcaneus bone, outer lower edge (heel zone), and the anterior superior iliac spine (ASIS) zone (Figure 3).



Figure 1 Reflex rolling



Figure 2 Reflex creeping



Figure 3 First position

Outcome measurements

Personal characteristic assessment forms conclude: gender, age, body mass index, occupation, working hours per day, period of back pain, and underlying disease.

The visual analog scale (VAS) is a self-reported scale consisting of a horizontal or vertical line, usually 10 cm long (100 mm). For pain intensity, the scale is most commonly anchored by “no pain” (score of 0) and pain as bad as it or worst imaginable pain (score of 10.) [22].

Modified Oswestry low back pain disability index (ODI). The functional state was evaluated using the ODI, which also showed any limitations in daily activities. The ODI is a 10-item questionnaire with values ranging from 0 to 5 [7]. The final result is a ranking of 50 no to mild disability (0-40 %; score 0-20), 41-100%; score: 21-50) is a severe disability). A more (bedridden) is indicated by higher scores [7, 22] (0-20%=minimal disability, 21-40%=moderate disability, 41-60=severe disability, 61-80%=crippled disability, 81-100% = bed-bound disability).

Statistical analysis

The s-wilk test was used to test the normal distribution of values. Descriptive statistics were frequency, percentage, mean, and standard deviation (SD) to express personal characteristics. Inferential statistics were a chi-square test used to compare personal characteristics between the experimental and control group, a dependent t-test used to compare pain level and functional ability within the group, and an independent t-test used to compare pain level and functional ability after the trial (post-test) in the experimental group and control group at 95% confidence interval. We used $\alpha = 0.05$ as the cut-off point of statistical significance.

Results

Personal characteristics

Comparing the personal information of the two groups, it was found that there was a difference in gender, age, body mass index, working hours per day, period of low back pain, and underlying disease that was not statistically significant (Table 1).

Table 1 Participants' characteristics

Characteristics	Experiment (n=25)	Control (n=25)	p-value
Sex			
Male	11 (44.00)	5 (20.00)	0.06
Female	14 (56.00)	20 (80.00)	
Age (years)			
20-49	17 (68.00)	15 (60.00)	0.64
50-60	8 (32.00)	10 (40.00)	
Mean/SD	40±12.39	43.44±11.21	
Min-max	20-59	21-60	
Body mass index (kg/m²)			
Standard	14 (56.00)	9 (36.00)	0.08

Characteristics	Experiment (n=25)	Control (n=25)	p-value
Overweight	11 (44.00)	16 (64.00)	
Mean/SD	22.41±3.56	24.37±3.46	
Min-max	17.67-33.60	18.70-30.8	
Work hour per day (hrs)			
8	18 (71.00)	13 (52.00)	0.34
> 8	7 (28.00)	12 (48.00)	
Period of low back pain (month)			
≤ 6	17 (68.00)	16 (64.00)	0.68
> 6	8 (32.00)	9 (36.00)	
Underlying disease			
No	12 (48.00)	9 (36.00)	0.39
Yes	13 (52.00)	16 (64.00)	
NCD (HT, DM, DLP)	8 (61.53)	10 (62.50)	
SLE	1 (7.69)	0	
MPs (neck, upper back)	2 (15.38)	2 (12.50)	
PU	1 (7.69)	0	
GERD	0	1 (6.25)	
Asthma	0	2 (12.50)	
Hyperthyroid	1 (7.69)	1 (6.25)	

Chi-square test; NCD=non communicative disease; HT=hyper tension; DM=diabetes mellitus; DLP=dyslipidemia; SLE= systemic lupus erythematosus (SLE); MPs=myofasial pain syndrome; PU=peptic ulcer; GERD=gastroesophageal reflux disease

The pain level and functional ability

The pain score and the functional ability before and after treatment: comparing before and after treatment, the results showed that, both groups' pain scores and functional ability decreased statistically significantly (Table 2).

Table 2 Comparing the pain score (VAS) and the Oswestry disability index (ODI) before and after treatment

Indicator	Experiment (n=25)			Control (n=25)		
	Pre-test	Post-test	p-value	Pre-test	Post-test	p-value
Pain score	6.12±1.30	1.00±0.00	<0.001	6.40±1.65	1.92±1.45	<0.001
Oswestry disability index	14.04±7.01	4.7±3.62	<0.001	22.48±20.69	9.68±7.13	0.005

Comparing the pain score and functional ability between groups before treatment

The results showed that comparing the mean pain scores between the experimental group (6.12±1.30) and the control group (6.4±1.65) and the mean score of functional ability between the experimental group (14.04±7.01) and the control group (22.48±20.69), they were not significantly different (p-value = 0.51 and p-value = 0.059, respectively) (Table 3).

Table 3 Comparing the pain score and Oswestry disability index between groups before treatment

Indicator	Two-sample t test with equal variances					t	df	p-value
	Mean	SD	SE	95% CI				
				Lower	Upper			
Visual analog scale								
Experiment (n=25)	6.12	1.30	0.28	-1.13	0.57	-1.93	48	0.51
Control (n=25)	6.40	6.40	-8.44	-17.23	0.49			
Oswestry disability index								
Experiment (n=25)	10.04	7.01	4.37	-17.23	0.49	-3.10	48	0.59
Control (n=25)	22.48	20.69	-4.96	-8.12	-1.74			

Comparing the pain score and functional ability between groups after treatment

The results showed that, comparing the mean pain scores between the experimental group (1.00 ± 0.00) and the control group (1.92 ± 1.49) and the mean score of functional ability between the experimental group (4.72 ± 3.62) and the control group (9.68 ± 7.18), they were significantly different (p -value = 0.005 and p -value = 0.004, respectively) (Table 4).

Table 4 Comparing the pain score (VAS) and Oswestry disability index (ODI) between groups after treatment

Variables	Two-sample t test with equal variances					t	df	p-value
	Mean	SD	SE	95% CI				
				Lower	Upper			
Visual analog scale								
Experiment (n=25)	1.00	0.00	-9.20	-1.52	0.32	-3.07	48	0.005
Control (n=25)	1.92	1.49	-0.29	-1.53	-0.30			
Oswestry disability index								
Experiment (n=25)	4.72	3.62	-4.96	-8.18	-1.74	-3.10	48	0.004
Control (n=25)	9.68	7.18	1.60	-8.21	-1.71			

Discussion

The present results found that both treatments reduced low back pain and improved functional ability. This is due to the effect of pelvic traction on the stretching of the joints and other structures, which reduces the force exerted on the sprained spinal disc and helps increase blood flow, resulting in improved flexibility and movement of the lumbar spine [32]. Transcutaneous electrical nerve stimulation (TENS) can reduce pain because, based on the principles of gate control theory, it increases the peripheral sensory system's ability to access the central nervous system. It has to go through a "gate" in the spinal cord to reach the brain. As a result, the pulse that arrives first will prevent the door from permitting the pulse that enters later. Even if another pulse arrives at this gate sooner, it reduces muscle spasticity and increases the flexibility of muscles, tendons, and joints [33]. The results of ultrasound diathermy are deep heat, which can increase tolerance to pain (pain threshold), improve circulation, reduce spasticity, reduce inflammation, and increase flexibility [34]. The vojta therapy effect results in the automatic and regular functioning of the body's muscles. The vojta therapy effect results in the automatic and regular functioning of the body's muscles; the core muscles, leg muscles, and hip muscles are stronger. After being stimulated, it causes the muscles in almost every part of the body to work, especially the core muscles, legs, and hips, which helps the spine to stretch (elongation) and increases the twisting and rotation of the spine, helping to increase the angle of movement of the spine. It has a positive effect on patients with low back pain [5, 10, 11, 13, 18, 29]. Therefore, vojta therapy is like exercising, but the patient does not do it himself. In addition, the effects of stimulation, which also contribute to the muscle work of the core muscles, legs, and hips muscles, especially the muscle group that rotates the legs and spreads them out (Abduction with external rotation muscle), working in unison and being

stronger [9, 11], affecting low back pain patients to be able to function, reduce pain, and have a normal gait [2,19]. Based on these results, patients in vojta therapy combined with standard physical therapy had lower pain levels and were able to perform more functions when compared to the standard physical therapy group. According to the study of Iosub, et al. [26] conducted a comparative study of vojta therapy and standard physical therapy treatment in 17 patients with disc herniation, aged 30-79 years. It was found that both groups had decreased pain scores and improved ability to perform activities of daily living (ODI).

The study of Hamed et al. [12] conducted a study comparing vojta therapy combined with TENS therapy and a hot pack and another group receiving TENS combined with a hot pack in 40 patients with non-specific low back pain, with an average age of 26 years. It was found that the vojta therapy combined with TENS and a hot pack had a significantly better quality of life (ODI) than another group. Vojta therapy consists of starting postures and applying pressure to stimulation points in predetermined positions and directions based on vojta therapy's principles, and the motor centers are stimulated in the appropriate sequence to control the muscles of both the upper and lower limbs via the 12 propriospinal neurons in the spinal cord. This causes the transmission of nerve impulses to control the motor system and sensory processing, resulting in brain stimulation, reflex movement, and body movement according to the developmental patterns of normal humans [6, 15] This is consistent with a study by Łozińska [2] that compared the effects of vojta therapy and standard physical therapy in low back pain patients on gait patterns in 17 adults with non-specific low back pain patients. It was found that the vojta therapy group had a rhythmic step and elongated both the left and right feet, increasing walking speed significantly more than the physical therapy group. There is also a study by Juárez-Albuixech et al. [29], who studied to compare the

effects of vojta therapy with transcutaneous electrical stimulation (TENS) in 12 back pain patients aged 31–74 years. The results of vojta therapy show positive results in terms of reducing pain, increasing functional ability, and increasing flexibility more than using TENS with statistical significance, which is consistent with the study of Żurawski et al. (2019) [13], who studied the effects of vojta on low back pain in teenagers with discopathy-associated syndromes for 2 weeks and found that the pain score decreased with statistical significance. Vojta Therapy is a program that promotes muscle strength and increases movement efficiency. Patients do not have to exert themselves, which is different from normal training in general programs. Therefore, it is beneficial for back pain patients, patients who have difficulty moving, or patients who do not like to exercise. They can also advise patients with back pain to practice basic postures by themselves at home or instruct the caregiver to stimulate the patient under guidance. However, only physical therapists who have been trained and have obtained a certificate can provide treatment. At present, treatment with vojta therapy is still limited. Lack of personnel It is seen that physical therapists should be encouraged to study and train to become experts in vojta. To be used in the treatment of this group of patients and other groups of patients in the future to continue to become more widespread. Results for long-term vojta therapy for back pain patients should be monitored in the future. Additionally, vojta therapy should be studied in disease groups related to the skeletal and musculoskeletal systems that are commonly observed, such as individuals with neck pain. The results of the Oswestry Indicator score (ODI) before treatment showed that the experimental group had a moderate disability of 28.08% (ODI=21-40%; 14.04 ± 7.01), and the control group had a low ability of 44.96% (severe disability) (ODI= 41-60%; 22.48 ± 20.69). After treatment showed that both groups had a high ability to perform daily activities (minimal disability: 9.4% for the experimental group (ODI= 0-20%; 4.72 ± 3.62) and 19.36% for the control group (ODI= 0-20%; 9.68 ± 7.18).

In the present study, there was no restriction on the exercise of the sample group before or during the study, which may affect the current results. The long-term effects of vojta therapy on patients should be studied, and the results must be measurable by physical therapy devices to confirm the correct intervention, such as back-leg strength and range of motion of the lumbar spines, hips, knees, and ankles.

Conclusion

In summary, combining vojta therapy with standard physical therapy has had beneficial effects on patients with non-specific low back pain. Both reduce pain and increase their functional ability and work when compared with standard physical therapy alone. After treatment, the vojta Therapy group combined with standard physical therapy experienced a 13–14% greater

reduction in back pain compared to the standard program group alone. Treatment results of vojta therapy combined with physical therapy according to standards result in reduced back pain. Increase the ability to do daily activities and increase the work efficiency of patients with back pain, such as sitting and working longer when the pain decreases and the core muscles are stronger.

Acknowledgements

The researcher would like to thank the head of the Rehabilitation Medicine Center, the Physical therapy staff at Udon Thani Hospital, and all patients who cooperated and helped to make the research work successful.

References

- [1] Werner DAT, Grotle M, Gulati S, Austevoll IM, Madsbu MA, Lønne G, et al. Can a successful outcome after surgery for lumbar disc herniation be defined by the Oswestry Disability Index Raw Score? *Global Spine Journal*. 2020; 10(1): 47–54.
- [2] Łozińska P, Wójtowicz D, Wdowiak P, Dziuba A. Changes in kinematic parameters during walking in adults with low back pain subjected to Vojta therapy: a pilot study. *Physiotherapy Quarterly*. 2019; 27(2): 22–8.
- [3] Tiwawatpakorn J, and Sutheeravut P. Collaboration of patients undergoing chronic low back pain rehabilitation by community participation, Songkhla Province, Thailand. *Thai Journal of Public Health*. 2021; 51(1): 75–87..
- [4] Longlalerng1 W, Longlalerng W, Siritwattanasatorn M, and Suwatthanakul T. Comparison of therapeutic effects between physical program with ketoprofen gel and diclofenac gel with low back pain syndrome on acute herniated nucleus pulposus patients: a randomized controlled trial. *Thai Journal of Physical Therapy*. 2020; 42(3): 147–62.
- [5] Kim B, Yim J. Core stability and hip exercises improve physical function and activity in patients with non-specific low back pain: a randomized controlled trial. *Tohoku J Exp Med*. 2020; 251(3): 193–206.
- [6] Sanz-Esteban I, Cano-de-la-Cuerda R, San-Martín-Gómez A, Jiménez-Antona C, Monge-Pereira E, Estrada-Barranco C, et al. Cortical activity during sensorial tactile stimulation in healthy adults through Vojta therapy: a randomized pilot controlled trial. *Journal of Neuro Engineering and Rehabilitation*. 2021; 18(1):13.
- [7] Sanjaroensuttikul N. The Oswestry low back pain disabilityqQuestionnaire (version 1.0) Thai Version. *J Med Assoc Thai*. 2007; 90 (7): 1417-22

- [8] Mattiuzzi C, Lippi G, and Bovo C. Current epidemiology of low back pain. *Journal of Hospital Management and Health Policy*. 2020; 4(15): 1-6.
- [9] Tayati W, Chompunuch N, Wongphaet P. Effect of vojta therapy on balance and walking of community dwelling chronic stroke patients. *ASEAN Journal of Rehabilitation Medicine*. 2020; 30(1): 21–5.
- [10] Ha SY, and Sung YH. Effects of vojta approach on diaphragm movement in children with spastic cerebral palsy. *J Exerc Rehabil*. 2018; 14(6): 1005–9.
- [11] Ha SY, Sung YH. Effects of Vojta method on trunk stability in healthy individuals. *J Exerc Rehabil*. 2016; 12(6): 542–7.
- [12] Hamed WM, Ibrahim AH, and Shalaby AS. effects of vojta method on quality of life in patients with chronic non-specific low back pain. *Egypt. J. of Appl. Sci*. 2021; 36(5): 29–40.
- [13] Żurawski A, Kiebzak W, Zmyślina A, Pogożelska J, Kotela I, Kowalski TJ, et al. Efficacy of the use of the McKenzie and vojta methods to treat discopathy-associated syndromes in the pediatric population. *Int J Occup Med Environ Health*. 2019; 32(1): 33–41.
- [14] Ferreira ML, de Luca K, Haile L, Steinmetz J, Culbreth G, Cross M, et al. Global, regional, and national burden of low back pain, 1990–2020, its attributable risk factors, and projections to 2050: a systematic analysis of the global burden of disease study 2021. *Lancet Rheumatol*. 2023; 5(6): e316–e329.
- [15] Sonthikul C, Kaewmunee W, Bunphruek S, Sroisakul K, Thuphom N, and Yaemrattanakul W. Immediate effect of vojta therapy on walking speed and postural balance of individuals with chronic stroke: a pilot study. *Archives of Allied Health Sciences*. 2022; 34(2): 16–24.
- [16] Knezevic NN, Candido KD, Vlaeyen JWS, Van Zundert J, Cohen SP. Low back pain. *The Lancet*. 2021; 398(10294): 78–92.
- [17] Ngamjarus C, Chongsuvivatwong V, McNeil E, and Heinz Holling. Enhancement of learning on sample size calculation with a smartphone application: a cluster-randomized controlled trial. *Southeast Asian J Trop Med Public Health*. 2017; 48(1): 240–252.
- [18] Balagué F, Mannion AF, Pellisé F, Cedraschi C. Non-specific low back pain. *The Lancet*. 2012; 379(9814): 482–91.
- [19] Koch C, and Hänsel F. Non-specific low back pain and postural control during quiet standing-a systematic review. *Frontiers in Psychology*. 2019;10(586): 1-9.
- [20] Qaseem A, McLean RM, O’Gurek D, Batur P, Lin K, Kansagara DL, et al. Nonpharmacologic and pharmacologic management of acute pain from non-low back, musculoskeletal injuries in adults: a clinical guideline from the American College of Physicians and American Academy of Family Physicians. *Ann Intern Med*. 2020; 173 (9): 739–48.
- [21] Temcharoensuk P, Likhitnopakhun S, Kraikum S, and Limsuwa S. Parents’ perspectives on vojta therapy and factors related to effectiveness in children with motor disabilities. *Thai Journal of Physical Therapy*. 2022;44(3): 193–207.
- [22] Sae-jung Surachai, Hunzavong Torkamol, and Jirarattanapochai Kitti. Reliability of Thai version of Oswestry questionnaire for the evaluation of low back pain patients. *Srinagarind Medical Journal*. 2002; 17(4): 247–51.
- [23] Tiwawatpakorn J, Wongkiratimethawi T, and Sukubol S. The development and effectiveness of the Hat-Yai back school program in patients with chronic low back pain. *Thai Journal of Physical Therapy*. 2022; 44(1): 29–46.
- [24] Ferraro R, Garman S, Taylor R, Parrott JS, and Kadlowec J. The effectiveness of transverse abdominis training on balance, postural sway and core muscle recruitment patterns: a pilot study comparison across age groups. *J Phys Ther Sci*. 2019; 31(9): 729–37.
- [25] Sangsaikaew A, Korcharoenyos C, Donprapeng B, and Sirisawat M. The effects of promoting physical activity in daily life program on pain and disability in patients with non-specific low back pain. *Journal of Research in Nursing-Midwifery and Health Sciences*. 2019; 39(1): 93–104.
- [26] Iosub ME, Ianc D, Sirbu E, Ciobanu D, and Lazăr L. Vojta therapy and conservative physical therapy versus physical therapy only for lumbar disc protrusion: a comparative cohort study from Romania. *Applied Sciences*. 2023; 13(4): 2292.
27. Eppe C, Maurer-Burkhard B, Lichti MC, and Steiner T. Vojta therapy improves postural control in very early stroke rehabilitation: a randomised controlled pilot trial. *Neurol Res Pract*. 2020; 2(23). 1-11.
- [28] De-La-Barrera-Aranda E, Gonzalez-Gerez JJ, Saavedra-Hernandez M, Fernandez-Bueno L, Rodriguez-Blanco C, and Bernal-Utrera C. Vojta therapy in neuromotor development of pediatrics patients with periventricular leukomalacia: case series. *Medicina*. 2021; 57(11): 1149.

- [29] Juárez-Albuxech ML, Redondo-González O, Tello I, Collado-Vázquez S, and Jiménez-Antona C. Vojta therapy versus transcutaneous electrical nerve stimulation for lumbosciatica syndrome: a quasi-experimental pilot study. *Journal of Bodywork and Movement Therapies*. 2020; 24(1): 39–46.
- [30] International Vojta Society. Vojta Therapy: Reflex Locomotion – The Fundamentals of Vojta Therapy. Available from: <https://www.vojta.com/en/the-vojta-principle/vojta-therapy/fundamentals>
- [31] Sirindhorn National Medical Rehabilitation. Vojta therapy in adult.2021
- [32] Kongsomchom A, Watchara Sudachom, Janwantanakul P. What to do for chronic back pain? *Siriraj Medical Bulletin*. 2020 Feb ;13(1): (in Thai)
- [33] Tanabe H, Akai M, Doi T, Arai S, Fujino K, and Hayashi K. Immediate effect of mechanical lumbar traction in patients with chronic low back pain: a crossover, repeated measures, randomized controlled trial. *Journal of Orthopaedic Science*. 2021; 26(6): 953–61.
- [34] Sung JH, Lee JM, and Kim JH. The effectiveness of ultrasound deep heat therapy for adhesive capsulitis: a systematic review and meta-analysis. *Int J Environ Res Public Health*. 2022; 19(3): 1859.