1) **MANUAL MEDICINE**
   Manual therapy (manipulative treatment)

2) **REHABILITATION**
   AS THE POINT OF THE INTENSIVE MEDICAL CARE

MUDr. Alois Krobot, Ph.D.
krobot@fnol.cz
Rehabilitation and manual therapy

- Rehabilitation is defined as well as the restoration of function in the motor system.

- Like this definition implies recuperation of active voluntary motion. To place emphasis on active exercise is therefore justified to achieve normal active control of movement.

- Structures that move passively however such as joints, ligaments, fasciae and tendons frequently play a key role in this recovery, even for severe muscle spasm.

- In fact, the use of passive manipulative therapy by a qualified individual may enable a patient to carry out active motion, whereas omitting these methods would result in frustration and loss of (physician) time.
The basic concepts a mechanisms of manual therapy

- Manual medicine has been known to **supplement and contribute to other medical specialities**, especially such fields as medical rehabilitation or physical medicine, also physiotherapy, conservative orthopedic surgery and neurology.

- **Manual therapy is the most frequent form of the medical rehabilitation**

- Within the field of manual medicine itself, there have been identified certain treatment procedures that, because of their known potential risks, require special attention and thus should be performed only by licensed practitioners.

- In particular, the manual therapy techniques associated with certain risks include the classic manipulation procedures, also known as “**thrust techniques**“ or now called “**the mobilization with impulze techniques**“.
The management of manual medicine

It is the task and duty of licensed practitioner to recognize both the absolute and relative contraindications to manipulative therapy.

- The physical therapist is neither trained nor authorised to discern the contraindications, because an in-depth clinical assessment alone may often not be sufficient.

- The physician only can judge if and what further diagnostic workup is in order and follow up accordingly, i.e. radiographs, laboratory tests, etc.

- On the other hand, the nonthrust techniques, also known in more general terms as “the soft tissue techniques“ or more recently called the “mobilisation techniques without impulse“.

All manual therapy techniques, both the mobilisation techniques with and without impulse, require an exact anatomic, biomechanic and neurophysiologic understanding of locomotor system.
Manual medicine (manipulative treatment)

- Manual manipulative treatment is originally an important instrument in the restoration of passive motion of joints.

- Following innovation techniques affected not only joints but also the soft tissues, in particular fasciae and muscles (so-called myofascial tissues). As well as muscle as whole in spasm (so-called “muscle strain“) and / or only the muscle fasciculus in reflective spasm (so-called “trigger point“ (TrP). Many of these techniques also make use of the patient’s muscles and therefore may be considered semiactive. Such methods - today the most extended - are a link between passive manual treatment and the active voluntary participation of patient. They are simple only verify applications of the conventional physiotherapy principle PNF (prioprio-neuro-facilitation).

- Recently implement up-to-date modern reflective stimulative techniques combining the passive non-voluntary methods (positional release) and specific cumulative extero- and proprio-ceptive stimulation of “primitive movement frames“ (i.e. preinspirium, reflective locomotion, etc).

- Even more important is the diagnostic value of the techniques of the manual medicine. These assessment (diagnostic and at the same time therapeutic techniques) are useful for understanding so-called “funtional movement pathology“.
Changes in (motor) function

- Unfortunately: *Physiology is no less complicated than morphology.*

The condition affecting the motor system that most often requires treatment, including rehabilitation, is not the obvious loss of motor control or motor function, but first of all the pain, also termed the myofascial pain.

Use of this descriptive term seem justified in so far as this pain, whatever its true origin, is expressed of felt mainly in muscles and their attachment points.

Despite its enormous incidence, this affliction is poorly understood: No pathological structural changes have so far been confirmed as relevant and it is secret hope of many researches that discovery of such changes is just round the corner.
Changes in (motor) function -2

The fact that some changes in function are immediately reversible provides a rational explanation for some „miracle cures“ after treatment by manipulation or other „reflex therapy methods“.

Unfortunately, locomotor dysfunction has remained a medical no man´s land, lost between such specialities as neurology, orthopedics, rheumatology and rehabilitation medicine.

In view of its importance a clear distinction between structural and “functional“ pathology (dysfunction) is fundamental – for diagnosis and management as well as for classification.

If we accept changes in function as relevant in term “myofascial pain“ – then we should be able to explain why and how dysfunction can truly cause it.

This explanation seems relatively easy: whatever the type of dysfunction we treat (muscle spasm or a change of soft tissues or altered body (axial) statics, we invariably meet increased tension.
Changes in (motor) function -3

In fact impaired function of the motor system is associated less with inability to move than with pain resulting from increased tension.

If we move in the direction of a restricted joint, overstrain, assume unfavorable positions or perform strenuous work, etc. the common denominator is increased tension (so-called muscle / soft tissues STRAIN).

The link between strain and pain should be readily understandable. Pain is in the first place a warning sign of impending danger and, in the locomotor system, is an indicator of the need to protect against overstrain.
Changes in (motor) function -4

Pain receptors, therefore, are found precisely where tension is most prominent in the motor system, i.e. in muscles with their attachment points, joint capsules, ligaments, meningeal sheaths, and the outer layers of the annulus fibrosus.

From what it can well be understood that myofascial pain (strain) is the most frequent type pain experienced by the human organism. The question is where and how to apply (functional or reflex) therapy. If we have a painful structural lesion (i.e. inflammation) we know where to apply treatment.

Function on the other hand implies correlations and interplay of many structures. Therefore: “He who applies treatment to the site of pain is usually lost“ (Mennel). We must apply our manual therapy mainly to the real source of (motor) dysfunction and not to the painful area.
Changes in (motor) function -5

Clinical experiences has shown that changes in function follow certain patterns; as a rule if we find one change there is another connected with it (i.e.) we observe certain “chain reactions“.

It is possible to show that these chain reaction follow certain rules that correspond to the basic function of locomotor system, i.e.:

- Gait, involving mainly the lower extremities and the pelvis with the lumbar spine.
- Body (axial) statics, involving mainly the trunk and neck.
- Respiration, involving mainly the thorax, rib, and diaphragm and the other respiratory muscles.

The cause of disturbed motor function is frequently in the motor system itself. It may however lie outside in particular in the viscera, triggering characteristic patterns or (i.e. cardiac or pleural) chain myofascial reactions.
Diagnostic utility of palpation / the barrier phenomenon

✓ Dysfunction causes increased tension in various structures (tissues) of the motor system nad this tension relates to pain.

✓ The main tool in the diagnosis of changes in tension is absolutely PALPATION.

✓ Palpation is an art that was once important in medicine. Together with inspection it was the basis of clinical movement medicine (manual medicine and as well as clinical kinesiology).

✓ Regrettably it is now largely neglected. For this reason: It is necessary to give a concise analysis of palpation in relation to manipulation.
Education of palpation and the barrier phenomenon

1) The first step is to apply our finger (fingers, hand) to the body surface and to concentrate on what we want to investigate: resistance to pressure, temperature, moisture, smoothness or roughness of skin and tissue mobility. In this effort we use not only our sense of touch but also proprioception.

2) To make both palpatory diagnostic and treatment more effective and better understood, we must be aware of the barrier phenomenon, i.e.: Moving a joint (or other soft tissues) from a neutral position involves first a range of motion in which resistance uniform and negligible. As we approach the end of the range we meet resistance which gradually increase.

3) The moment resistance starts to increase, i.e. when we meet the slightest resistance, we have reached the barrier. We feel so-call “end-feel“: Category for diagnosis as well as for therapy.
**Existence two barriers**

a) **Physiological barrier** (Ph): Relevant normal function.

b) **Pathological barrier** (Path): Relevant dysfunction but it also patomorphology (!)

c) **Anatomical barrier (respective)** (A):

The normal barrier is soft and resilient and can be easily sprung.

The pathologic or restrictive barrier is one that is met too soon and feels abrupt.
Indications for manual therapy

✓ PAIN - acute
   - chronic
   - localised
   - referred

✓ Segmental restriction with hard endfeel
✓ Segmental restriction with soft endfeel
✓ Segmental restriction without pain
✓ Segmental hypermobility

✓ Zone of irritation (prominent)
✓ Zone of irritation (discrete)

✓ Muscular imbalance significant
✓ Muscular imbalance discrete
Contraindications to manual therapy

- acute inflammatory processes
- destructive processes (tumors, metastases)
- marked osteoporosis
- significant degenerative changes
- vertebral basilar insufficiency
- hard orthopedic deformities
- whiplash injuries to the cervical spine
- hypermobility
- psychiatric and psychologic changes (!)
  such as psychoses, but also neuroses, hysteria, depression
Strategy of manual therapy after patient response

✓ The patient feels improvement after treatment:
   Treatment is repeated until the treatment goal has been attained.

✓ The patient’s symptoms are exacerbated for hours subacutely after treatment but show improvement the day after treatment:
   Continue treatment regimen.

✓ The patient’s symptoms are exacerbated immediately after treatment:
   Reevaluation of the previous findings, detailed documentation of physical findings, including neurologic assessment and history.

✓ Progressively worsenign symptoms (over days or weeks to months):
   Manual therapy should be discontinued and the other methods should be concidered.

✓ In case of neurologic complications:
   Immediate hospitalization (!).

✓ The patient’s status remains unchanged, neither improvement nor worsening of the initial symptom:
   Discontinue manual treatment and reevaluate the patient psychosocial situation (“sempre-lo-stesso-syndrome“).
Manual medicine – current treatment modality

✔ traction

✔ mobilisation and manipulation

  **mobilisation without impulse** - (repetitive, acyclic, shaking techniques)

✔ mobilisation with impulse = **manipulation**
  - low velocity manipulation
  - high velocity manipulation

✔ **neuromuscular technique** - mobilisation using PNF principles
  - muscle energy techniques (MET): I., II. and III. category

✔ **myofascial release and myofascial stretch**

✔ **positional release technique**

✔ **reflectional stimulation of the “primitive frame’s“ from axial and respiratory movements**
  - (“stimulation of evolution motor reminiscences“) to minimize abnormal muscle spasmus (and pain) and re-storation of the physiological movements
In fine a good example gold standard of manual therapy

Zona irritation: C1 – C2

Technique:
Mobilisation with impulse (thrust):
Rotation restriction.

Indicating:
Movement: Rotation restriction with hard endfeel.
Pain: Suboccipital area, occasionally radiating to the region between the scapulae.

Treatment procedure:
A rotatory impulse force is directed toward the transverse of the atlas.
View of problems of the intensive care

Recently boom of patients after resolution of critical illness, poly- or cranio- trauma or surgery risk.

They have common considerable problems:

- Consume a disproportionate amount of intensive care unit (ICU) resources.
- Unable or have problem to wean from mechanical ventilation (MV).
- Target risk of development of the myoplasticity (myoplastic hyperstiffness of skeletal muscles) / not spasticity (spasticity syndromes are only at patients with „CNS lesions“).
- Target risk of development of the other complications of bed rest and inactivity and/or immobilization.
Resolution

and at the same time the rational therapy as the point of the general medical care is

**early, seasonable and specific**
(outgoing of the neurophysiological kinesiology)

**rehabilitation**
(physioterapy)
Immobilitation

One the most prevalent syndromes encountered by rehabilitative specialists is the resulting from prolonged bed rest and immobilitation.

The basis of the immobilitation syndrome is an imbalance of the normal relationship between rest and physical activity - two biologic processes which are essential to preserve man’s optimal physical condition.

While excesses of physical activity can produce exhaustion (and over-use syndromes) - the lack of physical activity has been exactly shown to result in profound physiologic and biomechanic changes in practically all organs and symptoms of the body.
The following systems are adversely affected by immobilization:

1) central nervous system
2) respiratory system
3) cardiovascular system
4) muscular system
5) skeletal system
6) digestive, renal and endocrine systems
7) integumentary system
Central nervous system (bed rest / immobilisation):
Adverse emotional and intellectual responses to prolonged bed rest include:
- altered sensation, including low pain threshold
- decreased motor activity, aggravated by muscular weakness and atrophy, inability to perform skilled activities
- emotional disturbances
- decrease of intellectual function due to anxiety, depression and diminished stimulation.

Cognitive rehabilitation program (physiotherapy and ergotherapy):

1) Sensory stimulation: The institution of a rehabilitation program of sensory stimulation is the most effective means of preventing or treating the CNS manifestations of immobilizations.

2) Similarly it is necessary to provide intellectual challenges to these patients and make them perform specific tasks in order to preserve intellectual functional.
Respiratory system (bed rest / immobilisation) -1:

Patients with multifactorial diseases on ICU:

- **Serious risk of the fatigue ascend the weakness of the respiratory muscles – mainly diaphragm**
- **Serious risk of the critical illness neuromuscular abnormalities (CINMA) – myopathies and neuropaties**

This results in:

- **Decreased tidal volume**
- **Decreased maximum breathing capacity**
- **Increased respiratory rate**

Pooling of secretions in the bronchioles interferes with the action of the cilia and makes the patients susceptible to hypostatic pneumonia. As a result: increased arterial-venous shunting and arterial hypoxemia ensue.
Respiratory system (bed rest / immobilisation) -2:

Prevent pulmonary complications by:

- Frequent (preferably hourly) position changes (!!!!)
- Urging deep breathing and cough
- Early mobilization
- Frequent pulmonary toilet
- Percussion and postural drainage
Respiratory system (bed rest / immobilisation) -3:

60 – 70% of vital capacity and most of the tidal volume is provided by the diaphragm (physiological state).

- In the presence the great deal of patological changes the diaphragm is so depressed that the costal parts of diaphragm and costal margin or base of the thorax cannot expanded.
- The patient tends to lean forward tipping the diaphragm anteriorly and favoring increased excursion.
- The accessory respiratory muscles (SCM, infrahyoids, pectorals, latissimus dorsi (!), etc. expand the upper chest increasing the tidal volume, particularly during exercise or with conditions in which the work of breathing is increased.

Strengthening and maintance of the “range of motion“ of respiratory muscles by deep breathing or periodic maximal insufflations are important components of most rehabilitation programs.
Respiratory system (bed rest / immobilisation) -4:

Plasticity of respiratory muscles must be considered in the context of their unique physiological demands. The continuous rhythmic activation of respiratory muscles makes them among the most active in the body.

Respiratory muscles, especially the diaphragm, are non-weight-bearing, and thus, in contrast to limb muscles, are not exposed to gravitational effects.

Perturbations in normal activation and load known to induce plasticity in limb muscles may not cause similar adaptations in respiratory muscles. In this review, we explore the structural and functional properties of the diaphragm muscle and their response to alterations in load and activity.

Overall, relatively modest changes in diaphragm structural and functional properties occur in response to perturbations in load or activity. However, disruptions in the normal influence of phrenic innervation by frank denervation, tetrodotoxin nerve block and spinal hemisection, induce profound changes in the diaphragm, indicating the substantial trophic influence of phrenic motoneurons on diaphragm muscle.
Respiratory system (bed rest / immobilisation) -5:

Rehabilitation programs:
- There are wide consensus on the efficacy of postural drainage and controlled or assisted coughing in assisting pulmonary toilet.
- On the other hand the efficacy of chest percussion is controversial: Although high frequency mechanical percussion or vibration has been argued to be more effective than manual percussion, there are no controlled studies which demonstrate efficacy of chest percussion in general (!).

There is consensus on the efficacy of the physiotherapy on the course of weaning from mechanical ventilation:
- Manual stimulation of the costal parts of the diaphragm
- Positional stretch of the full-range trunk muscles as iliopsoas, quadratus lumborum a latissimus dorsi
- Positional stimulation of the abdominal muscles as the opponent of diaphragm
Cardiovascular system (bed rest / immobilisation):

- Increased resting heart rate.
- Stroke volume is decreased by about 15% at rest and the stroke volume response to exertion is diminished.
- Blood plasma volume is decreased, while extracellular fluid volume remains unchanged.
- Maximal oxygen uptake (Vo2 max) is reduced.
- Myocardial perfusion is decreased because of shortening of the diastolic period as a result of tachycardia.
- Orthostatic hypotension:
  (Blood pressure may reach levels as low as 60/30 within 10 – 20 seconds of dangling at the bedside).
- Phlebotrombosis.
**Muscular system** (bed rest / immobilisation):

1) **Lose of strength of muscles**
Imobilised muscles lose 20% of their strength the first week (!), 20% of the remaining strength the second week, and so on.
Endurance also decrease at a similar rate due to a reduction in metabolic activity but appears to recover more rapidly.
During recovery only 10% of strength is regained per week.

2) **Myoplastic hyperstiffness**
Myoplasticity is the ability of skeletal muscle to adapt structurally and functionally in response to changes in activity level and to prolonged positioning. Immobilised muscles exert excessive resistance to muscle stretch. The excessive resistance is due primarily to changes within (myoplasticity): 
*Loss of sarcomeres + Increased weak binding of actin and myosin + Atrophy of muscle fibers.*
Muscle atrophy due to immobilisation is limited to 30 to 35% of the origin muscle volume (in the absence of a lower motor neuron lesion).

**Solution:** The proper and regular positioning (!) and reflective physiotherapy (!!).

---

**REHABILITATION STRATEGY : PREVENTION AND TREATMENT OF THE IMMOBILIZATION SYNDROME**

---
Skeletal system (bed rest / immobilisation) - 1:

The normal homeostatic balance between accretion and resorption of bone depends on the muscular pull on bones and on the effect of gravity while standing. With inactivity bone mass is lost because the stimulus to bone accretion is diminished while resorption continues unabated.

Immobilization osteoporosis does not show up on X-ray until a great deal of bone mass has been lost.

The following complications of immobilization osteoporosis occur:

- Fractures with minimal trauma.
- Ectopic calcification in soft tissues.
- Hypercalcemia and hypercalciuria and their outgrowths.
Skeletal system (bed rest / immobilisation) -2:

Treatment of immobilization osteoporosis is the resumption of weight bearing early as possible and active resistive exercises.

Joint contractures limit ROM and may occur in almost any of the tissues surrounding a joint. Joint motion may also be blocked by: cartilage damage, joint incongruency, synovial proliferation and capsular fibrosis.

Common pathogenesis: Loose collagen fibers III type around the joint change into type I collagen fibers which form dense fibrous bands (Recently: The theory of the myofibroblasts).

Prevention and rehabilitation of myoplastic hyperstiffness even constrictures is by:
- Proper positioning
- Active and passive exercise (sustaining ROM – range of motion).
- Prolonged stretch (low tension and heat about 40 degrees).
- Dynamic splinting and casting.
Summary

The prevention and rehabilitation treatment of „the immobilization syndrome“:

1) Proper positioning – respecting the „kinesiology of human functions“.
2) Treatment teamwork for weaning patients from mechanical ventilation.
3) Respiratory and coughing exercises (respiratory physiotherapy).
4) Adequate position and passive mobilization of all joints.
5) Adequate nutrition and skin hygiene.
6) Active isotonic or isometric exercises as prevention of myoplasic stiffness.
7) Reflective and voluntary physiotherapy benefit by sufficient spontaneous ventilation.
8) Gradual cardiovascular reconditioning through physical exercise and passive tilt.
9) The most important: Provision of enviromental stimuli and intelectual challenges (so-called cognitive rehabilitation programs).