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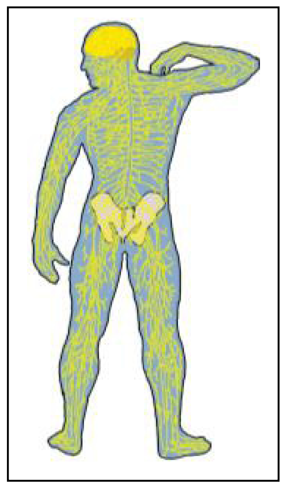
Newsletter IPNFA research committee

Newsletter number 4, this issue presents material from all over the world. I received from our colleagues in Brazil information from a study they performed; it concerns the effect of PNF treatment in impingement problems. Furthermore we present some abstracts that were pointed out to us by our former president, Carsten Schäfer. We appreciate all the input from every IPNFA member (also associate members), so feel free to contact us. On behalf of the research committee, I wish a joyful reading. Fred.

From our colleagues in South Africa; *Clinical Solution*; I found a nice item to open our 4th edition. It's is something to remember how amazed we should be about our body and those that we treat. In therapy we see a wide range of patients experiencing problems in several areas, from various tissues. In this scenario it's not uncommon to be upset and even frustrated with a slow recovery. It's funny how we forget, when everything is working well, how much happens in your body every second, in all kinds of tissues. In this newsletter, we will make you think a little about the systems we physical therapists are specialized in.

The Brain and Nerves

 Nerve impulses to and from the brain travel as fast as 170 miles per hour. Ever wonder how you can react so fast to things around you or why that stubbed toe hurts right away? It's due to the super-speedy movement of nerve impulses from your brain to the rest of your body and vice versa, bringing reactions at the speed of a high powered luxury sports car.



 The brain operates on the same amount of power as 10-watt light bulb. The cartoon image of a light bulb over your head when a great thought occurs isn't too far off the mark. Your brain generates as much energy as a small light bulb even when you're sleeping.

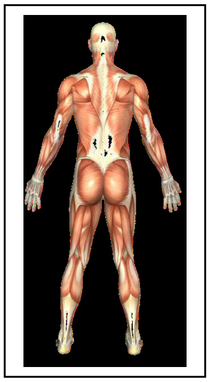
 The human brain cell can hold 5 times as much information as the Encyclopaedia Britannica or any other encyclopaedia for that matter. Scientists have yet to settle on a definitive amount, but the storage capacity of the brain in electronic terms is thought to be between 3 or even 1,000 terabytes. The National Archives of Britain, containing over 900 years of history, only takes up 70 terabytes, making your brain's memory power pretty darn impressive.

 Your brain uses 20% of the oxygen that enters your bloodstream. The brain only makes up about 2% of our body mass, yet consumes more oxygen than any other organ in the body, making it extremely susceptible to damage related to oxygen deprivation. So breathe deep to keep your brain happy and swimming in oxygenated cells.

 The brain is much more active at night than during the day. Logically, you would think that all the moving around, complicated calculations and tasks and general interaction we do on a daily basis during our working hours would take a lot more brain power than, say, lying in bed. Turns out, the opposite is true. When you turn off your brain turns on. Scientists don't yet know why this is but you can thank the hard work of your brain while you sleep for all those pleasant dreams.

The brain itself cannot feel pain. While the brain might be the pain centre when you cut your finger or burn yourself, the brain itself does not have pain receptors and cannot feel pain. That doesn't mean your head can't hurt. The brain is surrounded by loads of tissues, nerves and blood vessels that are plenty receptive to pain and can give you a pounding headache.

80% of the brain is water. Your brain isn't the firm, gray mass you've seen on TV. Living brain tissue is a squishy, pink and jelly-like organ thanks to the loads of blood and high water content of the tissue. So the next time you're feeling dehydrated get a drink to keep your brain hydrated.



Muscles and Bones

It takes 17 muscles to smile and 43 to frown. Unless you're trying to give your face a bit of a workout, smiling is a much easier option for most of us. Anyone who's ever scowled, squinted or frowned for a long period of time knows how it tires out the face which doesn't do a thing to improve your mood.

Babies are born with 300 bones, but by adulthood the number is reduced to 206. The reason for this is that many of the bones of children are composed of smaller component bones that are not yet fused like those in the skull. This makes it easier for the baby to pass through the birth canal. The bones harden and fuse as the children grow.

We are about 1 cm taller in the morning than in the evening. The cartilage between our bones gets compressed by standing, sitting and other daily activities as the day goes on, making us just a little shorter at the end of the day than at the beginning.

The strongest muscle in the human body is the tongue. While you may not be able to bench press much with your tongue, it is in fact the strongest muscle in your body in proportion to its size. If you think about it, every time you eat, swallow or talk you use your tongue, ensuring it gets quite a workout throughout the day.

The hardest bone in the human body is the jawbone. The next time someone suggests you take it on the chin, you might be well advised to take their advice as the jawbone is one of the most durable and hard to break bones in the body.

You use 200 muscles to take one step. Depending on how you divide up muscle groups, just to take a single step you use somewhere in the neighbourhood of 200 muscles. That's a lot of work for the muscles considering most of us take about 10,000 steps a day.

The tooth is the only part of the human body that can't repair itself. If you've ever chipped a tooth you know just how sadly true this one is. The outer layer of the tooth is enamel which is not a living tissue. Since it's not alive, it can't repair itself, leaving your dentist to do the work instead.

Bone is stronger than some steel. This doesn't mean your bones can't break of course, as they are much less dense than steel. Bone has been found to have a tensile strength of 20,000 psi while steel is much higher at 70,000 psi. Steel is much heavier than bone, however, and pound for pound bone is the stronger material.

The feet account for one quarter of all the human body's bones. You may not give your feet much thought but they are home to more bones than any other part of your body. How many? Of the two hundred or so bones in the body, the feet contain a whopping 52 of them.

In the spring of this year I received the kind request to give some feedback on a first draft of a paper from Leandro Giacometti Da Silva ea. The enthusiasm to do research on our nice concept was evident. Even when still some questions are unanswered the basic idea is appreciated. In spite of some unclearness in the chosen treatment protocol this work should gain our attention and I hope we will hear more from this line of work.
So for all to read, here is the abstract.

Summary from Brazil (LEANDRO GIACOMETTI DA SILVA)
Impingement syndrome treated with PNF

Introduction: shoulder impingement syndrome (SIS) is a disease that affects many individuals in society. There are differences in establishing a gold standard protocol for the treatment of this pathology. The aim of this study was to evaluate the efficacy of a treatment for shoulder impingement syndrome with the method of proprioceptive neuromuscular facilitation (PNF).
Methods: Nine patients were selected by the School of Physiotherapy Clinic - Ulbra Torres, suffering from SIS with medical referral. These individuals underwent a PNF treatment protocol for six sessions and three assessments (baseline, final assessment and follow up).
Results: We found that patients who underwent the program showed significant positive results at the end of the approach. Improvement occurred in the UCLA score in both at the end of the protocol as well as for follow up results ($p = 0.000$ and $p = 0.001$). Pain decreased significantly in the visual scale of pain VAS, keeping results on the period of follow up ($p = 0.000$ and $p = 0.008$). The range of motion (ROM) of the shoulder increased and remained after late in the active movements of flexion ($p = 0.05$ and $p = 0.029$), abduction ($p = 0.035$ and $p = 0.049$), external rotation ($p = 0.001$ and $p = 0.034$) and internal rotation ($p = 0.038$ and $p = 0.01$). Muscle strength showed an increase for shoulder flexion ($p = 0.049$ and $p = 0.05$) and external rotation of the shoulder ($p = 0.013$ and $p = 0.011$).
Conclusion: It is suggested that PNF method can be effective for the treatment of patients with SIS, with improvement in pain, function, ROM and strength.

We looked and found ---- >a nice abstract with the help from Carsten

FB Horak, *Age and Ageing* 2006; **35-S2**

Postural orientation and equilibrium: what do we need to know about neural control of balance to prevent falls?

Abstract

Postural control is no longer considered simply a summation of static reflexes but, rather, a complex skill based on the interaction of dynamic sensorimotor processes. The two main functional goals of postural behaviour are postural orientation and postural equilibrium. Postural orientation involves the active alignment of the trunk and head with respect to gravity, support surfaces, the visual surround and internal references. Sensory information from somatosensory, vestibular and visual systems is

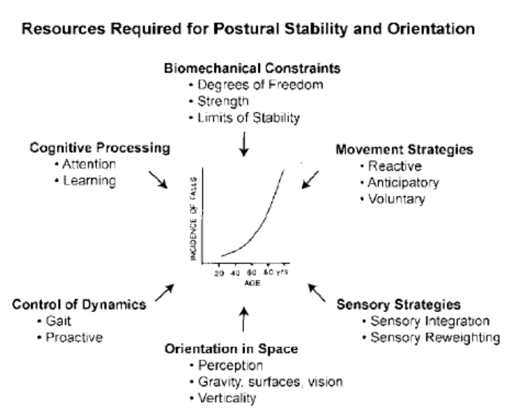


Figure 1. Important resources required for postural stability and orientation. Disorders in any of these resources may be the cause of balance disorders and the increased incidence of falls in the elderly, as shown by the graph. This framework suggests that each elderly individual is falling because of specific, unique constraints on their postural control system.

integrated, and the relative weights placed on each of these inputs are dependent on the goals of the movement task and the environmental context. Postural equilibrium involves the coordination of movement strategies to stabilise the centre of body mass during both self-initiated and externally triggered disturbances of stability. The specific response strategy selected depends not only on the characteristics of the external postural displacement but also on the individual's expectations, goals and prior experience. Anticipatory postural adjustments, prior to voluntary limb movement, serve to maintain postural stability by compensating for destabilising forces associated with moving a limb. The amount of cognitive processing required for postural control depends both on the complexity of the postural task and on the capability of the subject's postural control system. The control of posture involves many different underlying physiological systems that can be affected by pathology or sub-clinical constraints. Damage to any of the underlying systems will result in different, context-specific instabilities. The effective rehabilitation of balance to improve mobility and to prevent falls requires a better understanding of the multiple mechanisms underlying postural control.

Key points

Postural control is a complex motor skill based on interaction of dynamic sensorimotor processes.

Balance function depends on strategies that individuals use to accomplish stability for a particular task given their impairments.

Damage to different systems underlying postural control results in different, context-specific instabilities.

Effective assessment and rehabilitation of balance disorders require an understanding of the many systems underlying postural control.

Figure 2. Normal and abnormal limits of stability. (**A**) Healthy man leaning his body's centre of mass (CoM) (white dot) towards his forward limits of stability, represented as the area of a cone. (**B**) Woman with multisensory deficits attempts to lean forward without moving her body CoM forward. (**C**) Woman with multisensory deficits attempts to lean backwards but immediately takes a step to increase her base of support. The projection of the body CoM over the base of foot support is indicated schematically with a white arrow.

We looked and found ---- > A nice book: Fundamentals of Manual Therapy, Physiology, Neurology and Psychology by Eyal Lederman, Churchill Livingstone 1997

So to speak; a must have

Here we will give you an impression by qouting piece of chapter 9, concerning motor learning, one of our points of PNF philosophy.

MOTOR ABILITIES IN REHABILITATION

Rehabilitation is ultimately directed towards helping the patient to regain normal motor activity in work and leisure. The rehabilitation programme has to acknowledge the activity to which the patient will return. Rehabilitation of a sports injury will concentrate on specific groups of motor ability underlying the particular activity, for example the ability to use explosive force for tennis serves. This will be different from the rehabilitation of an office worker suffering from a repetitive strain injury. Improving abilities during the treatment period may reduce the need to rehabilitate all of the patient's daily skills. A stroke patient will not be guided through all the possible daily tasks but, instead, though certain underlying abilities that will help to improve a variety of skills. Treatment may encompass such abilities as

coordination, static force, dynamic force and control precision. This does not exclude the rehabilitation of specific skills that contain elements of the lost abilities. Many of these abilities can be reinforced by encouraging the patient to perform daily tasks that depend on these abilities. The motor programme and its neuromuscular connection will adapt to the activity in which it was trained (see the sections on neuroplasticity and transfer above).139 For example, if motor learning involves static force ability, the person may improve that area but not necessarily speed or coordination. If these are to develop, they must be included in the rehabilitation programme. If the aim of treatment is to rehabilitate balance, balance-enhancing techniques must be used; muscle force enhancement techniques alone will not be sufficient. This point is very important, as musculoskeletal rehabilitation often focuses on force rehabilitation regardless of the activity to which the patient is returning. This principle is highlighted by the following example. Teaching a child to write involves endless repetitions to improve such abilities as speed, finger precision, coordination and force in the form of endurance. Training in force ability in this situation would be inconceivable: it is unthinkable for the child to perform warming-up finger force exercises using weights. In much the same way, a person who has suffered a stroke may be unable to write because of loss of strength, fine control and coordination. Treatment that focuses on strength exercise alone will be of only limited benefit. Unless coordination and precision are redeveloped, the person will be unable to write, no matter how strong his or her muscles are.

Motor abilities in the treatment of musculoskeletal injury

An indication of the importance of abilities following musculoskeletal injury has been assessed in the rehabilitation of subjects with anterior cruciate ligament damage in the knee. One group received the commonly prescribed treatment of active-static techniques, whilst the other carried out a programme designed to enhance proprioception. This programme included active-dynamic exercise and the use of repetition, speed, balance, coordination and movement patterns. Although in both programmes there was an improvement in function, this improvement was significantly greater in the proprioceptive group. Similarly, functional instability of the ankle was shown to improve with treatment that focused on improving functional movement, balance and coordination ability. The improvement in the group working on abilities was significantly greater than that of the group receiving conventional treatment.

INTROSPECTIVE/AWARENESS AND RELAXATION ABILITIES

Added to the list of abilities that can be improved during treatment are introspection/awareness and relaxation ability, which are important for postural and movement awareness and motor relaxation. Some patients seem unable to introspect and 'feel their body', and may find it difficult to relax fully. This inability may impede the rate of improvement.

PHYSIOLOGICAL ABILITIES: RECIPROCAL ACTIVATION AND ANTAGONIST CO-ACTIVATION

Reciprocal activation and antagonist co-activation are patterns of motor recruitment in muscles. Although these are strictly not motor abilities, abnormal motor activity may result from changes in the patterns of motor recruitment. Antagonist co-activation is a motor pattern that serves partly to increase the stiffness and stability of joints during static posture and movement.62,143,144 In co-activation, antagonistic muscle groups (e.g. the hamstrings and quadriceps) contract simultaneously. Reciprocal activation, in which the agonist group is contracting while the antagonist group is passively elongated serves to produce movement. During various motor activities, these patterns of contraction take place either separately or jointly. For example, during intricate physical activity such as using a pair of scissors, co-activation stabilizes the whole limb and hand while reciprocal activation produces the cutting movement. These two forms of activation can be demonstrated during slow and fast joint movements. While sitting, if one slowly extends one's knee, reciprocal activation of the quadriceps and passive elongation of hamstrings can be felt. Co-activation can be felt when standing with the knees slightly flexed, in which position, both the hamstrings and quadriceps muscles will be working simultaneously. It has been demonstrated that both forms of activation have separate motor control centres.20,109 It has been suggested that the rigidity seen in patients with central motor damage may be attributed to malfunction of these centres. The excessive muscle activity seen in these patients may possibly be related to increased co-activation. In failure of voluntary activation following joint damage, the inhibition and wasting of one group of muscles may alter the normal relationship between reciprocal and co-activation. Patients can be guided on how to use the two modes of muscle recruitment (Fig. 9.7). For example, co-activation can be achieved by instructing the patient to stiffen the joint whilst the practitioner attempts to move the joint rapidly into cycles of extension and flexion. Other methods are to instruct the patient to oscillate the joint rapidly within a narrow range, and asking the patient to produce a full voluntary isotonic contraction. Reciprocal activation can be produced during different movements by instructing the patient to relax antagonistic muscle groups. It has also been demonstrated (although not in all patterns of movement) that co-activation virtually disappears when subjectsare instructed to relax at the initiation of movement. Movement that is high in co-activation may shift towards reciprocal activation with practice.146 This may be important for reducing mechanical stress and energy expenditure during movement.

ENHANCING PROPRIOCEPTION

Within the sensory part of the motor system different sensory modalities can be enhanced in relationship to others, for example proprioception in proportion to other feedback elements such as vision. Conditions that may benefit from proprioception enhancement are discussed in Chapter 10. Proprioception can be enhanced by either:
• increasing the afferent volley by stimulation of the various mechanoreceptors • reducing visual feedback.

Enhancing proprioception by afferent stimulation

Various groups of mechanoreceptors can be maximally stimulated to increase proprioception from different musculoskeletal structures. Skin mechanoreceptors can be maximally stimulated by dynamic events on the skin, for example massage, rubbing and vibration. Maximal stimulation of joint receptors can be achieved by articulation techniques such as cyclical rhythmical joint movement or oscillation. The awareness of a group of muscles can be achieved by instructing the patient cyclically to contract and relax the muscle. Alternatively, the patient can be instructed to contract isometrically while the therapist disturbs the held position by, for example, oscillating the joint. Generally speaking, active-dynamic techniques produce the largest proprioceptive inflow; second to these come passive-dynamic techniques.

Table 9.2 The different ability traits and muscle recruitment patterns involved in physical activity. Some of these techniques are described further in Fig. 9.7

Abilities underlying physical skill	Description	Ability-enhancing manual techniques
Multilimb coordination	Ability to coordinate a number of limbs simultaneously	Active–dynamic technique involving whole body movement patterns such as used in PNF
Response orientation	Directional discrimination and orientation of movement pattern	Patient follows movement patterns initiated by therapist. Increase proprioceptive acuity by instructing the patient to close the eyes
Reaction time	Time lapse between stimulus and patient's response	Patient is instructed to react as fast as possible to a change in the therapist's guiding hand or a verbal cue; e.g. therapist guides patient's arm into flexion and, when stimulus is given, patient has to quickly change direction of movement
Speed of movement	Speed of gross limb movement when accuracy not required	Active dynamic techniques with rapid rate of movement, e.g. rapid extension or flexion of knee to set position such as the therapist's hand. Change position of hand to produce small to large arcs of movement or direction of movement
Rate control	Ability to make continuous motor adjustments relative to changes in speed and direction of an object	Active dynamic techniques with continuous varying force speed and direction imposed by therapist
Control precision	Ability to hold steady position coupled with fine movements of limbs and hands Important in operation of equipment where rapid, precise use of control is required	Patient stands on good leg and, with injured leg, draws numbers 1 to 10. Or, patient lying follows movement imposed by therapist using injured leg
Balance	Ability to use limbs or whole body in standing and movement	Patient stands on injured leg. Therapist supports patient but gently moves patient off balance. Alter knee flexion angle, ask patient to stand on toes or heel and balance
Introspect/kinesthesis and relax	Ability to 'see' proprioceptively and refine motor activity	1. Gentle passive movement of limb (e.g. shoulder and arm), palpating for tension in muscles and providing patient with verbal feedback on the level of relaxation in muscles 2. Patient fully contracts the tense muscle and then relaxes. Patient is instructed to concentrate on state of tension during contraction phase and on muscle relaxation following it
Rehabilitation programme can also include techniques that enhance central control together with local physical state of muscle:		
Static strength	Isometric strength of muscle	Active–static technique, different level of force applied at different angles, e.g. 50°, 90° knee flexion or any other angle. Add internal and external knee rotation or hip rotation
Dynamic strength	Muscle strength during movement	As above in static strength, but resistance to movement is through a dynamic range
Explosive strength	Ability to exert maximum energy in one explosive act such as a short sprint	Important in sports rehabilitation. Remedial exercise such as throwing an object as far or as high as possible
Dynamic flexibility	Extent of flexibility during active movement, e.g. passive rotation of cervical spine is greater than active	E.g. holding patient's head, instruct patient to fully rotate to end-range, adding some resistance throughout range. Repeat at different velocities
To the above motor abilities, other physiological mechanisms of muscle group recruitment can be added to the rehabilitation programme:		
Antagonist co-activation	Co-contraction of two antagonistic group of muscle, e.g. hamstring and quadriceps	Instruct patient to stiffen knee and resist rapid application of flexion and extension cycles
Reciprocal activation	Activation of one muscle group while its antagonist pair is relaxed	Instruct patient to extend then flex leg against resistance. At end of each movement, before limb is about to move in opposite direction, instruct patient to fully relax the prime mover. Vary level of resistance and speed of change between muscle groups. Also change joint angles

PNF, Proprioceptive neuromuscular facilitation.