

## Dear IPNFA®Members, Dear Friends

We present the next IPNFA® Newsletter prepared by the Research Committee. Below you will find the newest articles approved by the members of our committee. You can find also information about newest events in the field of our PNF. Enjoy by reading it

In June 2024, IAPNFK held its first academic conference of Korea via YouTube livestream. Unlike previous conferences conducted through ZOOM, this format resolved issues such as video quality deterioration and stuttering. Lee Mingyu (IPNFA® Instructor Candidate) presented on the theme Shoulder Impingement G.I.R.D.

You can access the recording through the link below (note that it is in Korean).  
<https://www.youtube.com/live/WqhoMVNQnpU?si=8RKLBqmqLGY8nyn0>

Additionally, IAPNFK held its annual general meeting in June, where we are pleased to announce that Lee Byungki (IPNFA® Basic instructor) has been elected as the new President of IAPNFK.



**WE STARTED TO COLLECT DATA FROM SOME INSTRUCTORS TO THE RESEARCH PROJECT WHICH AGNIESZKA STĘPIEŃ STARTED 1 YEAR AGO. INSTRUCTORS SHOULD TRY TO DOCUMENT THE RESULTS OF PATIENTS' TREATMENT DURING PNF COURSES (ALL LEVELS) USING 2 TOOLS:**

- 1. WHOQOL-BREF questionnaire – participants fulfill it together with a patient twice: before 1 treatment and after 4 days**
- 2. Table with results of tests on the body structure/function level and activity level (instructor prints the table and writes there the results by himself).**

**Research Com created the list of recommended/ standardized tests which may be helpful for participants.**

### **WE PLANNED THE NEW RESEARCH PROJECT:**

#### **Background:**

**There is a need for checking the effectiveness of particular PNF tools using objective measurements. Braiding is a chosen intervention. It is worth to check whether it has an immediate influence on gait pattern.**

#### **Objective:**

**To check an immediate influence of braiding on gait pattern (temporo-spatial parameters)**

#### **Material:**

**Adult orthopedic and neurologic patients with hip, knee or ankle disorders who present gait asymmetry. Place: Fizjo Instytut, Warsaw, Poland**

#### **Intervention:**

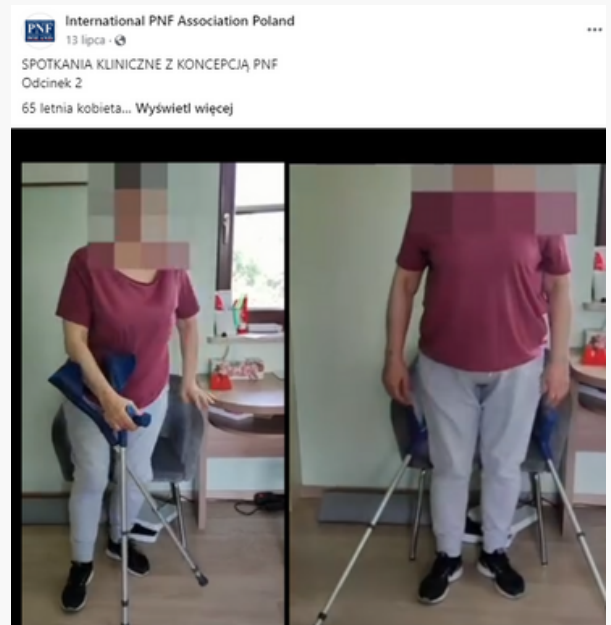
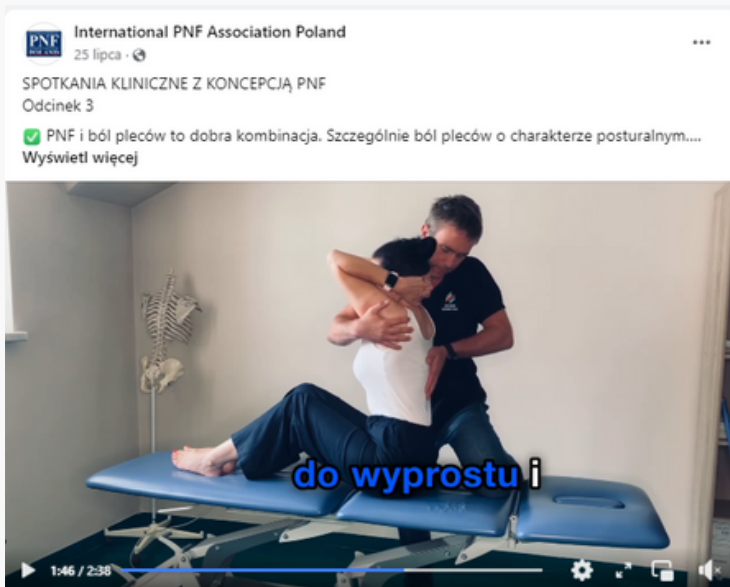
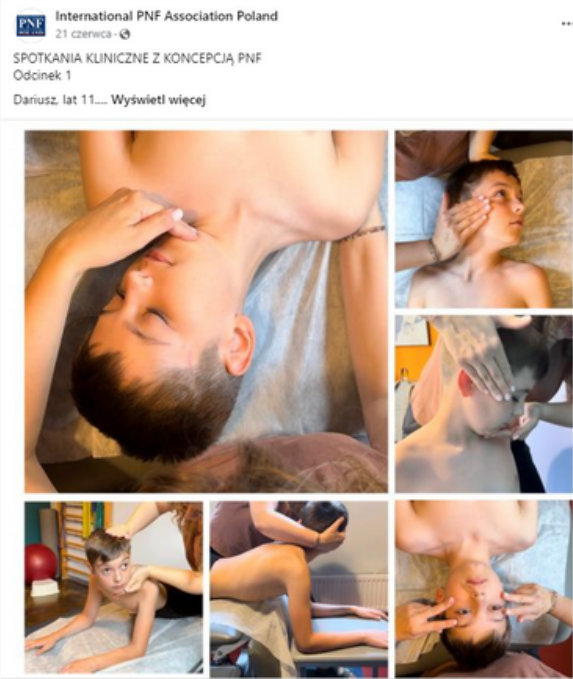
##### **Braiding (15 min)**

**Methods: Muscledlab system will be used for collecting the data about gait temporo-spatial parameters such as: number of steps, velocity and duration of gait cycle, cadence, double support, swing and stance duration, % of GCT for loading response, flat foot and pre swing. Sensors will be attached to patient's lower limbs and patient will be asked for 10 m walking test before and after one session of braiding.**



**IPNFA POLAND STARTS IN SOCIAL MEDIA A SERIES OF CLINICAL MEETINGS WITH THE PNF CONCEPT!**

In June, IPNFA Poland started a series of events promoting the PNF concept in social media. Every few weeks, members of the IPNFA Poland association publish interesting clinical cases, which are then discussed in terms of the PNF Concept. So far on IPNFA Poland social media you can find four case reports and the rest is coming.



**Effects of proprioceptive neuromuscular facilitation-based abdominal muscle strengthening training on pulmonary function, pain, and functional disability index in chronic low back pain patients**

**Abstract**

The purpose of this study was to evaluate the effect of abdominal muscle strengthening training (AMST) using proprioceptive neuromuscular facilitation (PNF) on pulmonary function, pain, and functional disability index in chronic low back pain (CLBP) patients. Thirty CLBP patients were randomly assigned to the traditional physical therapy (control) group (n=15) and PNF-AMST group (n=15). Forced expiratory volume at 1 second (FEV1) was measured to measure changes in pulmonary function. To measure the degree of pain, a visual analog scale (VAS) was used. The Oswestry Disability Index (ODI) was used to assess the disability level due to low back pain. A paired t-test was performed to compare differences within the groups before and after intervention. An independent t-test was performed to compare differences between the test and control groups. The level of significance was set at  $\alpha=0.05$ . Within-group changes in FEV1 were significantly different in the experimental group ( $P<0.01$ ), and those in VAS and ODI were significantly different in both groups (both  $P<0.01$ ). The improvements in FEV1, VAS, and ODI were significantly greater in the experimental group than in the control group ( $P<0.01$ ). This study showed that AMST using PNF was effective in enhancing pulmonary function and decreasing pain and functional disability index in patients with CLBP. We expect it to be useful as one of the programs for CLBP patients in the future.

**Keywords:** Low back pain; Oswestry Disability Index; Proprioceptive neuromuscular facilitation; Pulmonary function; Visual analog scale.

The Effects of PNF Rhythmic Dance on the Change of Static Balance Ability in Young Adults

This study was to investigate the effects of upper and lower limb composing patterns of PNF(proprioceptive neuromuscular facilitation) on the static balance ability by 20 subjects for 6 weeks. This study was measured left one leg standing and right one leg standing with closed eyes on Good Balance system. These results led us to the conclusion that the mean speed of X, Y direction, COP(center of Pressure) velocity moment showed a statistical decrease when applying post-exercise. The above results from this study indicated that upper and lower limb composing patterns of PNF exercise has improved the static balance ability.

As a result, this study showed that upper and lower limb composing patterns exercise improve the ability of balance in young adults. Based on this study, it may be applied to old people.

Key words: Proprioceptive Neuromuscular Facilitation(PNF); Good Balance System; Center of Pressure(COP); Balance

## Neuroscientific model of motivational process

### Abstract

Considering the neuroscientific findings on reward, learning, value, decision-making, and cognitive control, motivation can be parsed into three sub processes, a process of generating motivation, a process of maintaining motivation, and a process of regulating motivation. I propose a tentative neuroscientific model of motivational processes which consists of three distinct but continuous sub processes, namely reward-driven approach, value-based decision-making, and goal-directed control. Reward-driven approach is the process in which motivation is generated by reward anticipation and selective approach behaviors toward reward. This process recruits the ventral striatum (reward area) in which basic stimulus-action association is formed, and is classified as an automatic motivation to which relatively less attention is assigned. By contrast, value-based decision-making is the process of evaluating various outcomes of actions, learning through positive prediction error, and calculating the value continuously. The striatum and the orbitofrontal cortex (valuation area) play crucial roles in sustaining motivation. Lastly, the goal-directed control is the process of regulating motivation through cognitive control to achieve goals. This consciously controlled motivation is associated with higher-level cognitive functions such as planning, retaining the goal, monitoring the performance, and regulating action. The anterior cingulate cortex (attention area) and the dorsolateral prefrontal cortex (cognitive control area) are the main neural circuits related to regulation of motivation. These three sub processes interact with each other by sending reward prediction error signals through dopaminergic pathway from the striatum and to the prefrontal cortex. The neuroscientific model of motivational process suggests several educational implications with regard to the generation, maintenance, and regulation of motivation to learn in the learning environment.

**Keywords:** decision-making; educational neuroscience; goal; motivation; neuroeducation; reward; self-regulation; value.

# ENHANCED NEUROGENESIS AND CELL MIGRATION FOLLOWING FOCAL ISCHEMIA AND PERIPHERAL STIMULATION IN MICE.

WEN-LEI LI 1, SHAN PING YU, MOLLY E OGLE, XIN SHENG DING, LING WEI  
DEV NEUROBIOL. 2008 NOV;68(13):1474-86. DOI: 10.1002/DNEU.20674.

## Abstract

Peripheral stimulation and physical therapy can promote neurovascular plasticity and functional recovery after CNS disorders such as ischemic stroke. Using a rodent model of whisker-barrel cortex stroke, we have previously demonstrated that whisker activity promotes angiogenesis in the penumbra of the ischemic barrel cortex. This study explored the potential of increased peripheral activity to promote neurogenesis and neural progenitor migration toward the ischemic barrel cortex. Three days after focal barrel cortex ischemia in adult mice, whiskers were manually stimulated (15 min x 3 times/day) to enhance afferent signals to the ischemic barrel cortex. 5-Bromo-2'-deoxyuridine (BrdU, i.p.) was administered once daily to label newborn cells. At 14 days after stroke, whisker stimulation significantly increased vascular endothelial growth factor and stromal-derived factor-1 expression in the penumbra. The whisker stimulation animals showed increased doublecortin (DCX) positive and DCX/BrdU-positive cells in the ipsilateral corpus of the white matter but no increase in BrdU-positive cells in the subventricular zone, suggesting a selective effect on neuroblast migration. Neurogenesis indicated by neuronal nuclear protein and BrdU double staining was also enhanced by whisker stimulation in the penumbra at 30 days after stroke. Local cerebral blood flow was better recovered in mice that received whisker stimulation. It is suggested that the enriched microenvironment created by specific peripheral stimulation increases regenerative responses in the postischemic brain and may benefit long-term functional recovery from ischemic stroke.

**EFFECTS OF HEAD AND NECK PATTERN OF PNF COMBINED WITH CONVENTIONAL BALANCE TRAINING IN OLDER ADULTS WITH BALANCE IMPAIRMENT – A RANDOMIZED CONTROL TRIAL**

**S. KUMAR, C.M. GEORGE**

**JOURNAL OF BODYWORK AND MOVEMENT THERAPIES**

**VOLUME 40, OCTOBER 2024, PAGES 552-5562024 [HTTPS://DOI.ORG/10.1016/J.JBMT.2024.02.008](https://doi.org/10.1016/j.jbmt.2024.02.008)**

**Abstract**

**Background :** Falls are a prevalent and serious concern among individuals in their older life. Residual impairments, such as balance and gait deficiencies, reduced sensory processing, and diminished strength, are the common causes of falls. Balance and mobility deficits can last for years and are linked to a high rate of falls (>6 months). Proprioceptive Neuromuscular Facilitation is neuromuscular re-education in which sensory receptors are stimulated to provide information regarding body posture and movement.

**Objective :** To identify the effects of Head and Neck Pattern of PNF combined with Conventional Balance training in elderly.

**Methods:** A total of 40 subjects were randomly assigned to the Experimental Group (Group A) and the Control Group (Group B) (Group B). The following were the criteria for inclusion: Subjects aged 60–80 years old, of both genders, who had experienced one or more episodes of loss of balance in the previous 12 months, were ambulating independently, had a Mini-mental scale score of 24 or higher, and were ready to participate. Subjects with heart or lung disease, chronic neurological diseases, mental illness, an acute orthopaedic ailment, or a head injury were excluded.

**Results:** Group A showed greater improvement when compared to Group B ( $p < 0.05$ ) Comparison of Pre and Post values of FAB and CBMS showed significant difference ( $p < 0.05$ ).

**Conclusions:** The study provides evidence that PNF Pattern based Exercises when combined with Conventional Balance Training is effective in training individuals with balance impairment.



**EFFECTS OF CORE STRENGTHENING VERSUS LOWER LIMB PROPRIOCEPTIVE NEUROMUSCULAR  
FACILITATION TECHNIQUES ON TRUNK FUNCTION AND STABILITY**  
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**RIPHAH INTERNATIONAL UNIVERSITY, LAHORE, PAKISTAN, 2023**  
**PJPT ISSN NO: 2663-0796 (PRINT) | ISSN NO: 2663-080X (ONLINE)**

**ABSTRACT:**

**Objective:** To compare the effects of core the strengthening versus lower limb proprioceptive neuromuscular facilitation (PNF) techniques on trunk function and balance in chronic stroke patients. **Methods:** The randomized controlled trial (RCT) took place at Itiefaq hospital & Riphah Rehabilitation Centre, Lahore, Pakistan. Participants consisted of individuals of both sexes aged between 40 and 70 who were suffering from chronic stroke (6 months to 2 years). Two groups were randomly assigned; Group A received a combination of core strengthening exercises with conventional treatment, while Group B underwent PNF therapy alongside conventional treatment. Outcome measures were evaluated using the Trunk Impairment Scale (TIS) and Berg Balance Scale (BBS). **Results:** Out of 42 patients, there were 21 patients in each of the two groups. Between each group, scores for BBS and TIS showed statistically significant results, as evidenced by a p-value of exceed 0.05. Between group results were significant in case of Berg Balance Scale ( $p < 0.05$ ). **Conclusion:** The research concluded that applying core strengthening exercises and lower limb proprioceptive neuromuscular facilitation techniques enhanced the balance and trunk function in individuals with the chronic stroke.

**A CROSS-SECTIONAL STUDY TO ASSESS DUAL-TASK INTERFERENCE IN POSTURAL CONTROL IN PEOPLE WITH LOWER LIMB AMPUTATION**

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**GAIT & POSTURE, VOLUME 113, SEPTEMBER 2024, PAGES 204-208**

**[HTTPS://DOI.ORG/10.1016/J.GAITPOST.2024.06.013](https://doi.org/10.1016/j.gaitpost.2024.06.013)**

**Abstract**

**Background:** In people with lower limb amputation (LLA), the loss of limb structures and peripheral motor and sensory systems result in significant mobility challenges, including impaired postural stability. **Objective:** The primary objective of this study was to evaluate the dual-task interference (DTI) on postural control and dual-task interference on cognition during static and dynamic balance in people with LLA and compare the same with controls. The secondary objective of this study was to compare the DTI on postural control and DTI on cognition between LLA of different etiology. **Design:** Cross-sectional observational study **METHODOLOGY:** Fifteen people with unilateral LLA and 15 age and gender-matched controls participated in this study at a tertiary care hospital. The outcome measures used were anterior-posterior stability index (APSI), medial-lateral stability index, and overall stability index (OSI) using Biodex Balance System and a cognitive task parameter, namely correct response rate in serial seven subtraction test. Quantitative variables were compared using a Wilcoxon rank-sum test. Spearman's correlation test was used to establish the correlation between the DTI on cognition and the DTI on postural control. **Results:** DTI on postural control during static balance was significantly higher in people with LLA than controls (APSI, OSI). No significant difference was observed in DTI on postural control during dynamic balance. No significant difference was observed in DTI on cognition during static and dynamic balance. A significant negative correlation was observed between DTI on cognition and DTI on postural control (APSI) during static balance people with LLA. **Significance:** In people with unilateral LLA, the addition of a cognitive task results in significant deterioration of sagittal plane postural control during static balance but not during dynamic balance due to the over-allocation of resources to a cognitive task.

# A Four-Week Minimalist Shoe Walking Intervention Influences Foot Posture and Balance in Young Adults—A Randomized Controlled Trial

Anna Gabriel ,Katharina Fuchs,Bernhard Haller,Iwona Sulowska-Daszyk,Thomas Horstmann, Andreas Konrad

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## Abstract

**Introduction:** Minimalist shoes (MS) are beneficial for foot health. The foot is a part of the posterior chain. It is suggested that interventions on the plantar foot sole also affect the upper segments of the body. This study aimed to investigate the local and remote effects along the posterior chain of four weeks of MS walking in recreationally active young adults.

**Methods:** 28 healthy participants (15 female, 13 male;  $25.3 \pm 5.3$  years;  $70.2 \pm 11.9$  kg;  $175.0 \pm 7.8$  cm) were randomly assigned to a control- or intervention group. The intervention group undertook a four-week incremental MS walking program, which included 3,000 steps/day in the first week, increasing to 5,000 steps/day for the remaining three weeks. The control group walked in their preferred shoe (no MS). We assessed the following parameters in a laboratory at baseline [M1], after the four-week intervention [M2], and after a four-week wash-out period [M3]: Foot parameters (i.e., Foot Posture Index-6, Arch Rigidity Index), static single-leg stance balance, foot-, ankle-, and posterior chain range of motion, and muscle strength of the posterior chain. We fitted multiple hierarchically built mixed models to the data. **Results:** In the MS group, the Foot Posture Index ( $b = -3.72$ ,  $t(51) = -6.05$ ,  $p < .001$ ,  $[-4.94, 2.51]$ ) and balance ( $b = -17.96$ ,  $t(49) = -2.56$ ,  $p = .01$ ,  $[-31.54, 4.37]$ ) significantly improved from M1 to M2, but not all other parameters (all  $p > .05$ ). The improvements remained at M3 (Foot Posture Index:  $b = -1.71$ ,  $t(51) = -2.73$ ,  $p = .009$ ,  $[-4.94, 0.48]$ ; balance:  $b = -15.97$ ,  $t(49) = -2.25$ ,  $p = .03$ ,  $[-29.72, 2.21]$ ).

**Discussion:** Walking in MS for four weeks might be advantageous for foot health of recreationally active young adults but no chronic remote effects should be expected.

**EFFECTIVENESS OF PELVIC PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION TECHNIQUES ON BALANCE AND GAIT PARAMETERS IN CHRONIC STROKE PATIENTS: A RANDOMIZED CLINICAL TRIAL**  
**MANALI A. BOOB , RAKESH K. KOVELA. PHYSIOTHERAPY, RAVI NAIR PHYSIOTHERAPY COLLEGE, DATTA MEGHE INSTITUTE OF MEDICAL SCIENCES, WARDHA,CUREUS. 2022 OCT; 14(10): E30630.**  
**PUBLISHED ONLINE 2022 OCT 24. DOI: 10.7759/CUREUS.30630**

## **Abstract**

**Background** Stroke is the second leading reason for death and the third most common reason for disability. Stroke is a source of possible substantial harm and is often more disabling than lethal. Common stroke defects include stiffness, tiredness, loss of balance on the afflicted side, as well as gait impairment, resulting in an inability to sustain postural alignment. Pelvic proprioceptive neuromuscular facilitation (PNF) is a physical rehabilitation that combines functionally dependent diagonal activity patterns with neuromuscular facilitator strategies to improve motor behaviour, endurance, and muscle activity and control. This protocol was created to describe the experimental study design for evaluating the combined impact of pelvic PNF and task-oriented exercises in chronic stroke patients to improve balance and gait parameters. **Aim and objective** The purpose of our study is to investigate the effectiveness of pelvic PNF as well as task-oriented exercises on balance, gait parameters, and in pelvic asymmetry. **Methods** The participants (n=30) were stroke survivors who fulfilled the inclusion criteria for research and were divided into two groups. The regimen lasted four weeks and took 30 minutes each day. Patients were evaluated at the beginning and end of their treatment. In both groups, pre- and post-intervention outcome measures were recorded and the data was analyzed. **Result** Following four weeks of rehabilitation, subjects showed remarkable improvement in balance, gait parameters, and pelvic inclination in both groups, i.e., pelvic PNF and task-oriented exercises in group A and task-oriented exercises in group B, but Group A showed a major improvement in outcome measures. A p- value of less than 0.05 was considered significant. Despite the fact that both treatment regimens were successful for the patient, pelvic PNF combined with task-oriented exercises exhibits a statistically significant difference from task-oriented exercises.

**Conclusion:** Pelvic PNF along with task-oriented exercises proved to be beneficial and can help in the restoration of balance and gait parameters as a result of normalisation in the geometry and symmetry of the pelvis in stroke patients. The pelvis, which is a connecting link between the trunk and lower limbs, plays a crucial role in balance and also in lower limb performance exclusively in gait.

# EFFICACY OF BILATERAL LOWER-LIMB TRAINING OVER UNILATERAL LOWER-LIMB TRAINING TO REEDUCATE BALANCE AND WALKING IN POST-STROKE SURVIVORS: A RANDOMIZED CLINICAL TRIAL:

PALLAVI HARJPAL, MOH&#39;D IRSHAD QURESHI,CORRESPONDING AUTHOR RAKESH K KOVELA, AND MOLLI JAIN:

CUREUS. 2022 OCT 27;14(10):E30748. DOI: 10.7759/CUREUS.30748.

## Abstract

**Background and objective** While designing the rehabilitation regime of a hemiplegic patient, most physiotherapists focus on the affected/hemiparetic side. The less affected/unaffected side remains unused and loses its properties, i.e., muscle strength, girth, balance, and gait, thus causing deconditioning effects in patients&#39; overall rehabilitation. To enhance the recovery process, the focus should be drawn to training both sides equally to fasten the recovery process. The rationale behind designing this study was to maintain the integrity of the unaffected side along with rehabilitation of the affected side in hemiplegic patients. Many proven studies focus on bimanual upper-limb training in post-stroke survivors, but there is a lack of literature regarding the same in the lower limbs. This clinical trial was designed to study the effect of bilateral lower-limb training over unilateral lower-limb training on balance and walking in post-stroke survivors. **Methods** 40 hemiplegic patients were selected and randomly divided into two groups: Group A (unilateral training group (UTG)) and Group B (bilateral training group (BTG)). Patients in Group A underwent approach-oriented training using the motor relearning program (MRP) and proprioceptive neuromuscular facilitation (PNF) for the affected side, while those in Group B underwent strength training for the lower- limb muscles using DeLorme&#39;s principle for the unaffected side and approach-oriented

training using the MRP and PNF for the affected side for a period of six weeks, five days per week. A strengthening regimen was designed for the unaffected side, considering the frequency, intensity, time, and type (FITTs) principle provided by the American College of Sports Medicine (ACSM). The static and dynamic balance along with gait parameters were measured using the functional reach test (FRT), one-leg stance test (OLST), Berg balance scale (BBS), Dynamic Gait Index (DGI), gait parameters (stride length, gait velocity, and cadence), and Brunnstrom recovery stages (BRS) at the baseline and post rehabilitation.

**Results** Both groups significantly improved following therapy ( $p < 0.05$ ). Group B showed more significant results both statistically and clinically. The enhancement in the FRT (2.25,  $p < 0.03$ ), OLST (5.12,  $p < 0.0001$ ), BBS (0.68,  $p < 0.020$ ), and DGI (1.70,  $p < 0.030$ ) scores indicated improvement in static and dynamic balance in the two groups. Patients showed improvement in the stereotyped sequence of movements indicating recovery on the BRS (4.62,  $p < 0.0001$ ). The overall gait parameters in patients, i.e., gait velocity (6.78,  $p < 0.0001$ ), stride length (3.59,  $p < 0.001$ ) and cadence (6.15,  $p < 0.0001$ ), improved post rehabilitation. **Conclusion** The results of this study showed that the BTG had positive impacts on the

postural balance and walking capacities of subacute hemiparetic stroke patients, promoting early recovery in comparison to the UTG. This study also helped to design a strengthening protocol for the

# PROPRIOCEPTION FROM A SPINOCEREBELLAR PERSPECTIVE

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PMID: 11274339

DOI: 10.1152/PHYSREV.2001.81.2.539

FREE ARTICLE

## Abstract

This review explores how proprioceptive sensory information is organized at spinal cord levels as it relates to a sense of body position and movement. The topic is considered in an historical context and develops a different framework that may be more in tune with current views of sensorimotor processing in other central nervous system structures. The dorsal spinocerebellar tract (DSCT) system is considered in detail as a model system that may be considered as an end point for the processing of proprioceptive sensory information in the spinal cord. An analysis of this system examines sensory processing at the lowest levels of synaptic connectivity with central neurons in the nervous system. The analysis leads to a framework for proprioception that involves a highly flexible network organization based in some way on whole limb kinematics. The functional organization underlying this framework originates with the biomechanical linkages in the limb that establish functional relationships among the limb segments. Afferent information from limb receptors is processed further through a distributed neural network in the spinal cord. The result is a global representation of hindlimb parameters rather than a muscle-by-muscle or joint-by-joint representation.

**FUNCTIONAL MULTIDISCIPLINARY REHABILITATION VERSUS OUTPATIENT PHYSIOTHERAPY FOR  
NON SPECIFIC LOW BACK PAIN: RANDOMIZED CONTROLLED TRIAL**

**YVES HENCHOZ 1, PIERRE DE GOUMOËNS, ALEXANDER KAI LIK SO, ROLAND PAILLEX**

**AFFILIATIONS EXPAND**

**PMID: 21181567**

**DOI: 10.4414/SMW.2010.13133**

**FREE ARTICLE**

**ABSTRACT**

**Introduction:** In recent decades the treatment of non-specific low back pain has turned to active modalities, some of which were based on cognitive-behavioural principles. Non-randomised studies clearly favour functional multidisciplinary rehabilitation over outpatient physiotherapy. However, systematic reviews and meta-analysis provide contradictory evidence regarding the effects on return to work and functional status. The aim of the present randomised study was to compare long-term functional and work status after 3-week functional multidisciplinary rehabilitation or 18 supervised outpatient physiotherapy sessions.

**Methods:** 109 patients with non-specific low back pain were randomised to either a 3-week functional multidisciplinary rehabilitation programme, including physical and ergonomic training, psychological pain management, back school and information, or 18 sessions of active outpatient physiotherapy over 9 weeks. Primary outcomes were functional disability (Oswestry) and work status. Secondary outcomes were lifting capacity (Spinal Function Sort and PILE test), lumbar range-of-motion (modified-modified Schöber and fingertip-to-floor tests), trunk muscle endurance (Shirado and Biering-Sørensen tests) and aerobic capacity (modified Bruce test).

**Results:** Oswestry disability index was improved to a significantly greater extent after functional multidisciplinary rehabilitation compared to outpatient physiotherapy at follow-up of 9 weeks ( $P = 0.012$ ), 9 months ( $P = 0.023$ ) and 12 months ( $P = 0.011$ ). Work status was significantly improved after functional multidisciplinary rehabilitation only ( $P = 0.012$ ), resulting in a significant difference compared to outpatient physiotherapy at 12 months' follow-up ( $P = 0.012$ ). Secondary outcome results were more contrasted.

**Conclusions:** Functional multidisciplinary rehabilitation was better than outpatient physiotherapy in improving functional and work status. From an economic point of view, these results should be backed up by a cost-effectiveness study.

# **EFFECT OF CORE STRENGTHENING WITH PELVIC PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION ON TRUNK, BALANCE, GAIT, AND FUNCTION IN CHRONIC STROKE**

**VISHAL SHARMA 1, JASKIRAT KAUR 2**

**AFFILIATIONS EXPAND**

**PMID: 28503533**

**PMCID: PMC5412494**

**DOI: 10.12965/JER.1734892.446**

## **ABSTRACT**

The purpose of this study was to evaluate the effects of core strengthening combined with pelvic proprioceptive neuromuscular facilitation (PNF) on trunk impairment, balance, gait, and functional ability of chronic stroke patients. Twenty-three participants with chronic stroke were recruited and randomly allocated to one of the two groups: core strengthening combined with pelvic PNF (group 1, n=13), and pelvic PNF with trunk flexibility exercises (group 2, n=10). Intervention was given to both groups for 60 min per session 5 times per week for 4 weeks. Performance of both groups was evaluated on Trunk Impairment Scale, Tinetti Performance Oriented Mobility Assessment (Tinetti-POMA), Balance Evaluation Systems Test (Mini-BESTest), Wisconsin Gait Scale, and Barthel Activities of Daily Living Index prior to and after the completion of the intervention. The comparison between postintervention scores of Tinetti-POMA between group 1 (18.76±1.78) and group 2 (16.8±1.87) and Mini-BESTest group 1 (16.15±1.28) and group 2 (14.7±1.41) showed significant difference (P=0.018). The results indicated that core stabilisation combined with pelvic PNF was more effective for improving trunk impairment, balance and gait of chronic stroke patients.

**Keywords: Balance; Core strengthening; Gait; Proprioceptive neuromuscular facilitation; Stroke.**



EXERCISE-INDUCED HYPOALGESIA FOLLOWING PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION AND RESISTANCE TRAINING AMONG INDIVIDUALS WITH SHOULDER MYOFASCIAL PAIN: RANDOMIZED CONTROLLED TRIAL

JMIRX MED . 2022 DEC 27;3(4):E40747. DOI: 10.2196/40747.

**Abstract**

**Background:** Various exercises can attenuate pain perception in healthy individuals and may interact with the descending pain modulation in the central nervous system. However, the analgesic effects of exercise in patients with myofascial pain can be disrupted by the pathological changes during chronic pain conditions. Thus, the exercises targeted on the facilitation of the sensory-motor interaction may have a positive impact on the restoration of the descending pain modulation and the analgesia effects.

**Objective:** This paper estimates the effect of proprioceptive neuromuscular facilitation (PNF) and resistance training on exercise-induced hypoalgesia (EIH) and conditioned pain modulation (CPM) among patients with myofascial pain syndrome.

**Methods:** A total of 76 female patients with myofascial pain syndrome (aged 18-30 years), with the pain in the upper trapezius and a visual analog scale score of greater than 30/100 mm, were enrolled in the study. Participants were randomly assigned into 3 intervention groups, including isometric (n=18, 24%), isotonic (n=19, 25%), and PNF (n=20, 26%) exercises, as well as 1 control group (n=19, 25%) with no intervention. Pressure pain threshold and the CPM responses at the myofascial trigger point, arm, and leg sites were assessed before and after the exercise session. The effective EIH response was reflected in the improvement of pressure pain thresholds.

**Results:** There was an increase in pressure pain thresholds and CPM responses at trigger point ( $P<.001$  and  $P<.001$ ), arm ( $P<.001$  and  $P<.001$ ), and leg sites ( $P<.001$  and  $P=.03$ ) in participants who performed PNF and isotonic exercise, while the isometric exercise only increased pressure pain thresholds at leg sites ( $P=.03$ ). Compared with the control group, both the isotonic ( $P=.02$ ) and PNF ( $P<.001$ ) groups showed greater EIH responses at the trigger points. In comparison to the control group, only the PNF exercise ( $P=.01$ ) significantly improved pressure pain thresholds and CPM responses at arm and leg sites compared to the control group.

**Conclusions:** PNF, isotonic, and isometric exercises could lead to local and global EIH effects. The improvement in CPM response following PNF and isotonic exercises suggested that the EIH mechanisms of different resistance exercises may be attributed to the enhancement of the endogenous pain modulation via the motor-sensory interaction from the additional eccentric and dynamic muscle contraction.

**Trial registration:** Chinese Clinical Trial Registry ChiCtr202111090819166165; <https://tinyurl.com/2ab93p7n>.

**Keywords:** PNF; chronic pain; conditioned pain modulation; exercise; exercise induced hypoalgesia; exercise-induced hypoalgesia; hypoalgesia; musculoskeletal pain; myofascial pain; myofascial pain syndrome; pain; pain management; physical therapy; physiotherapy; proprioceptive neuromuscular facilitation; resistance exercise; resistance training; shoulder myofascial pain; shoulder pain; upper back pain.

## Abstract

**[Purpose]** The purpose of this case study was to identify the effects of independent and intensive therapeutic exercise using Proprioceptive neuromuscular facilitation on the size of calcium deposits, pain self-awareness, and shoulder joint function in a patient with calcific tendonitis.

**[Subject and Methods]** The subject was a 42-year-old female patient with calcific tendonitis and acute pain who had difficulty with active movement and problems with general function. The independent and intensive Proprioceptive neuromuscular facilitation exercise was applied for 40 min twice a day five times a week for two weeks for a total of 20 times. An X-ray, the visual analog scale, a simple shoulder test, the Constant-Murley Scale, and passive range of motion was used to evaluate the patient's change.

**[Results]** The size of the calcium deposit, the visual analog scale score, and the simple shoulder test score decreased. The Constant-Murley Scale score and the passive range of motion were increased.

**[Conclusion]** The results of this study suggested that intensive and independent therapeutic short-term exercise without any other exercise reduced pain and produced positive effects in shoulder function in a patient with the calcific tendonitis, which could confirm the importance of therapeutic exercise in the treatment of calcific tendonitis.

**Keywords:** Calcific tendinitis; PNF; Shoulder joint.

G BOSCO 1, R E POPPELE

PROPRIOCEPTION FROM A SPINOCEREBELLAR PERSPECTIVE

PHYSIOL REV . 2001 APR;81(2):539-68. DOI: 10.1152/PHYSREV.2001.81.2.539.

#### ABSTRACT

This review explores how proprioceptive sensory information is organized at spinal cord levels as it relates to a sense of body position and movement. The topic is considered in an historical context and develops a different framework that may be more in tune with current views of sensorimotor processing in other central nervous system structures. The dorsal spinocerebellar tract (DSCT) system is considered in detail as a model system that may be considered as an end point for the processing of proprioceptive sensory information in the spinal cord. An analysis of this system examines sensory processing at the lowest levels of synaptic connectivity with central neurons in the nervous system. The analysis leads to a framework for proprioception that involves a highly flexible network organization based in some way on whole limb kinematics. The functional organization underlying this framework originates with the biomechanical linkages in the limb that establish functional relationships among the limb segments. Afferent information from limb receptors is processed further through a distributed neural network in the spinal cord. The result is a global representation of hindlimb parameters rather than a muscle-by-muscle or joint-by-joint representation.

## RANDOMIZED CONTROLLED TRIAL

YVES HENCHOZ 1, PIERRE DE GOUMOËNS, ALEXANDER KAI LIK SO, ROLAND PAILLEX

FUNCTIONAL MULTIDISCIPLINARY REHABILITATION VERSUS OUTPATIENT PHYSIOTHERAPY FOR NON SPECIFIC LOW BACK PAIN: RANDOMIZED CONTROLLED TRIAL

YVES HENCHOZ 1, PIERRE DE GOUMOËNS, ALEXANDER KAI LIK SO, ROLAND PAILLEX

SWISS MED WKLY . 2010 DEC 22:140:W13133. DOI: 10.4414/SMW.2010.13133. ECOLLECTION 2010.

### Abstract

**Introduction:** In recent decades the treatment of non-specific low back pain has turned to active modalities, some of which were based on cognitive-behavioural principles. Non-randomised studies clearly favour functional multidisciplinary rehabilitation over outpatient physiotherapy. However, systematic reviews and meta-analysis provide contradictory evidence regarding the effects on return to work and functional status. The aim of the present randomised study was to compare long-term functional and work status after 3-week functional multidisciplinary rehabilitation or 18 supervised outpatient physiotherapy sessions.

**Methods:** 109 patients with non-specific low back pain were randomised to either a 3-week functional multidisciplinary rehabilitation programme, including physical and ergonomic training, psychological pain management, back school and information, or 18 sessions of active outpatient physiotherapy over 9 weeks. Primary outcomes were functional disability (Oswestry) and work status. Secondary outcomes were lifting capacity (Spinal Function Sort and PILE test), lumbar range-of-motion (modified-modified Schöber and fingertip-to-floor tests), trunk muscle endurance (Shirado and Biering-Sørensen tests) and aerobic capacity (modified Bruce test).

**Results:** Oswestry disability index was improved to a significantly greater extent after functional multidisciplinary rehabilitation compared to outpatient physiotherapy at follow-up of 9 weeks ( $P = 0.012$ ), 9 months ( $P = 0.023$ ) and 12 months ( $P = 0.011$ ). Work status was significantly improved after functional multidisciplinary rehabilitation only ( $P = 0.012$ ), resulting in a significant difference compared to outpatient physiotherapy at 12 months' follow-up ( $P = 0.012$ ). Secondary outcome results were more contrasted.

**Conclusions:** Functional multidisciplinary rehabilitation was better than outpatient physiotherapy in improving functional and work status. From an economic point of view, these results should be backed up by a cost-effectiveness study.

WOJCIECH BOROWICZ 1, KUBA PTASZKOWSKI 2, LUCYNA PTASZKOWSKA 3, JOANNA ROSIŃCZUK 4, EUGENIA MURAWSKA-CIAŁOWICZ 5

ASSOCIATION BETWEEN SERUM VITAMIN D LEVELS AND PHYSICAL OUTCOMES OF PATIENTS WHO UNDERWENT REHABILITATION FOLLOWING ISCHEMIC STROKE

MED SCI MONIT . 2023 MAY 30;29:E940115. DOI: 10.12659/MSM.940115.

ABSTRACT

**BACKGROUND** Ischemic stroke is the most common cause of disability in adults. Deficiency of vitamin D in patients with cardiovascular diseases is increasing. Only a few studies have assessed the relationship between serum vitamin D levels and functional capacity and degree of disability. This study aimed to evaluate the association between serum vitamin D levels and physical outcomes of 94 patients who underwent physical rehabilitation following ischemic stroke.

**MATERIAL AND METHODS** A group of 94 patients was enrolled; however, 80 patients (61.8±6.9 years) were included. They underwent a 6-week rehabilitation using proprioceptive neuromuscular facilitation (PNF, 60 min daily), mirror therapy (MT, 30 min daily), and occupational therapy (OT, 45 min daily). The Barthel Index (BI) and modified Rankin scale (mRS) were used for functional assessments. Laboratory blood tests for serum vitamin D and insulin-like growth factor 1 (IGF-1) levels were conducted.

**RESULTS** There was a significant increase in BI scores (median difference=2.0 points [pts];  $P<0.001$ ) and IGF levels (median difference=124.6 ng/ml;  $P<0.001$ ) after rehabilitation. There was a significant decrease in mRS scores (median difference=7.0 pts;  $P<0.001$ ), but there was no significant difference in vitamin D levels ( $P=0.40$ ). The effect of age ( $B=-0.01$ ,  $P=0.04$ ) and serum vitamin D level ( $B=-0.02$ ,  $P=0.01$ ) on the BI score was demonstrated. The effect of body mass index (BMI) results ( $B=-0.07$ ,  $P=0.02$ ) on the mRS score was observed.

**CONCLUSIONS** Lower serum vitamin D levels and more advanced age may be associated with worse functional outcomes in first-ever ischemic stroke patients.

## THE MEANINGS OF SALUTOGENESIS

JANUARY 2017 DOI:10.1007/978-3-319-04600-6\_2 IN BOOK: THE HANDBOOK OF SALUTOGENESIS (PP.7-13)

### Abstract

The term salutogenesis is associated with a variety of meanings that Aaron Antonovsky introduced in his 1979 book *Health, Stress and Coping* and expounded in many subsequent works. In its most thoroughly explicated meaning, salutogenesis refers to a model described in detail in *Health, Stress and Coping*, which posits that life experiences help shape one's sense of coherence (a global orientation); life is understood as more or less comprehensible, meaningful and manageable. A strong sense of coherence helps one mobilise resources to cope with stressors and manage tension successfully. Through this mechanism, the sense of coherence helps determine one's movement on the health Ease/Dis-ease continuum. In its most particular meaning, salutogenesis is almost equivalent to the sense of coherence. In its more general meaning, salutogenesis refers to a scholarly orientation focusing attention on the study of the origins of health, contra the origins of disease. Salutogenesis—model, sense of coherence and orientation—is in harmony with developments across the social sciences that seek better understanding of positive aspects of human experience. For instance, the key concepts of salutogenesis, of positive psychology and of positive organisational behaviour are consonant even if the terminologies are not uniform. It is therefore quite easy to label research and practice in these arenas as having a salutogenic orientation, and use the salutogenesis umbrella metaphor to embrace the cornucopia of scholarly ideas. Among these is the quite specific idea of the sense of coherence, and this meaning of salutogenesis is dominant, at least in the health promotion literature. This is so much so that some equate salutogenesis with the sense of coherence and refer to the sense of coherence as a model or theory (rather than as part of the salutogenic model). This book is about salutogenesis in all these meanings, which are briefly characterised in this chapter, to set the stage for the chapters that follow. We also briefly discuss salutogenesis in relation to other concepts within and beyond the health arena, with which salutogenesis has important kinship.

BENGT LINDSTRÖM 1, MONICA ERIKSSON  
SALUTOGENESIS

J EPIDEMIOL COMMUNITY HEALTH . 2005 JUN;59(6):440-2. DOI: 10.1136/JECH.2005.034777.

**Abstract**

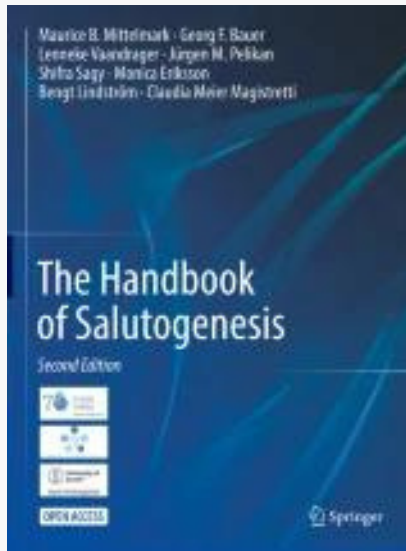
The editor of the journal has taken the initiative to develop glossaries on central concepts in health promotion. The aim of this paper is to explain and clarify the key concepts of the salutogenic theory sense of coherence coined by Aaron Antonovsky. The explanations and interpretations are the result of an analysis of the scientific evidence base of the first 25 years of salutogenic research, described and discussed in an ongoing project on a systematic review by the above authors. The contemporary evidence shows the salutogenic approach could have a more central position in public health and health promotion research and practice. Furthermore, it could contribute to the solution of some of the most urgent public health problems of our time such as the question of mental health promotion. Finally, it could create a solid theoretical framework for health promotion.

## THE HANDBOOK OF SALUTOGENESIS, 2ND EDITION

EDITORS: MAURICE B. MITTELMARK, DR. GEORG F. BAUER, LENNEKE VAANDRAGER, PROF. DR. JÜRGEN M. PELIKAN, PROF. SHIFRA SAGY, MONICA ERIKSSON, BENGT LINDSTRÖM, AND PROF. DR. CLAUDIA MEIER MAGISTRETTI.

### EDITOR INFORMATION

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THE INTRAMUSCULAR ACTIVATION OF SCAPULAR STABILIZING MUSCLES DURING PUSH-UP PLUS AND PNF EXERCISES IN A QUADRUPED POSITION APRIL 2013

JOURNAL OF PHYSICAL THERAPY SCIENCE 25(4):371-374 25(4):371-374 DOI:10.1589/JPTS.25.371

**Abstract**

**[Purpose]** The purpose of this study was to identify the upper trapezius/serratus anterior (UT/SA) ratio and the intramuscular activation of scapular stabilizing muscles during proprioceptive neuromuscular facilitation (PNF) and push-up plus (PUP) exercises in a quadruped position.

**[Subjects and Methods]** Fourteen healthy men voluntarily participated as research subjects for this experiment. All subjects were measured in terms of the activation of their scapular stabilizing muscles using surface electromyography during random PNF and PUP exercises in a quadruped position.

**[Results]** The PUP exercise showed a significantly higher level of middle serratus anterior activity than the PNF exercise. The PNF exercise showed statistically significant higher level of lower trapezius and lower serratus anterior activities than the PUP exercise. There was a significantly lower UT/LSA ratio in the PNF than in the PUP exercise.

**[Conclusion]** The PUP exercise is more suitable for middle serratus anterior training than the PNF exercise. Furthermore, the PNF exercise is more effective than the PUP exercise as a training method for lower trapezius and lower serratus muscles and an unbalanced UT/LSA ratio.

ELECTROMYOGRAPHIC ANALYSIS OF KNEE PUSH UP PLUS VARIATIONS: WHAT IS THE INFLUENCE OF THE KINETIC CHAIN ON SCAPULAR MUSCLE ACTIVITY?

BR J SPORTS MED. 2010 NOV;44(14):1010-5. DOI: 10.1136/BJSM.2009.062810. EPUB 2009 SEP 14.

**Abstract**

**Objective:** First, to look for appropriate closed kinetic chain exercises to restore intramuscular imbalance between upper trapezius (UT) and serratus anterior (SA) in overhead athletes. Second, to determine the influence of using diagonal pattern muscle recruitment during knee push up plus (KPP) exercises on scapular electromyographic activity.

**Design:** Single group repeated-measures design.

**Setting:** Controlled laboratory study.

**Participants:** Thirty-two physically active individuals in good general health who did not have a history of neck and/or shoulder injury or surgery nor participated in high-level overhead sports or performed upper limb strength training for more than 5 h/week. **Interventions** Subjects performed the standard KPP and six variations.

**Main outcome measurements:** Electromyographic activity of the three trapezius parts and the SA.

**Results:** Four exercises with a low UT/SA can be selected for rehabilitation of intramuscular balance: standard KPP, KPP with homolateral leg extension, KPP with a wobble board and homolateral leg extension and one-handed KPP. The use of a wobble board during KPP exercises and performance on one hand has no influence on SA electromyographic activity. Heterolateral leg extension during KPP stimulates lower trapezius activity, whereas homolateral leg extension stimulates SA activity.

**Conclusions:** In case of intramuscular scapular imbalance, some exercises are preferable over others because of their low UT/SA ratio. The use of a kinetic chain approach during KPP exercises influences scapular muscle activity.

YU OKUBO 1, KOJI KANEOKA, ATSUSHI IMAI, ITSUO SHIINA, MASAKI TATSUMURA, SHIGEKI IZUMI, SHUMPEI MIYAKAWA

ELECTROMYOGRAPHIC ANALYSIS OF TRANSVERSUS ABDOMINIS AND LUMBAR MULTIFIDUS USING WIRE ELECTRODES DURING LUMBAR STABILIZATION EXERCISES

J ORTHOP SPORTS PHYS THER . 2010 NOV;40(11):743-50. DOI: 10.2519/JOSPT.2010.3192.

**Abstract**

**Study design:** Experimental laboratory study.

**Objectives:** To measure trunk muscle activity using wire electrodes during lumbar stabilization exercises and to examine if more effective exercises to activate the deep trunk muscles (local muscles) exist.

**Background:** Lumbar stabilization exercises are performed to improve motor control of trunk muscles. However, the magnitude of activation of local muscles during lumbar stabilization exercises is not clear.

**Methods:** Nine healthy men with no history of lumbar spine disorders participated in the study. Fine-wire electrodes were inserted into the transversus abdominis (TrA) and lumbar multifidus, bilaterally. In addition, surface electrodes were attached to the rectus abdominis, external obliques, and erector spinae, bilaterally. Electromyographic signal amplitude was measured during the following exercises: elbow-toe, hand-knee, back bridge, side bridge, and curl-up. Two-way analyses of variance were used to compare muscle activity level among exercises and between sides for each muscle.

**Results:** The exercise showing the greatest activity level for the TrA was elbow-toe exercise with contralateral arm and leg lift. In addition, for the TrA, a significant side-to-side difference in activation level was demonstrated for 7 of the 11 exercises that were performed. The activity level of the multifidus was greatest during the back bridge exercises. The curl-up exercise generated the highest activity level for the rectus abdominis and the back bridge, with single-leg lift exercises generating the highest erector spinae activity.

**Conclusions:** The exercises investigated in this study resulted in a wide range of effort level for all 5 muscles monitored. Many of the exercises also resulted in an asymmetrical (right versus left side) activation level for a muscle, including the TrA.

ELECTROMYOGRAPHIC ANALYSIS OF GLUTEUS MAXIMUS, GLUTEUS MEDIUS, AND TENSOR FASCIA LATAE  
DURING THERAPEUTIC EXERCISES WITH AND WITHOUT ELASTIC RESISTANCE

INT J SPORTS PHYS THER . 2018 AUG;13(4):668-675. PMID: 30140560 PMCID: PMC6088126

**Abstract**

**Background:** Strengthening and activation of the gluteus maximus and gluteus medius while minimizing the contribution of the tensor fascia latae are important components in the treatment of many lower limb injuries. Previous researchers have evaluated a myriad of exercises that activate the gluteus maximus (GMax) and gluteus medius (GMed), however, limited research has been performed describing the role of the addition of elastic resistance to commonly used exercises.

**Purpose:** The primary purpose of this study was to determine the gluteal-to-tensor fascia latae muscle activation (GTA index) and compare electromyographic muscle activation of the GMax, GMed, and TFL while performing 13 commonly prescribed exercises designed to target the GMax and GMed. The secondary purpose of this study was to compare muscle activation of the GMax, GMed, and TFL while performing a subgroup of three matched exercises with and without elastic resistance.

**Study design:** Repeated measures cohort study.

**Methods:** A sample of 11 healthy, physically active male and females, free of low back pain and lower extremity injuries, were recruited for the study. Surface electromyography was used to quantify the normalized EMG activation of the gluteus maximus, gluteus medius, and tensor fascia latae while performing 13 exercises. Three of these exercises were performed with and without elastic resistance. The maximal voluntary isometric contraction was established for each muscle and order in which the exercises were performed was randomized to minimize the effect of fatigue.

**Results:** The relative activation of the gluteal muscles were compared to the tensor fascia latae and expressed as the GTA index. Clams with and without resistance, running man gluteus maximus exercise on the stability trainer, and bridge with resistance, generated the highest GTA index respectively. Significant differences in activation of the TFL occurred between clams with and without resistance.

**Conclusions:** The findings are consistent with those of previous investigators who reported that the clam exercise optimally activated the gluteal muscles while minimizing tensor fascia latae activation.

**Levels of evidence:** Level 2b.

**Keywords:** Elastic resistance; electromyography; gluteus maximus; gluteus medius.

RICHARD A. EKSTROM, ROBERT A. DONATELLI, KENJI C. CARP,  
ELECTROMYOGRAPHIC ANALYSIS OF CORE  
TRUNK, HIP, AND THIGH MUSCLES DURING 9 REHABILITATION EXERCISES J ORTHOP SPORTS  
PHYS THER 2007;37(12):754-762. DOI:10.2519/

**Abstract**

**Study design:** Prospective, single-group, repeated-measures design.

**Objective:** To identify exercises that could be used for strength development and the exercises that would be more appropriate for endurance or stabilization training.

**Background:** The exercises analyzed are often used in rehabilitation programs for the spine, hip, and knee. They are active exercises using body weight for resistance; thus a clinician is unable to determine the amount of resistance being applied to a muscle group. Electromyographic (EMG) analysis can provide a measure of muscle activation so that the clinician can have a better idea about the effect the exercise may have on the muscle for strength, endurance, or stabilization.

**Methods and measures:** Surface EMG analysis was carried out in 19 males and 11 females while performing the following 9 exercises: active hip abduction, bridge, unilateral-bridge, side-bridge, prone-bridge on the elbows and toes, quadruped arm/lower extremity lift, lateral step-up, standing lunge, and using the Dynamic Edge. The rectus abdominis, external oblique abdominis, longissimus thoracis, lumbar multifidus, gluteus maximus, gluteus medius, vastus medialis obliquus, and hamstring muscles were studied.

**Results:** In healthy subjects, the lateral step-up and the lunge exercises produced EMG levels greater than 45% maximum voluntary isometric contraction (MVIC) in the vastus medialis obliquus, which suggests that they may be beneficial for strengthening that muscle. The side-bridge exercise could be used for strengthening the gluteus medius and the external oblique abdominis muscles, and the quadruped arm/lower extremity lift exercise may help strengthen the gluteus maximus muscle. All the other exercises produced EMG levels less than 45% MVIC, so they may be more beneficial for training endurance or stabilization in healthy subjects.

**Conclusion:** Our results suggest these exercises could be used for a core rehabilitation or performance enhancement program. Depending on the individual needs of a patient or athlete, some of the exercises may be more beneficial than others for achieving strength.

## ABSTRACT

**Context:** Weakness of the gluteus medius and gluteus maximus is associated with a variety of musculoskeletal disorders. However, activation of synergistic muscles that are not targeted should be considered when prescribing side-lying hip-abduction (SHA) exercises. Log-rolling positions may affect hip-abductor activity during SHA.

**Objective:** To determine the effects of log-rolling positions on gluteus medius, gluteus maximus, and tensor fasciae latae activity during SHA in participants with gluteus medius weakness.

**Design:** Controlled laboratory study.

**Setting:** University research laboratory.

**Patients or other participants:** Twenty-one participants with gluteus medius weakness.

**Intervention(s):** Three types of SHA were performed: frontal-plane SHA in neutral position (SHA-neutral), frontal-plane SHA in anterior log-rolling position (SHA-anterior rolling), and frontal-plane SHA in posterior log-rolling position (SHA-posterior rolling).

**Main outcome measure(s):** Surface electromyography was used to measure hip-abductor activity. One-way repeated-measures analysis of variance was calculated to assess the statistical significance of the muscle activity.

**Results:** The SHA-anterior rolling showed greater gluteus medius and gluteus maximus activation than the SHA-neutral ( $P = .003$  and  $P < .001$ , respectively) and SHA-posterior rolling ( $P < .001$  and  $P < .001$ , respectively). The SHA-neutral demonstrated greater gluteus medius and gluteus maximus activation than the SHA-posterior rolling ( $P < .001$  and  $P = .001$ , respectively). The SHA-anterior rolling produced less tensor fasciae latae activation than the SHA-neutral ( $P < .001$ ) and SHA-posterior rolling ( $P < .001$ ). The SHA-neutral showed less tensor fasciae latae activation than the SHA-posterior rolling ( $P < .001$ ).

**Conclusions:** The SHA-anterior rolling may be an effective exercise for increasing activation of the gluteus medius and gluteus maximus while decreasing activation of the tensor fasciae latae in participants with gluteus medius weakness.

**Keywords:** exercise; muscles; recovery of function; surface electromyography.

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HANDBOOK OF BEHAVIORAL NEUROSCIENCE

VOLUME 25, 2018, PAGES 239-251

CHAPTER 23 - ASCENDING ACTIVATING SYSTEMS OF THE BRAIN FOR EMOTIONAL AROUSAL

### ABSTRACT

The chapter describes two anatomically and neurochemically distinct ascending tegmental reticular systems that are responsible for the initiation and maintenance of emotional arousal and, eventually, the development of the emotional state. The initiation of emotional arousal in rats is accompanied by the emission of valence-specific ultrasonic vocalizations (USVs) that served as a measure of this arousal. Activity of the ascending mesolimbic cholinergic system initiates the aversive (negative) arousal and subsequent emission of 22-kHz USVs while the activity of the ascending mesolimbic dopaminergic system initiates the appetitive (positive) arousal and subsequent emission of 50-kHz USVs. The chapter describes anatomical localization, projections, terminal regions, and functions of the mesolimbic cholinergic system from the laterodorsal tegmental nucleus and the mesolimbic dopaminergic system from the ventral tegmental area.

MIN SUN CHOI, DONG KYU LEE

THE EFFECT OF KNEE JOINT TRACTION THERAPY ON PAIN, PHYSICAL FUNCTION, AND DEPRESSION IN PATIENTS  
WITH DEGENERATIVE ARTHRITIS

J KOR PHYS THER 2019;31(5):317-321

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**Abstract**

**Purpose:**

To identify the effect of knee joint traction therapy on pain, physical function, and depression in patients with degenerative arthritis.

**Methods:**

In total, 30 patients with degenerative arthritis were randomly assigned to one of two groups: the experimental group, who underwent knee joint traction therapy, and the control group, who underwent general physical therapy (15 patients per group). Pain was measured using the visual analogue scale (VAS), physical function was measured using the Western ontario and McMaster universities osteoarthritis (WOMAC) index, and depression was measured using the Beck depression inventory (BDI). The VAS, WOMAC score, and BDI score were recorded before and after the 4-week treatment.

**Results:**

As a result of comparison within groups, the experimental and control group showed significant difference for VAS, WOMAC and BDI after the experiment ( $p < 0.05$ ). In comparison between the two groups, the experimental group in which knee joint traction was applied showed more significant change in VAS, WOMAC and BDI than the control group ( $p < 0.05$ ).

**Conclusion:**

This study showed that knee joint traction therapy was effective in improving pain, physical function, and depression in patients with degenerative arthritis.

**Keywords :** Knee joint traction, VAS, WOMAC, BDI