

PNF

Proprioceptive neuromuscular facilitation, or "Kabat" for short, is one of the most basic techniques working with the patient on a neurophysiological basis

History

American neurophysiologist Dr. Herman Kabat (1913-1995) is considered to be the founder of this treatment methodology along with his fellow physiotherapists Margaret Knott and Dorothy Voss. In the 1960s, this method was also imported to Czechoslovakia, where it gained a number of admirers, followers and especially patients. Originally, the concept was focused only on patients with poliomyelitis, but the effectiveness of the method has been shown for a much wider spectrum of diagnoses.

The Principle of the Method

It is important to realize that the main purpose of the method is to facilitate the learning of a certain movement, then a movement pattern using signals coming directly from the body, using the responses of receptors (e.g. muscle spindle, Golgi tendon bodies, joint capsule receptors, skin receptors) and thus targeted affects the motoneurons of the anterior spinal horns, along with targeted impulses from the brain centers, a movement response usually occurs.

Theory of nomenclature

- **FORMULA** is the indication of movement in the proximal joint..
- **DIAGONAL** is the union of two antagonistic patterns.
- **VARIATION** since the middle joint (knee, elbow) has two possibilities of movement, we can perform the diagonal in a flexion variant or in extension.

Facilitation

Facilitation is a tool to help the patient find a more economical and advantageous movement and restore its functionality.

Facilitation techniques

- **resistance** is used to increase tension, helping conscious muscle contraction
- **irradiation and amplification** are used to extend the stimulation response to the synergistic muscle of the movement
- **manual contact**, the increase in tension varies according to the therapist's grip and grip or, on the contrary, permission and only light guidance of movement
- **the position of the therapist** determines the direction in which the movement will be performed and enables the patient's movement to be guided
- **verbal movement guidance** allows the patient to better concentrate on the movement being performed, the therapist guides the patient's voice and also times the individual components of the movement
- the **visual accompaniment of the movement** enables the patient to be better aware of the movement as well as its conscious correction
- **limb traction** facilitates movement and stability of the root joint
- **stretching** facilitates muscle contraction, reduces muscle fatigue

Diagonals

The basic diagonals include the diagonal of the blade, pelvis, upper limb, and lower limb. For the limbs, we then distinguish between the I and II diagonals in the flexion or extension variant.

Blade diagonal

- VP for all positions: the patient lies on his side with the lower limb bent, the lower upper limb is bent under the head
- movement: **anterior elevation**
- position: facing the patient's head, one hand holds the shoulder from the front, fingers wrap around the acromion, the other under it
- prompt the patient to perform an anterior elevation with the scapula (in the forward direction upwards)
- when the patient performs, the therapist pulls the scapula into the posterior depression and lightly springs
- muscles: serratus anterior muscle, pars cranialis trapezius muscle, pectoralis major muscle, levator scapulae

muscle

- movement: **posterior depression**
- hold: palm of one hand parallel to the lower angle of the scapula, fingers pointing towards the acromion
- request the patient to make a posterior depression with the scapulai
- when the patient performs, the therapist pulls the scapula into anterior elevation and lightly springs
- muscles: m. latissimus dorsi, mm. rhomboidei, pars caudalis m. trapezius

- movement: **anterior depression**
- holding: one hand on the anterior, the other on the posterior edge of the axilla, fingers pointing to the elbow
- request the patient to make an anterior depression with the scapulai
- when the patient performs, the therapist pulls the scapula into posterior elevation and lightly braces
- muscles: pectoralis major et minor, serratus anterior muscle

- movement: **posterior elevation**
- holding: one hand placed on the trapezius muscle with the fingers resting on the spina, the other under it
- prompt the patient to perform posterior elevation with the scapula
- when the patient performs, the therapist pulls the scapula into the anterior depression and lightly springs
- muscles: m. levator scapulae, pars cranialis et medialis m. trapezius

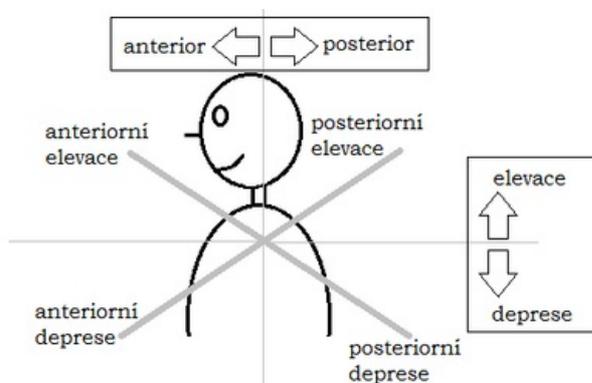


Diagram of the blade diagonal

Pelvis diagonals

- VP for all positions: the patient lies on his side with the lower limb bent, the lower upper limb is bent under the head

- movement: **anterior elevation**
- holding: the fingers of one hand hold the upper edge of the iliac blade, the other right behind it, but the palm does not hold the pelvis from above
- prompt the patient to perform anterior elevation
- when the patient performs, the therapist pulls the pelvis into the posterior depression and lightly springs
- muscles: obliquus externus abdominis (contralateral), obliquus internus abdominis (homolateral)

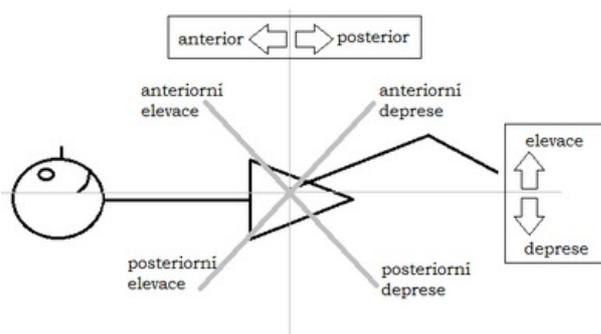


Diagram of pelvic diagonals

- movement: **posterior depression**
- holding: one hand holds the tuber ischiadicum, the other placed under it
- prompt the patient to perform a posterior depression
- when the patient performs, the therapist pulls the pelvis into anterior elevation and lightly braces
- muscles: quadratus lumborum (contralateral), iliocostalis lumborum (homolateral), longissimus thoracis (homolateral)

- movement: **anterior depression**
- holding: one hand holds the upper edge of the iliac blade, the other is placed on the tuberositas tibiae
- prompt the patient to perform an anterior depression
- when the patient performs, the therapist pulls the pelvis into posterior elevation and lightly braces
- muscles: obliquus abdominis internus (contralateral), obliquus abdominis externus (homolateral)

- movement: **posterior elevation**
- holding: one hand holds the upper edge of the iliac blade from above, the other is behind it
- prompt the patient to perform posterior elevation
- when the patient performs, the therapist pulls the pelvis into the anterior depression and lightly springs
- muscles: quadratus lumborum (homolateral), latissimus dorsi (homolateral), iliocostalis lumborum, longissimus thoracis

Diagonals of the upper limb

For the upper limbs, we mark movement patterns as I. and II. diagonal. Each of these diagonals has a basic flexion and extension movement pattern and a flexion and extension variant for the central joint (elbow). The therapist holds the patient's hand with his homolateral hand in such a way that the patient's index finger is caught "like a cigarette" between his II. and III. finger. Between V. finger of the therapist and IV., III. is the patient's thumb. Between II. and I. the therapist's finger is then the patient's three remaining fingers. The therapist then controls the movement in the elbow joint with the contralateral hand.

Diagonal I flex pattern		
	default position	final position
acromion	posterior depression	anterior elevation
scapula	adduction, internal rotation	abduction, external rotation
shoulder joint	extension, abduction, internal rotation	flexion, adduction, external rotation
elbow joint	extension	extension
forearm	pronation	supination
wrist	dorsal flexion, ulnar duction	palmar flexion, radial duction
thumb	extension, abduction	flexion, adduction, opposition
MP joints, fingers	extension, abduction, ulnar duction	flexion, adduction, radial duction
PIP, DIP	extension	flexion/semiflexion

Diagonal II flexion formula		
	default position	final position
acromion	anterior depression	posterior elevation
scapula	abduction, internal rotation	adduction, external rotation
shoulder joint	extension, adduction, internal rotation	flexion, abduction, external rotation
elbow joint	extension	extension
forearm	pronation	supination
wrist	palmar flexion, ulnar duction	dorsal flexion, radial duction
thumb	flexion, adduction, opposition	extension, abduction
MP joints, fingers	flexion, adduction, ulnar duction	extension, abduction, radial duction
PIP, DIP	flexion	extension

Diagonals of the lower limb

For the lower limbs, we mark movement patterns as I. and II. diagonal. Each of these diagonals has a basic flexion and extension movement pattern and a flexion and extension variant for the central joint (knee). The therapist holds the foot from below with his hand so that he reaches the toes, the other hand controls the movement in the knee area.

Diagonal I flexion formula		
	default position	final position
hip joint	extension, abduction, internal rotation	flexion, adduction, external rotation
knee-joint	extension	extension
ankle joint	plantar flexion, eversion	dorsal flexion, inversion
fingers	flexion, fibular deviation	extension, abduction, tibial deviation

Diagonal II flexion formula		
	default position	final position
hip joint	extension, adduction, external rotation	flexion, abduction, internal rotation
knee-joint	extension	extension
ankle joint	plantar flexion, inversion	dorsal flexion, eversion
fingers	flexion, adduction, tibial deviation	extension, abduction, fibular deviation

Other PNF techniques

Rhythmic initiation

- goal: starting a movement, learning a new movement or movement pattern, improving coordination and perception of movement, normalizing the range of movement, relaxing the patient
- indications: too fast or slow movement, increased muscle tension, movement initiation disorder, uncoordinated movement
- procedure: the therapist demonstrates the movement passively with timing and comments, then the patient tries it himself under the verbal guidance of the therapist, possible escalation of difficulty (passive, active with assistance, active, against resistance)

A combination of isotonic contractions

- goal: coordination and active control of movement, increase in range, strengthening of muscles
- indication: loss of coordination and ability to move actively, reduced range of motion
- procedure: the therapist leads the patient's movement against the resistance (concentric contraction) at the end of the movement there is a stabilizing hold (isometric contraction) and the movement back is led by the therapist, the patient is pushed (eccentric contraction)

Stabilizing reversal

- goal: increasing muscle strength, improving stability
- indication: inability to maintain isometric contraction, reduced muscle strength, joint instability
- procedure: the therapist applies resistance in one direction, when the patient engages the muscles sufficiently, the therapist changes the direction

Rhythmic stabilization

- goal: improving stability, increasing range of motion and increasing muscle strength
- indications: joint instability, limited range of motion, muscle weakness or pain during movements
- procedure: the therapist puts the patient in a position, then tries to deflect it, the patient tries to keep the original position

Contraction, relaxation

- goal: increasing range of motion
- indication: limited range of motion
- procedure: setting the segment to the maximum possible position, the patient performs the movement against resistance, relaxation for 5 seconds, the patient actively tries to return to the maximum possible range of motion

Endurance, relaxation

- goal: increasing the range of motion, reducing pain during movement
- indication: reduced range of motion, painful active movement
- procedure: setting the segment to the maximum possible painless position, then the patient performs an isometric contraction while gradually increasing the resistance for at least 5 seconds, then comes relaxation and return active returned to the maximum possible painless position

Repeated stretching

- goal: prevention or reduction of fatigue, increase in range, increase in muscle strength, facilitation of engaging in movement
- indications: weakness, inability to initiate movement, awareness of movement
- execution: before starting the movement, the therapist stretches several times to the maximum possible extent or during the movement he returns slightly and stretches again

Indication

The use of this methodology is extremely broad in today's medicine. It is used in peripheral palsy, in CNS diseases (states after stroke, multiple sclerosis, ataxia), after spinal operations, in degenerative joint diseases, in posture disorders, etc.

Contraindication

There are not many contraindications, mainly febrile diseases, metastasizing tumors and severe diseases of the cardiovascular system.

References

Related articles

Literature

- HOLUBÁŘOVÁ, Jiřina – PAVLŮ, Dagmar. *Proprioreceptivní neuromusculární facilitace část 1.* 1. edition. Praha : Karolinum, 2007. ISBN 978-80-246-1294-2.
- ADLER, Susan – BECKERS, Dominiek – BUCK, Math. *PNF in Practice.* 3. edition. Heidelberg : Springer Medizin Verlag, 2008. ISBN 978-3-540-73901-2.