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August 2016

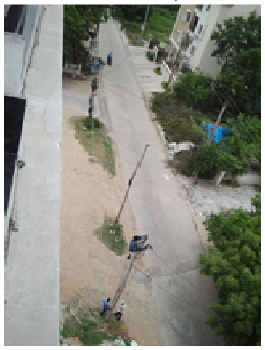
Newsletter IPNFA research committee

An exciting time went by. The Olympics are still in progress at the moment we design the newsletter edition August 2016. We know we all saw perfect PNF pattern. The most perfect use of pattern movement resulted most of the time in Gold, Silver and Bronze medals. Even the IPNFA was present. Shige accompanied a Japanese athlete (Table tennis) as her PT at the Olympics. Hence, the IPNFA was represented in Rio. Unfortunately the athletes' management did not allowed to share photos or information from the Rio activities.
As reported at the meeting in Vallejo, the research committee members of 2014/2015 summarized the available literature in a narrative review. It was submitted in April 2015 to Physical Therapy Reviews (PTR journal). The manuscript has been accepted for publication after a review process and now the article is available online in PTR journal. It will be printed in one of the upcoming editions of the journal. In the review process we received very good and nice guidance and advice from Stephen Schmidt from the Vallejo staff. The abstract is presented in this newsletter.
I wish a joyful reading. Fred.

This Newsletter is edited while teaching a PNF basic course in Hyderabad, India
Here some impressions. 1)The course room, 2) Lunch break, 3) practical training session.



In India I experienced a friendly atmosphere and I was welcomed at the first day with beautiful flowers. The participants are focused in all class sections and are keen on research outcomes and on conducting research themselves. Furthermore the cultural aspect is interesting, to my personal view there is a wide social span in relation to economic status, all present and visible within a view hundred meters. 1) Unsecured working circumstances. 2) Dirt. 3) Nice "green streets".



From Marcel we received a publication in German Together with Savas and Sakis (See last newsletter; *Mavromoustakos et al.)* this publication is competing in the publication prize 2016.

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Muskelsache

HANDS-ON: PNF-TECHNIKEN FÜR DIE SCHULTER PNF bietet zahlreiche Möglichkeiten, muskulär bedingte Einschränkungen im Schultergelenk zu behandeln. IPNFA-Instruktor Marcel Grzebellus beschreibt fünf Maßnahmen zur Schultermobilisation und ergänzt diese durch Videos aus Thiemes E-Learning-Plattform „physiofortbildung".

In English translated:

Muscle matter

Hands-on: PNF-Techniques for the shoulder

PNF offers a great array of possibilities to treat muscular restrictions of the shoulder joint. IPNFA-Instructor Marcel Grzebellus describes five applications for shoulder mobilization and is supplementing those additionally by video clips from the Thieme E-Learning platform "*physiofortbildung*

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An electromyographic investigation of the pattern of overflow facilitated by manual resistive proprioceptive neuromuscular facilitation in young healthy individuals: a preliminary study

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Abstract

Aim: To investigate the pattern of overflow facilitated by the use of resistive proprioceptive neuromuscular facilitation (PNF). *Method*: In a group of 12 young, healthy individuals, recruitment of electrical activity into the tibialis anterior (TA) muscle of the right lower limb (RLL) was assessed using surface electromyography (sEMG) during a random-sequence application of manually-resistive PNF to the other three limbs. *Results*: Resistance exercise applied to the left lower limb (LLL) was associated with a considerable increase in sEMG activity in the RLL TA muscle compared to its baseline level ($p = 0.001$). Resistance exercise applied to the right or left upper limbs (RUL or LUL) respectively showed similar sEMG activity in RLL TA muscle to its baseline level. *Conclusion*: A resistance exercise would appear to be effective in producing electrical activity in the contralateral homologous muscles of non-exercised limb.

Keywords

Electromyography, irradiation, muscle stretching exercises, overflow, proprioception

History

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The proprioceptive neuromuscular facilitation-concept; the state of the evidence, a narrative review

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Introduction: The proprioceptive neuromuscular facilitation-concept (PNF-concept) is a widely used rehabilitation concept, and is in many countries part of the undergraduate curriculum of physiotherapy education. It is also offered in postgraduate training worldwide. The modern physiotherapist is confronted with the application of evidence-based practice; therefore, the aim of this review is to summarize the available evidence for this rehabilitation concept.
Method: A search was completed using Pubmed, ScienceDirect, PEDro, Cochrane library and the International PNF Association website. An evidence-based practice approach has been promoted in the field of physiotherapy since the early 1990s, hence we limited the search from 1990 until 2014.
Major findings: Seventy-four sources that were found were categorized in: (A) PNF philosophy, (B) PNF basic principles and procedures, (C) PNF techniques in rehabilitation. In the reviewed publications, a variety of indications and subject populations were identified including: neurological, musculoskeletal, pulmonary, geriatric and mixed disorders. The publications varied in type and quality, ranging from case studies, clinical trials, randomized controlled trials and reviews. This variety of publications, treatment indications and outcome measures in the publications warranted a narrative review
Discussion and conclusion: The scope and diversity of articles in the review make it difficult to study the PNF-concept in a methodical way, since different components of a comprehensive rehabilitation approach may act as confounders when measuring the effects of one specific part of the approach. There is a substantial body of research which supports the use of PNF as a comprehensive rehabilitation concept. The literature also describes that the PNF-concept is applied in clinical practice in a variety of populations and indications; however, efficacy for specific indications and populations requires further investigation.

Keywords: Proprioceptive neuromuscular facilitation, PNF, Motor learning, Physical therapy, Clinical rehabilitation

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On the next pages you will find **Table 2** from the publication. This table provides an overview of all used studies and publications in this review.
You will find the kind of study (eg. RCT, CT, Review, Case Study etc), the PNF issue addressed in the study, the population used in the study, the measurement outcome and the results.

Table 2 Overview of all used sources in relation to the PNF-concept (section B: PNF basic principles and procedures and section C: PNF techniques)

Study, author and year	Type of study	Focus of PNF issue	Population	Outcome measure	Result
PART A: Publications in relation to PNF basic principles and procedures					
Fallon et al. 2001[25]	CT	Tactile stimuli	18 healthy subjects	EMG recordings of tibialis anterior, medial and lateral gastrocnemius and soleus muscle.	Tactile stimulus effects the muscle activity about the ankle which are important to control gait.
Gabriel et al. 2006[26]	Review	Resistance, motor learning		Functional strength	Resistance effects neural drive of motor units, based on motor synchronization and firing rate.
Johnson and Johnson 2002[27]	Descriptive text	Approximation, irradiation, timing			
Kofotolis et al. 2005[28]	RCT	Resistance	24 healthy males	Muscle hypertrophy	Cross sectional area m. vastus lateralis increased.
Arai et al. 2001[29]	RCT	Resistance, patterns and irradiation	six post-surgery knee patients	EMG activity contralateral limb and torque produced	PNF pattern demonstrated a 23% increase in torque in the contralateral limb, while straight activity in sagittal plane produced not over 13%.
Sato and Maruyama 2009[31]	CT	Resistance, patterns and irradiation	30 healthy males	Extension force contralateral lower limb	The extension force of the lower limbs increased significantly. Contralateral more than ipsilateral.
Yigiter et al. 2002[32]	RCT	Approximation	50 unilateral trans-femoral amputee patients	Weight bearing on amputated leg, stride length, step width, cadence and velocity	PNF-based therapy with approximation effected stance stability.
Shimura and Kasai 2002[33]	CT	Resistance and patterns	seven healthy males	Motor evoked potentials and EMG reaction time	PNF positions superior over neutral positions.
Witt et al. 2011[34]	CT	PNF Pattern	21 healthy subjects	EMG activation of scapula muscle	In PNF patterns significantly higher activation.
McMullen and Uhl 2000[35]	Descriptive text	Kinetic chain / pattern			
Myers and Lephart 2000[36]	Review	Sensory motor system / irradiation and pattern		Athletic function	PNF pattern mimic athletic function.
Mahoney et al. 2011[37]	CT	Summation of stimuli	18 'old' subjects and 18 'young' subjects	Response time to multi-sensory stimuli.	Elderly tend to respond faster to a combination of somatosensory and visual stimuli. Younger people tend to respond faster to a combination of somatosensory and auditory stimuli.
PART B: Publications in relation to PNF techniques in rehabilitation					
Studies in relation to PNF Hold Relax and Contract Relax techniques					
Godges et al. 2003[38]	RCT	CR	20 shoulder patients	ROM for external rotation + overhead reaching.	PNF group improved significantly more than control group.
Decicco and Fisher 2005[39]	RCT	HR and CR	30 healthy subjects	Difference between HR and CR on ROM	HR and CR are equal effective.
Funk et al. 2003[40]	RCT	CR vs SS	40 healthy subjects	ROM knee extension	PNF more effective then SS.
Wenos and Konin 2004[41]	CT	HR before and after warming up	24 healthy males	ROM hamstrings	HR more effective after warming up.
Youdas et al. 2010[42]	CT	HR and CR	35 healthy subjects	ROM knee extension (hamstrings)	Significant change in ROM, no lower EMG activity.
Feland and Marin 2004[43]	RCT	HR and CR and contraction intensity	72 healthy males	ROM hamstrings	Sub maximal and maximal contraction are equal effective.

(*Continued*)

Table 2 (*Continued*)

Study, author and year	Type of study	Focus of PNF issue	Population	Outcome measure	Result
Schuback et al. 2004[44]	RCT	Self-applied vs therapist applied HR	42 healthy subjects	ROM hip flexion (hamstrings)	Both procedures are significantly effective.
Rowlands et al. 2003[45]	RCT	HR and CR and contraction time	37 healthy females	ROM hamstrings	Longer contraction time results in more improvement of ROM.
Bonnar et al.2004[46]	RCT	HR and CR and contraction time	60 healthy subjects	ROM hip flexion (hamstrings)	3, 6 and 10 s contraction time have the same effect on ROM.
Davis et al. 2005[47]	RCT	CR (reciprocal) vs SS	19 healthy adults	ROM knee extension (hamstrings)	SS more effective than PNF.
Carter et al. 2000[48]	RCT	HR and CR	24 healthy females	Mean output of muscle performance	Muscle activity decreased directly after PNF stretching.
Church et al. 2001[49]	CT	CR	40 healthy females	Vertical jump performance	Jump height decreased after PNF stretching.
Marek et al. 2005[50]	CT	HR and CR	19 healthy subjects	Mean output of muscle performance	Muscle activity decreased directly after both, PNF and static stretching.
Bradley et al. 2007[51]	CT	HR and CR	18 healthy males	Vertical jump performance	Performance decreased after 10 min of stretching but was fully recovered after 15 min of rest.
Klein et al. 2002[52]	Prospective CT	CR (PNF flexibility in elderly)	11 elderly persons	ROM shoulder and ankle, Sit to Stand and TUGT	Significant improvement in ROM clinical important improvement in Sit to Stand and in TUGT.
Ferber et al. 2002[53]	CT	HR	32 elderly males	ROM knee extension (hamstrings)	Significant change in ROM.
Ferber et al. 2002[54]	CT	HR	26 elderly males	ROM knee extension + EMG activity from the hamstrings	Significant change in ROM, no reduction of EMG activity.
Moore and Kulkulkas 1991[55]	CT	HR	16 females	H-reflex from M. triceps surae	Short time of depressed H-reflex amplitudes.
Olivo and Magee 2006[56]	CT	CR	30 healthy subjects	EMG activity in masticatory muscles	No reduction in EMG activity.
Weerapong et al. 2004[10]	Review	HR and CR		ROM and muscle performance	ROM improves significantly, inconclusive in muscle performance.
Chalmers 2004[57]	Review	HR and CR		ROM	PNF clearly has a positive influence on ROM, relaxation unclear.
Sharman et al. 2006[11]	Review	HR and CR		ROM	PNF most effective means for increasing ROM, mechanism unclear.
Hindle et al. 2012[12]	Review	HR and CR		ROM and muscle performance	Improvement of both, ROM and muscle performance.
Studies on PNF in relation to Rhythmic Initiation and Combination of Isotonics					
Cilento et al. 2006[58]	RCT	RI and CoI (in elderly)	63 elderly females	Sit to Stand, TUGT and functional reach test	Patients improved in all more than in the control group.
Studies in relation to PNF Reversal techniques					
Gabriel et al. 2001[59]	RCT	DR and SR	26 healthy females	Muscle activity in antagonist	EMG activity of antagonist was higher after activation of agonist.
Kamimura et al. 2009[60]	CT	DR and SR	10 healthy males	Muscle activity in antagonist	EMG activity of antagonist was higher after activation of agonist.
Studies in relation to PNF in stroke patients					
Wang 1994[62]	CT	RI, DR, CoI on pelvis patterns in stroke patients	20 stroke patients	Gait speed and cadence	Speed and cadence both improved significantly.
Khanal et al. 2013[63]	RCT	RI, DR, CoI on pelvis patterns in stroke patients vs conventional physiotherapy (truncal exercises)	30 stroke patients	Trunk impairment, balance, gait speed and gait cadence	All outcome measures improved significantly more in the PNF group then in the control group.

Ribeiro et al. 2012[64]	RCT	PNF gait training and pelvis patterns vs weight supported treadmill training in stroke patients	23 stroke patients	Gait parameters	The interventions showed equal results in both groups.
Choi et al. 2013[65]	RCT	PNF + taping vs neurodevelopment treatment in stroke patients	30 stroke patients	BBS and 10 meter walking speed	PNF group improved more than control group.
Pohl et al. 2002[66]	RCT	PNF and neurodevelopment treatment vs treadmill training in stroke patients	60 stroke patients	Gait speed, gait cadence and stride length	Treadmill training improved more than PNF and neurodevelopment treatment.
Kraft et al. 1992[67]	RCT	PNF Resisted training vs electro stimulation and no treatment for wrist in stroke patients	18 stroke patients	Fugl-Meyer test and in grip strength	Electro group improved by 42% PNF by 18% no training by 0%
Duncan et al. 2003[68]	RCT	Structured programme PNF included vs spontaneous recovery in stroke patients	92 stroke patients	Knee extension force, BBS, endurance, gait velocity and gait distance	Structured programme exceeds spontaneous recovery.
Studies in relation to PNF in musculoskeletal indications					
Kofotolis and Kellis 2006[69]	RCT	DR and SR in CLBP	86 females with CLBP	Lumbar ROM, muscle endurance, functional ability and pain perception	PNF more effective then natural spontaneous recovery.
Maicki et al. 2012[70]	RCT	Col and SR in Neck pain patients vs manual therapy	80 patients with neck pain	Cervical ROM and strength, pain perception and NDI	PNF group improved more than manual therapy group.
Nakra et al. 2013[71]	RCT	PNF-based treatment vs conventional treatment in shoulder patients	30 shoulder patients	SPADI and overhead reach height	Statistically significant and clinically important improvement in the PNF group.
Studies in relation to PNF in gait disabilities					
Mirek et al. 2003[72]	CT	PNF gait training in Parkinson patients	three Parkinson patients	Step frequency and gait speed	Significant improvement of both outcome measures.
Yigiter et al. 2002[32]	RCT	PNF gait training vs traditional gait training in trans-femoral amputee patients	50 unilateral trans-femoral amputee patients	Weight bearing on amputated leg, stride length, step width, cadence and velocity	PNF-based therapy was superior over traditional therapy.
Sahay et al. 2013[73]	RCT	PNF gait training vs traditional gait training in trans-tibial amputee patients	30 unilateral trans-tibial amputee patients	Weight bearing on amputated leg, stride length, step width, cadence and velocity	PNF-based therapy was superior over traditional therapy.
Caplan et al. 2009[74]	RCT	HR vs static stretching in healthy subjects.	18 rugby players	Gait pattern in stride length and stride rate	Stride length increased stride rate decreased.
Studies in relation to PNF in vital functions					
Cornelius et al. 1995[75]	RCT	Systolic and diastolic blood pressure responses during PNF stretching	60 healthy subjects	Raise of Systolic and diastolic blood pressure	Static contraction will increase blood pressure, but less than 15 mm Hg above baseline.
Pereira 2012[76]	CT	Systolic and diastolic blood pressure responses during PNF strengthening (RI, DR, Col)	15 elderly inactive females	Raise of Systolic and diastolic blood pressure	No statistically significant effect on blood pressure.
Nitz and Burke 2002[77]	CT	PNF breathing vs basal expansion breathing	7 patients with myotonic dystrophy	Respiration rate, heart rate, (TAM) thoracal abdominal motion and SpO_2	PNF group superior: Respiration declined with 30%, heart rate by 4.1%, SpO_2 increased by 2.6%, TAM by 556%.

(*Continued*)

Table 2 (*Continued*)

Namura et al. 2008[78]	CT	Facial profile after PNF for mimics.	40 healthy subjects	Photographed facial profile for nasolabial, mentolabial and mento-cervical angles	Angles changed significantly, although continued training is necessary to avoid relapse.
Study, author and year	**Type of study**	**Focus of PNF issue**	**Population**	**Outcome measure**	**Result**
PNF in case studies					
Morley and Perrault 2012[79]	Case report	Traumatic myositis ossificans in left thigh in a young sportsman. Soft tissue mobilization with HR techniques from PNF	A 13-year-old male rugby player	ROM, Pain, resuming training	All significantly improved and successful resuming of training.
Carlson and Hadlock 2007[80]	Case report	Rotator cuff surgery in a post-polio patient. PNF pattern for mobilization and strengthening	A 48-year-old female	Return to independent status	All achieved, also in retention test two years later.
Pasiut et al. 2005[81]	Case report	Gait training in 4 cases of stroke patients facilitated with pattern training for upper and lower limb in various positions	4 individual male stroke patients aged between 43 and 67 years	VICON measured knee and ankle joint angles in gait	All improved significantly, retentions was seen in 3 months follow up.
Luterek et al. 2009[82]	Case report	Haemophilia resulting in arthropathy of the knee, PNF with RI, SR and CoI	A 44 year old male	Strength, Pain, SPPB	Improved strength, decreased pain, 9 point improvement on the SPPB.
Smedes 2006[83]	Case report	Secondary impingement, PNF, combined with manual therapy. PNF for strengthening and functional task training	A 27-year-old female	Pain, gleno-humeral stability and return to work	Final objective achieved after 5 sessions of intervention.
Smedes 2009[84]	Case report	Secondary problems 16 years after a total hip replacement with impaired gait. PNF for strengthening and functional gait training	A 62-year-old female	Strength ROM, gait speed and gait distance	Clinical relevant improved was achieved after a 6 weeks treatment period.

PNF = Proprioceptive neuromuscular facilitation; RCT = randomized controlled trial; CT = clinical trial; EMG = Electromyography; ROM = range of motion; CR = contract relax; HR = hold relax; SS = static stretching; RI = rhythmic initiation; CoI = combination of isotonics; DR = dynamic reversals, SR = stabilizing reversals; TUGT = timed up and go test; BBS = Berg balance scale; CLBP = chronic low back pain; SPADI = shoulder pain and disability index; TAM = Thoracal abdominal motion; SPPB = short physical performance battery; vs = versus.

Adding life to years: WCPT launches World Physical Therapy Day resources and downloads

World Physical Therapy Day takes place on 8th September 2016, and this year WCPT is suggesting that physical therapists around the world publicise their important role in healthy ageing, and "adding life to years".

This choice of message follows the WHO World Report on Ageing And Health which says that "maintenance of functional ability has the highest importance" for older people. WCPT has played a significant role in the consultations which resulted in the new WHO ageing and health strategy. By 2050 the global population will include two billion people aged 60 or over, and 400 million aged 80 or over. See: http://www.wcpt.org/news/Word-PT-Day-2016-Jun16

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Effectiveness of Proprioceptive Neuromuscular Facilitation Techniques as Compared to Traditional Strength Training in Gait Training Among Transtibial Amputees

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ABSTRACT

Objective: To determine the effects of proprioceptive neuromuscular facilitation (PNF) techniques as compared with the traditional prosthetic strength training (TPT), in improving ambulatory function in subjects with transtibial amputation.

Study Design: Randomized control trial.

Place and Duration of Study: Artificial Limb Centre of Fauji Foundation Hospital, Rawalpindi, from July to December 2014.

Methodology: Patients with lower-limb amputation was selected through purposive sampling and randomly assigned into PNF group (n=31) and traditional group (n=32). The baseline and follow-up of 04 weeks treatment session was provided and measurement was noted through the locomotor capabilities index.

Results: The locomotor capabilities index abilities had significant difference in both groups. The mean index was 23.93 for PNF and 18.18 for TPT ($p > 0.05$), and the knee muscle strength was also significantly different ($p > 0.05$). There was no significant difference in gait parameters.

Conclusion: Proprioceptive neuromuscular facilitation technique is better in improving the locomotor abilities and knee muscle strength as compared to traditional training. The basic gait parameters have same effect in both groups.

Key Words: *Proprioceptive neuromuscular facilitation. Trans-tibial amputation. Locomotor capabilities index. Gait parameters.*