

Exercise therapy with the PNF concept:

A useful treatment strategy

With the use of the PNF concept a variety of sub goals can be achieved. These range from improvement of strength up to functional activities. In this way one can work on every level of the ICF with the PNF concept. In searching publications concerning the efficacy of the PNF method we soon run into smaller studies, which illustrate the variety of applicability^{8, 14, 15, 22, 29}. To illustrate the broad possibilities of the PNF concept this article deals with a case report in which an anterior shoulder instability plays a central role.

A young woman, 27 years of age with shoulder complains right calls in for physiotherapy. The complains are manifest in the right shoulder at the ventral caudal side and radiate into the forearm at the ventral side of thumb and index finger. The experienced amount of pain is indicated with VAS 6,8 on an analogue unnumbered line of 10 cm. These complains are enhanced during her job activities at a supermarket. She has to unpack and pack boxes. The most specific activity is taping a box with a self adhesive band, which is pulled over the box.

Based upon the anamnesis some function disorders seem to be the possible cause for the experienced problems during her (work)activities. I suspect a shoulder instability, maybe associated with a slight dislocation, pseudo-radicular irritation and/or tendinitises in the shoulder joint. Focused on this,

the physical assessment was carried out.

In the observation and analysis of the work related activities, like the for the patient specific act of taping a box, a disturbed coordination occurs showing a ventral tilt of the scapula.

The physiotherapeutic assessment of the cervical and thoracal area is negative. In the assessment of the shoulder the following test are positive: The apprehension test, the relocation test, the load and shift test, the quadrant test, the ULTT of the median nerve. In the palpation the caput humerus occurs to be ventralised compared with the left side. According to the publication of T'jonck ea28 and also according to the review of Callanan ea 5 the first three tests have a good reliability in assessing a gleno-humeral instability. The quadrant test of Maitland 18 (in this test a abduction is applied in supine, in which the combined movement, lateral rotation is obligate due to capsule/ligamentary tension. This to get a impression of the gleno-humeral joint) detects a changed movement behavior in the gleno-humeral joint. In this test it was obvious that the lateral rotation in abduction came earlier, and that the abduction was slightly restricted compared to the left side, as well in ROM and also in the end feel. This provokes a unpleasant and apprehensive sensation in the patient. In the ULTT test of the median nerve the complains are reproduced in the shoulder and arm at 90* abduction and 80* lateral rotation, the pain increased to maximal in a 60* restricted extension of the elbow in supination while the wrist remained in dorsal flex-

ion. This test too has a reasonable reliability in detecting a limited nerve mobility 11,30. The patient doesn't give symptoms of neurological loss, so a neurological assessment was not carried out.

The physiotherapeutic diagnosis was formulated:

Young woman, 27 years of age with shoulder complains at the right side, radiating into the hand and fingers based on a gleno-humeral instability associated with median nerve irritation. Because of this limited in carrying out activities like: reaching, grabbing and applying force, subsequently limited work participation.



The above mentioned assessment results indicate that the instability does not only occur during activities, but are also manifest in rest as a dislocation. The physiotherapeutic treatment plan exists based upon these results out of the following sub goals:

Main goal: Return to work

Sub goals: 1) repositioning of the caput humerus in the glenoid cavity; 2) pain relieve; 3) stabilization of the position mentioned in 1; 4) coordination exercise to keep dynamic stability during activities; 5) increase of mobility of the median nerve.

To achieve the stated sub goals I used the following interventions: manual dorsal mobilization of the head of the humerus, PNF exercise therapy (this will be specified in this article).

Supporting literature.

In the ideal world the evidence based practicing therapist would have direct access to all RCT 's and systematic reviews. For this there are many barriers¹⁷. It occurs that the ideal world for the EBP therapist does not exist. To check if the chosen treatment strategy is the right one, I searched for indications in literature. I used for this the journals: "manual therapy", "Fysio-praxis", "The Dutch journal for physiotherapy" and the database "Medline". The search terms: *instability, shoulder instability, proprioceptive training, motor control, PNF training, ULTT, median nerve*. With this I think that I checked for the Dutch physiotherapist a representative amount of accessible sources.

The reviews of Gibson ^{ea 9} and Casonato ^{ea 6} provides us with general guidelines to apply exercise therapy and manual therapy in case of a first episode of shoulder instability. Panjabi ²⁴ explains that every movement segment depends on three subsystems, the passive, the active and the neural subsystem. The active subsystem is build by the muscles and tendons around the gleno-humeral joint and the muscles from thorax to scapula. Gleno-humeral the rotator cuff muscles are mainly responsible for the positioning and stabilization of the caput humerus in the glenoid cavity. The neural or controlling subsystem is a essential link between the active and passive subsystem. The proprioception plays an important role in the guidance of muscles. An intact joint position

sense enables joint stabilization and fitting muscle activity to execute smooth movements. In case the active and neural subsystem do not function optimally the passive subsystem becomes overused and can get irritated.



The functionality and dynamic stability of the shoulder complex is ensured by local stabilizers and global mobilizers (Hess, Jones 12,16), This is similar to the system of low back instability described by Hodges, Richardson, and O'Sullivan ea 13,23. For the functionality the gleno-humeral joint can not be seen separately from the scapulo-thoracal stability, or even the anticipating stability of the lower spine and lower extremities. This System has to be trained as one, in a variety of situations.

Maitland 18 describes manual mobilization techniques to improve joint mobility, with these techniques repositioning of the slight dislocation can be achieved. Mulligan 20 explains that the manual glide can be combined with active exercise. Now based on proprioceptive guidance muscle activity is build up in the maintained position. He uses the term "mobilization with movements" and uses in that SNAG 's

(sustained natural assisted glide) During these maintained glides the patient is instructed to execute active exercises.

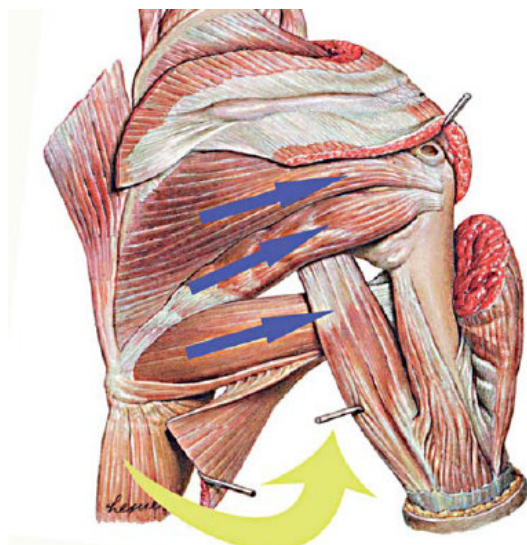
PNF training from sidelying into functional activity



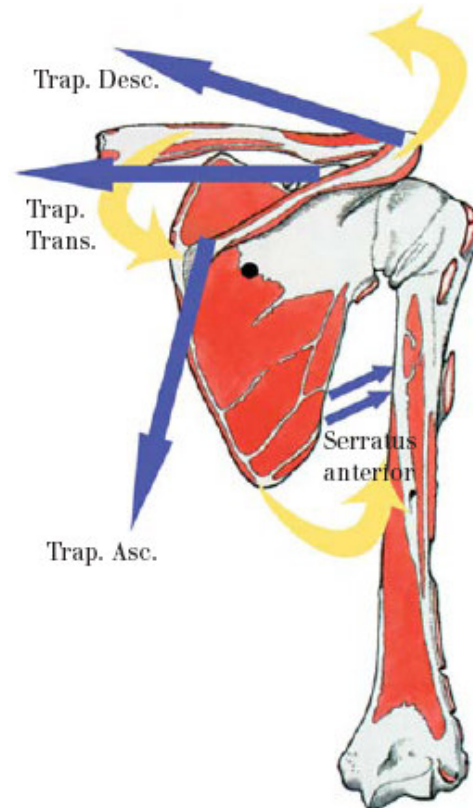
The study of Shimura and Kasai 25 shows clearly that the PNF positions and exercises are of benefit for initiating movements. They measured the effect on EMG reaction time and motor evoked potentials, both were positively influenced by the PNF positions. Magarey and Jones 16 propagate in shoulder issues to train the scapula setting on the thorax with PNF scapula pattern, both in open chain and in closed chain. Also the scapulo-humeral rhythm is discussed by them, and it is advocated to train the optimal coordination with PNF pattern. Besides Jones 16, Hess 12 also describes coupled forces on the scapula and humerus. The trapezius muscle and the serratus anterior muscle work synergistic to provide dynamic stability of the scapula. The rotator cuff muscles work in a similar way on the dynamic stability of the gleno-humeral joint. In a closed chain the lateral rotators work syner-

gistic with the serratus anterior muscle to ensure the lateral rotation of the scapula.

In the elevation of the arm during reaching, the total shoulder complex is activated. The integration of all components is described as the scapulo-humeral rhythm. There is a lot of discussion on this topic, but for now a average relation of 2:1 is considered as normal for humerus towards scapula. Mc Quade ea 21 studied the effect of external load on this rhythm. They discovered that in increasing load the relationship shifted towards 4,5:1. This indicates that more stabilizing forces on the scapula are necessary. In case this muscular system is not guided with the right coordination dislocating shifts may occur in the gleno-humeral joint. I feel that in case of a ventral and caudal dislocation an irritation of the median nerve could develop, especially in case of abduction and lateral rotation because of the thicker part of the head of the humerus rotating forwardly.



Serratus anterior, Infra spinatus, Teres Major, Teres Minor support in closed chain the lateral rotation of the scapula. In this way they act in dynamic stabilization of the shoulder.



Based upon this biomechanical reasoning and the positive tests it seems that in this case an irritation of the median nerve and of the capsule and ligamental system of the joint itself developed on a gleno-humeral instability. From a retrospective study of Marks¹⁹ it is evident that science especially holds the proprioceptive part of the muscle responsible for position sense. The PNF approach especially uses proprioceptive facilitation to activate the neuromuscular system and to improve with that the coordination during movement 4,14,26. There are surely more methods to think of, which make this possible. Nevertheless is the chosen performance building up preconditions and at last very functional oriented.

The treatment.

The patient received twice a week treatment during four weeks. Manual dorsal mobilizations of the caput hu-

merus were performed. During the dorsal glide the patient did active abduction exercises, in a way that SNAG 's1,2,7,10,20 of Mulligan were used. Besides that the taping of a box was trained and imitated with the PNF pattern extension/abduction/medial rotation with elbow extension. With this the coordinative guidance and specific muscle setting of the shoulder girdle can be taught and exercised goal oriented and controlled. To achieve this, the techniques "Rhythmic Initiation" and "Combinations of isotonic" were used. The basic procedure of "Timing for Emphasis" enables it to emphasize components of the pattern 4,26 . In this case the stabilization of the scapula is essential. This was exercised with emphasis by building up a "hold" in posterior depression of the scapula, on which the patient could train the above mentioned pattern. (see photo's)

In a closed chain, supporting the thorax on the forearms (puppy position), resistant exercises were given especially to the pattern flexion/abduction/lateral rotation with elbow extension. By this there is a clear irradiation and overflow into the lateral rotators and the lateral rotation of the scapula. By this the couple forces (mentioned before) for stabilization of scapulo-thoracic and gleno-humeral junctions can be exercised and trained very well. At the same time the centralization of the head of the humerus is ensured in a muscular way, if necessary with manual facilitation.

After the first two treatment sessions, in which mobilization was the treatment goal the emphasis was shifted on coordinating the necessary muscle activity with stabilization of the centered head of the humerus. With increased muscle sense (obvious by a more independent finding and maintaining of

the scapula position during the exercises) the emphasis was shifted to functional use in work imitated exercises²⁷. Every time the above described PNF pattern, techniques and procedures were used. The patient got home exercises, with "theraband", so she could do similar PNF exercises at home.

The result:

After the third treatment the pain score was dropped to VAS 3,4. after the fifth treatment return to work was achieved. At the end of the treatment sessions, the apprehension test, the relocation test, the load and shift test were negative. In the quadrant test the lateral rotation in abduction appears +/- 15* later than in the beginning, the abduction limitation has been solved. In the ULTT of the median nerve the elbow extension is now possible up to 30* while abduction and lateral rotation each are 100*. The palpation difference between left and right is now neglectable. The VAS is 0,7 during activity.

Finally.

The chosen treatment strategy led to a positive result for the patient and the therapist. The expertise and with that the knowledge, skill and experience of the therapist is within the manual therapy and the exercise therapy with the PNF concept. Several publications indicate that several sub goals can be achieved with PNF exercise therapy. Nevertheless it is the case that there are just a few to no bigger RCT 's published concerning the PNF concept. Especially not in relationship with the topic described in this case.

Taken in account that: the choice of the best treatment is an integration of scientific research outcomes on the one side and knowledge, skill and ex-

perience of the therapist on the other side, in adjustment with the values and objectives of the patient, the above described treatment approach is a well accountable therapy strategy.

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Explanation of some terms from the PNF concept. Compare with the article “Better understanding of PNF “Fysiopraxis” 12 2001

Timing: A term, which describes coordination.

Normal Timing describes the *visual* order of movements within a pattern. Movements do start distal and develops proximally. When **Timing for Emphasis** is used, the order of movements is stopped and specific one component of the total movement is exercised. Yet several techniques can be used. In this way an inter- or intramuscularly coordination deficit can specifically be treated.

RHYTHMIC INITIATION

Definition: A technique, for the goal oriented movement (Agonistic), in which rhythmic movements are performed in the full range of motion. It consists of four phases
1) Passive;2) Assisted;3) Resistive;4) Active.

Goal: learn a new movement
Improve the intra- and inter muscular coordination
Automation of a movement
Tonus Regulation

COMBINATIONS OF ISOTONICS

Definition: A technique for the agonists, in which concentric, eccentric and static contractions are combined, without loss of tension.

Goal: Improvement of eccentric control
Endurance improvement
Intra- and inter muscular coordination
Functional exercising

Overflow. The effect that occurs based upon ongoing nerve impulses to synergistic muscles (irradiation). Because of this there is a greater effect than only in the muscles which are directly involved in the exercise.

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