

LEVITAS

Suspension exercises

SKRIPT



Technomex

Pomagamy
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ABBREVIATIONS USED IN THE TEXT

PW - starting position

KKD - lower limbs

KD - lower limb

KKG - upper limbs

KG - upper limb

MM - muscle

Ep C - cervical spine

Ep Th - thoracic spine

Ep L - lumbar spine

Presented exercises and positions are just a small part of the capabilities of the device Levitas and the approach to therapy in sling. You can learn more during the specialized training.

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INTRODUCTION

Characteristics of the device

Levitas is a modern device for the sling treatment in a sling mounted to a metal frame. The unique design of suspension elements allows for precise and easy operation. Due to its modern design the suspension system is efficient and easily adjustable.

Accessories



In order to perform rehabilitation exercises Levitas is equipped with hardware, which consists of: sling, cuffs, spat, belts, ropes, weights.

Below is a list of typical equipment for Levitas.

- Sling for the chest
- Sling for the pelvis
- Sling for limb (thigh, lower leg, arm, forearm)
- Sling for foot
- Head sling

- Universal sling for arm, leg, head
- Self-locking sling
- Ankle cuff
- Thigh cuff
- Spat
- Pelvic strap (sling with four suspension points)
- Chest strap
- 2m cable for suspension
- 5.5 m cable for exercises with resistance
- 0.5, 1.0, 1.5, 2.0 kg weights

The advantages of rehabilitation exercises in Levitas

Advantages for the therapist: saving time and energy, hands-free - other techniques such as massage, resistance, traction available at the same time, the ability to maintain the distance between the therapist and patient, enables easy diagnosis,

Advantages for the patient: facilitation of a move, no pain during movement, a sense of security and relaxation, ability to carry out the exercise independently.



TYPES OF SUSPENSION IN LEVITAS

Levitas enables two types of suspension:

- full, where all the body is suspended over the ground,
- partial, where only one part of the body is suspended (upper or lower limb, both upper or lower limbs, lower limbs and hip, head and arm, upper trunk and head).

Each type of suspension can be made in two ways:

- single attachment point (PP; all slings suspended at one point)
- multipoint suspension (WP; slings suspended at various points). According to the possibility of movement suspensions are referred as mobile, partially mobile and stable. There are 8 ways of suspension possible in Levitas (Tab.I.).

Table I. Types of suspensions in Levitas

Stable	Partially mobile	Mobile
Neutral PP and WP	Lateral/Medial PP	Axial PP
Distal PP and WP	Lateral/Medial WP	Axial WP
Divergent WP		Proximal PP

Below is a brief description of each type of suspensions.

Single-point suspension (suspension point is the point of rotation of the suspended part of the body).

Axial single point suspension (axial PP) - the suspension is perpendicular to the axis of rotation of the joint. Movement of suspended part of the body is facilitated similarly in the two possible directions with the elimination of gravity.

Distal single point suspension (distal PP) - the point of suspension is moved distally to the axis of motion (e.g. attachment point of the lower limb is moved above the thigh, knee joint, etc.). In this type of suspension concave plane of motion is obtained. Movement in both directions is restricted by the need to overcome the force of gravity, but it is easier to return to the starting position. Suspension limits the range of motion, and is therefore more stable. Along with increasing distance from the point of suspension in the distal direction, the compression forces reduce while traction forces occur and increase.

Single point neutral suspension (neutral PP) - the point of suspension is located perpendicularly above the sling, thereby eliminating the forces of compression and tension. Plane of movement and impediment/ facilitation of movement as described above.

Single point proximal suspension (proximal PP) - the point of suspension is moved proximally to the axis of motion of the joint. Plane motion has a convex shape. Movement in both directions is facilitated (supported by gravity). Return to the starting position is restricted due to the force of gravity. Suspension results in compression forces action on the suspended part of the body.

Single point lateral or medial suspension (lateral / medial PP) - the point of suspension is moved laterally or medially in relation to the axial one. Localization of the plane of movement facilitates the movement towards the direction of the suspension point shift and limits it in the opposite direction. This is partially mobile type of suspension.

Single point diagonal suspension - a combination of distal and lateral-medial suspensions. It is used to achieve the desired direction of movement or adjustment of the existing suspension when one part of the body deflects excessively toward one side. Without photo.

Multipoint suspensions (here the plane of motion is determined by the farthest point of suspension).

Multipoint distal suspension (distal HR) - suspension points are moved distally. This suspension is used for traction .

Multipoint neutral suspension (neutral HR) - suspension points are located perpendicularly over the respective slings. This results in abolished compression and tension / traction forces. The plane of movement is concave. The same as distal and neutral PP this type of suspension is stable.

Multipoint lateral / medial suspension (lateral / medial HR) - suspension points are shifted respectively laterally or medially. This results in forced movement of the suspended part of the body in the direction of the suspension point shift. Movement in the opposite direction is restricted. This is the partially mobile type of suspension.

Multipoint divergent suspension (divergent HR) - suspension points are arranged in opposite to each other directions, such as dorsally and ventrally as well as laterally and medially . It is the most stable type of suspension . It is used to stabilize the desired portion of the body (e.g., stabilization of thigh during exercise of knee flexion and extension) or to stabilize the stretching positions .

Multipoint axial suspension (axial HR) - is a combination of axial PP and neutral WP. Due to movable frame the movement can be performed with the elimination of the compression forces and in a flat plane. This is the mobile type of suspension.

Regardless of the type of suspension, slings are placed distally from the joint, in which the peripheral movement takes place. Resuspension is made in the opposite direction.

FORCES USED DURING EXERCISES ON LEVITAS

In Levitas following types of forces are used:

- compression
- traction
- shear forces.

Each of them can be used for therapeutic purposes, but can also work negatively, damaging. **Compression forces** arise when attachment point is positioned proximally to the sling. Compression forces are contraindicated in osteoarthritis, rheumatic conditions, particularly in acute states. However, those are indicated in flaccid paresis and joint instability. **Traction** is obtained by moving the point of suspension in the distal to the trained joint direction. Traction is contraindicated in joint instability, but indicated in arthritis. **Shear forces** are generated by moving the point of suspension in the lateral or medial direction. They are used to stretch the muscles and mobilization in the limited mobility of the joint.

TYPES OF EXERCISES USED IN REHABILITATION ON LEVITAS

The device Levitas enables to carry out:

- active exercises in support
- active exercises in support with resistance
- active exercises with resistance
- self-supported exercises

Additionally, Levitas can be used for exercises/relaxing techniques, stretching, strengthening the stability and muscle coordination, and to mobilize the joints.

Here is the short description of the above types of exercises.

Active exercises in support - the patient alone performs movement within the full range of motion in condition of the total weight release of trained part of the body.

Indications: atrophy and muscle weakness (from +1 to+2), lesions of the articular surfaces, delayed bone union.

Contraindications: acute arthritis and peri-arthritis, acute periphlebitis, fever.

Objective: Preventing muscular atrophy, muscle strengthening, increasing range of motion

Active exercises in support with resistance - involve the movement performed independently by the patient within the full range of motion in condition of the total weight release of trained part of the body overcoming the additional resistance which value is less than the weight of the trained part of the body .

Indications: muscle weakness (up to +2 to +3) , osteoarthritis .

Contraindication: acute arthritis and peri-arthritis .

Objective: To strengthen the muscle .

Active exercises in support with resistance are usually performed in the axial sling with weights load. The weight is attached to an additional system. The cuff, connected to the directional pulley by the cable is placed in the middle of the limb length. Directional pulley and cable are placed in the plane of the movement on the lateral column. Directional pulley should be placed in such a way that in the middle of the range of motion the cable connecting the pulley and the cuff is perpendicular to the exercising part of the body. Additional pulley connected with weights by the cable should be placed on top of the unit .

Note - the range of motion in joints with an extensive mobility is divided into two sectors. The location of the directional pulley is selected for each sector separately.

Active exercises with resistance - involve the movement performed independently by the patient overcoming the force of gravity and additional external resistance. The rules of directional and additional pulleys location are similar to active exercises in support with resistance.

Indications: muscle strength 4, 5 in Lovett scale.

Contraindications: Fresh bone union, osteoporosis, cardiovascular diseases.

Objective: To strengthen the muscle.

Self-supported exercises - are based on the observation that the movement of one limb helps moving the other one. In order to perform exercises an arrangement of 1-2 blocks with cable passing is used. The sling, which connects to the cable running through the block is placed on the trained limb. The other end of the cable is held by the other limb.

Indications: limited mobility of joints, preparation for active or redression exercises.

Contraindications: acute arthritis and peri-arthritis, acute periphlebitis.

Objective: To increase the mobility of joints, relaxation in increased muscular tone, "warm-up" before active exercises.



GENERAL CONTRAINDICATIONS AND LIMITATIONS FOR SLING EXERCISES

- dizziness, particularly Meniere's syndrome (instability stimulates the organ of equilibrium, this refers mainly to the suspension of the head, trunk and whole body)
- extensive damage to the skin, burns, skin inflammation
- severe heart failure and cardiovascular diseases
- epilepsy
- peripheral occlusive arterial disease (caution with slings where legs are above the pelvis level)
- mental disorders (e.g. claustrophobia)
- osteoporosis
- joint instability (restrictions depend of the type of suspensions)

In addition, sling exercises are not applicable in the rehabilitation of the small joints of the hand and foot.

LOVETT'S SCALE

Sling exercises aimed to increase muscle strength are divided based on the strength of trained muscles, assessed according to Lovett's scale.

According to the Lovett's scale muscular strength values range from 0 to 5 (Table II.).

Tab.II. Muscular strength in Lovett's scale

Scale	Description
-------	-------------

5	Full range of motion against gravity and maximal resistance
4	Full range of motion against gravity and partial resistance
-4	Over 50% max. ROM against gravity and partial resistance
+3	Below 50% max. ROM against gravity and partial resistance
3	Full range of motion against gravity
-3	Over 50% max. ROM against gravity
+2	Below 50% max. ROM against gravity
2	Full range of motion without gravity
-2	Over 50% max. ROM without gravity
+1	Below 50% max. ROM without gravity
1	Palpable or visible muscular tension
0	Lack of muscular tension

ROM -range of motion

PRACTICAL PART

Lower limb

Hip

Movement: Abduction and adduction

Muscle strength 1-2



Example 1.

PM: lying supine. KKD straight.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, sling on foot. Cables suspension points perpendicularly over the slings (on the moving frame).

Movement: abduction and adduction



Example 2.

PM: lying supine. KKD straight.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, sling on foot. Cables suspension points perpendicularly over the slings (on the moving frame).

The possibility of moving suspension points in the distal direction - decompression.

Movement: abduction and adduction



Example 3.

PM: lying prone. Rectangular pillow under the trunk. KKD straight.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, sling covering the foot and ankle. Suspension points of cables connected to the slings perpendicularly over the hip joint.

Movement: abduction and adduction.

Muscular strength 2-3

In order to strengthen hip abductors proximally. In order to strengthen the hip adductors the suspension point should be shifted in the opposite direction (laterally).



Example 1.

PM: lying supine. KKD straight.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, sling on foot. Suspension points of cables connected to the slings shifted medially in the axis of hip joint.

Movement: abduction and adduction.



Example 2.

PM: lying supine. KKD straight.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, sling on the ankle. Cables connecting the suspension point are reversed with pulley at the top. Both ends of the cable are connected with a sling by snap hooks. Suspension points of both cables perpendicularly over the hip joint. This way of suspension allows performing movement with the rotation.

Movement: abduction and adduction with rotation. Possible workout in the pattern of PNF for KD: adduction, extension, internal rotation - abduction, flexion, external rotation.

Muscular strength 3-5

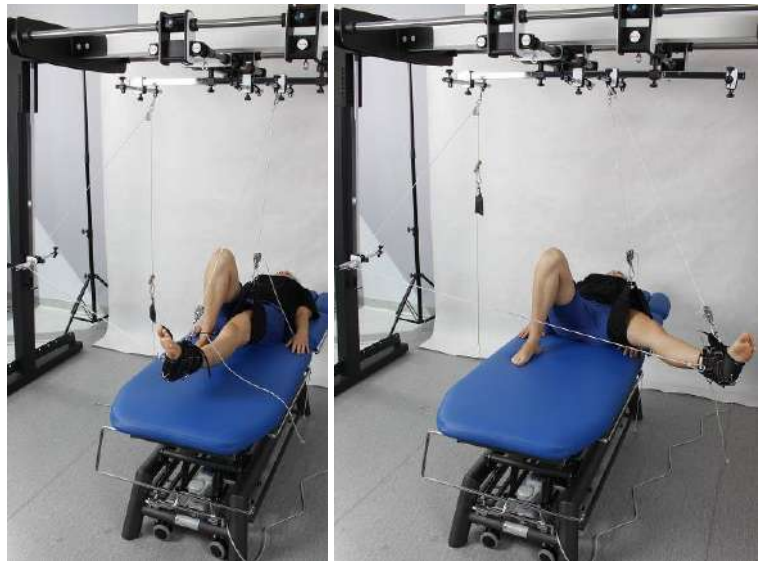
Example 1.

PM: lying supine. KKD straight.

Suspension: sling on his thigh a $\frac{1}{2}$ length, spat on the foot. Suspension points of cables connected to the slings perpendicularly over the hip joint. Resistance: additional cable system linking spat with directional and additional pulley. Directional pulley is placed on the lateral column.

Movement: abduction against the resistance.

For adduction with resistance, system of cable and pulley should be located in the same way from lateral site of KD.



Example 2.

PM: lying supine. KKD straight.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length. Suspension point of cable connected to the sling perpendicularly over the hip joint.

Resistance: manual exerted by the therapist on the dorsal foot.

Movement: abduction against resistance.



Stretching the hip adductors



Example 1.

PM: lying supine. One KD in abduction, bent in the knee joint - lower leg outside the couch. Other KD maximally adducted in the hip, the knee straight.

Suspension: Self-locking sling on the thigh, spat on the foot. Multipoint lateral suspension. The second cable attached to the thigh sling attached perpendicularly to the thigh on the side of the frame.

Position for mm: pectineus, gracillis, long adductor.



Example 2.

PM: bestride on the couch. One KD adducted with bent knee joint - lower leg outside the couch. Other KD maximally adducted in the hip, the knee straight.

Suspension: Self-locking sling on the thigh, spat on the foot. Multipoint lateral suspension. The second cable from the thigh sling attached perpendicularly to the thigh on the side of the frame.

Position for mm: additionally semitendinous, semimembranosus



Example 3.

PM: bestride on the couch. One KD adducted with bent knee joint - lower leg outside the couch. Other KD maximally adducted in the hip, also bent in the knee.

Suspension: Self-locking sling on the thigh, spat on the foot. Multipoint lateral suspension. The second cable from the thigh sling attached perpendicularly to the thigh on the side of the frame.

Position for mm: *additionally great adductor*

All positions can be used simultaneously for both lower limbs.

Traction of the hip - analgesic treatment

Traction of the hip is performed in position of 30° flexion and 30° adduction.



Example 1.

PM: lying supine. KD flexed in the knee joint at 30° and adducted by 30°. Suspension: sling on the thigh in its ½ of length. Suspension point of cable connected to the sling perpendicularly over the hip joint.

A wide sling to stabilize the trunk placed on the pelvis. Smaller sling is located on the distal part of the thigh, just behind the sling supporting the thigh. RR of the therapist under the thigh sling. Traction with the belt.

Movement: hip traction obtained by tilting therapist backwards



Example 2.

PM: lying supine. Trained KD in 30° of flexion and 30° of adduction.

Suspension: sling on the thigh in its ½ of length, sling on foot. Suspension points moved distally. A wide sling to stabilize the trunk placed on the pelvis.



Example 3.

PM: lying supine. Trained KD in 30 ° of flexion and 30 ° of adduction.

Suspension: sling on the thigh in its ½ of length, spat on the foot. Suspension points of cables perpendicularly over the slings. Cable connected to two pulleys attached to the spat sole. The first pulley is located in the extension of the axis of the lower extremity. The second pulley is placed on the top of the frame, so that the end of the cable can be held by the patient's unilateral hand.

Movement: the patient performs the hip traction through pulling the pulley system with the upper limb.

Flexion and extension

Muscular strength 1-2



Example 1.

PM: lying on the side of the not exercising KD, bent at the hip and knee. Trained KD straight in the knee joint.

Suspension: sling on the thigh in its ½ of length, spat on the foot. Cables suspension point perpendicularly over greater trochanter.

Movement: flexion and extension.



Example 2.

The same as above, but leg bent in the knee.

In this example, not exercised KD should be in zero position in the hip.



Example 3.

PW: lying on the side of the not exercising KD, bent at the hip and knee. Trained KD straight in the knee joint. Exercised KD straight in the knee.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, spat on the foot. Cables suspension point perpendicularly over slings, placed on moving frame.

Movement: flexion and extension.

In examples 1-3 we do not use the sling with a hole for the heel, because it causes

undesired in this exercise rotation of KD.

During exercise, there may be compensation movements due to increase of the lumbar lordosis during hip extension and its reduction during flexion of the hip. To avoid these compensations KD should be positioned in flexion or extension/ neutral position in the hip.

Muscular strength 2-3

Example 1.

PW: lying on the side of the not exercising KD, bent at the hip and knee. Trained KD straight in the knee joint.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, spat on the foot. Cables suspension point shifted, in the greater trochanter axis: dorsally - to restrict hip flexion, ventrally - to restrict hip extension.

Movement: hip flexion and extension.

Example 2.

PW: lying on the side of the not exercising KD, bent at the hip and knee. Trained KD straight in the knee joint.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, spat on the foot. Cables suspension point shifted ventrally - for strengthening the hip extensors dorsally - for strengthening the hip flexors, placed of moving frame, in the sling axis.

Movement: flexion and extension.

Example 3.

PW: lying supine, KKD straight.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, spat on the foot. Suspension point of the cable connected to the spat perpendicularly over the spat. The cable attached to thigh sling is located reversely, with pulley on the top. The other end of the cable is held by the patient in the homologous to trained KD hand. The



suspension point of the pulley with the cable is located at the level of $\frac{1}{2}$ trunk length.

Movement: the patient supports flexion in the hip by pulling the cable with hand.

For weaker patients the cable with two pulleys can be used.

Muscle strength 3-5



Example 1.

PM: lying on the side of the not exercising KD, bent at the hip and knee. Trained KD straight in the knee joint.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, spat on the foot. Cables suspension point perpendicularly over greater trochanter.

Movement: flexion and extension.

Resistance: additional system of the cable connecting the spat with the directional and additional pulleys and weight. Directional pulley is located ventrally on the

lateral column for strengthening hip extensors or dorsally - for strengthening hip flexors.

Movement: flexion or extension against the resistance.



Example 2.

PW: lying supine. Not trained KD bent in the hip and knee, pulled to the abdomen and stabilized in this position by KKG. Trained KD at the hip and knee. Lower leg outside the couch.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length. The cable with two pulleys attached to the sling. The suspension point with directional pulley

perpendicularly over the hip. Additional pulley. The sling hooked presence of two blocks. Pulley attachment point of directional angles of the hip joint. Additional pulley connected to a rope with a weight suspended on the side frame.

Movement: hip snap of overcoming the resistance of the weight.

Suspension: Suspension: sling on the thigh in its $\frac{1}{2}$ of length. The cable with two pulleys is attached to the cable. The suspension point with directional pulley perpendicularly over the hip joint. The additional pulley connected with the cable with weight suspended on lateral frame.

Movement: hip extension against the resistance of weight.

Mobilization of hip flexion and extension

Example 1. - mobilization of flexion

PW: lying supine on the side of not trained KD in neutral position. Trained KD bent in the hip and the knee.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, spat on the foot. The suspension point of cables connected to the slings shifted from axial location ventrally and cranially.



Example 2. - mobilization of extension

PW: lying supine on the side of not trained KD bent in the hip and the knee. Trained KD straight in the hip and the knee.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, spat on the foot. The suspension point of cable connected to the thigh sling shifted dorsally, and the one connected to the spat - distally and dorsally.

Example 3. - mobilization of extension

PW: lying on the side of not trained KD bent in the hip and the knee. Trained/mobilized KD straight in the hip and bent in the knee at an angle of approximately 30°.

Suspension: not trained KD: sling on the thigh in its ½ of length attached with the cable to the lateral frame. The sling on the foot attached with the cable in the point located perpendicularly over the sling. Trained/mobilized KD: sling on the thigh in its ½ of length, spat on the foot attached with the cable in points located perpendicularly over the slings.



Example 4. - mobilization of extension.

PW: as above. Not trained KD with foot based on the therapist.

Suspension: Trained/mobilized KD: spat on the foot attached with the cable in the point located perpendicularly over the spat. The weight may be used on distal part of thigh.

Movement: The patient presses with KD based on the therapist, trying to straighten the leg. The movement causes tension of muscles bending the hip on the

opposite side. Repeating this exercise causes less resistance to extension due to muscle fatigue.

Instead of the square manual resistance faced by the therapist can be used.

Mobilization of the hip with joint slides

Mobilization of extension



Example 1.

PW: lying on the side of not mobilized KD bent in the hip and the knee.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, spat on the foot. The suspension point of cables connected to the slings perpendicularly over the slings.

For traction therapist can use a set of linked two slings - for the thigh and for the pelvis. Smaller sling is located on the patient's the thigh on the level of his buttock.

Mobilization: the therapist stabilizes the hands the anterior inferior iliac spine and front distal part of the thigh of mobilized KD. By tilting back the slide in ventral direction is obtained.

Mobilization of flexion



Example 1.

PW: lying supine. Mobilized KD bent in the hip and the knee at 90° .

Suspension: sling on the lower leg, sling on the foot.

Mobilization: the therapist holds the thigh in proximal $\frac{1}{3}$ from the front and performs the slide in the caudal direction.

The exercise duration: 30-60s.



Stretching sciatic-tibial muscles



Example 1.

PW: lying supine. KKD maximally bent in the hip and straight in the knee. Small cushion or wedge is placed between the knees.

Suspension: One sling covers two lower legs, the second one - two thighs in their distal part.

Example 2.

PW: lying on the side with KD in neutral position in the hip joint and straight in the knee. The other KD bent maximally in the hip and straight in the knee.

Suspension: Self-locking sling in the $\frac{1}{2}$ length of the thigh, spat on the foot. Suspension points perpendicularly over the slings.

The cables connected to the sling on the thigh and spat, stabilize KD in the fixed position.





Example 3.

PW: lying supine. Not trained KD bent in the hip and the knee. Trained KD bent maximally in the hip and straight in the knee.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, spat on the foot. The sling on the thigh is connected to the unilateral hand with the cable and the pulley attached with the lateral frame. The cable from the spat is attached on the top or lateral frame.

Movement: by bending KG the patient supports stretching of sciatic-tibial muscles.

External and internal rotation

Example 1.

PW: lying supine. KKD straight.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, sling on the ankle. Cables connecting the sling to the suspension point are located reversely - with pulley on the top. Both ends of the cable are connected to the sling with snap hooks. Both cables points of suspension perpendicularly over the slings.

Movement: rotation.



Example 2.

PW: lying supine. Mobilized KD bent in the hip and the knee at 90°.

Suspension: sling on the thigh in its $\frac{1}{2}$ of length, sling on the foot.

Point of suspension of cables connected to the slings perpendicularly over the knee and hip.

Movement: rotation.

In order to increase rotational muscle strength, the therapist exerts the manual resistance at distal part of lower leg.



The knee joint

Flexion and extension

Muscle strength 1-2



Example 1.

PW: lying on the side on not trained KD bent in the hip and the knee at 45°. Trained KD bent in the hip at 45°.

Suspension: self-locking sling on the thigh in $\frac{1}{2}$ of its length, attached divergently, spat on the foot. The cable connected to the spat attached in the point located perpendicularly over the knee.

Movement: flexion and extension in the knee.

Example 2.

PW: lying on the side on not trained KD bent in the hip and the knee at 45°. Trained KD bent in the hip at 45°.

Suspension: self-locking sling on the thigh in ½ of its length, attached divergently, spat on the foot. The cable connected to the spat attached in the point located perpendicularly over the spat on moving frame.

Movement: flexion and extension in the knee.



Muscle strength 2-3

Example 1.

PW: Lying supine. Not trained KD straight. Trained KD bent in the hip at 45°.

Suspension: self-locking suspension on the thigh in ½ of its length, attached divergently, spat on the foot. The cable with the pulley connected to the spat. The pulley suspended perpendicularly over the ankle. The other end of the cable in unilateral hand.

Movement: movement of KG supports the movement of knee extension.



Example 2.

PW: Lying supine. Not trained KD straight. Trained bent in the hip at 45°.

Suspension: sling on the thigh in ½ of its length, attached to the lateral frame, spat on the foot. The cable with two pulleys attached to the spat. The first pulley suspended perpendicularly over the ankle. The second pulley on the lateral frame connected to the weight with the cable.

attached to the spat. The first pulley suspended perpendicularly over the ankle. The second pulley on the lateral frame connected to the weight with the cable.

Movement: extension supported with weight.



Example 4.

PW: lying prone. Not trained KD straight. Trained KD bent in the knee.

Suspension: The spat on the foot connected with the cable to two pulleys and weight. Directional pulley located on lateral frame at the height adjusted in such a way that the cable connecting the pulley and the spat is perpendicular to the lower leg in intermediate position, between flexion

and extension. Additional pulley on the top of the frame.

Movement: Flexion supported with weight.

Muscle strength 3-5



Example 1.

PW: lying prone. Not trained KD straight. Trained KD bent in the knee.

Suspension: The spat on the foot connected with the cable to two pulleys and weight. Directional pulley located on lateral frame at the height adjusted in such a way that the cable connecting the pulley and the spat is perpendicular to the lower leg in intermediate position, between flexion

and extension. Additional pulley on the top of the frame.

Movement: Flexion supported with weight.

Example 2.

PW: lying supine with KKD bent in the hip and knee. Feet based on the edge of the couch.

Suspension: sling on the thigh in $\frac{1}{2}$ of its length, attached to the top frame for stabilization of the thigh. The spat on the foot connected with the cable to the two pulleys and the weight. Directional pulley placed on the lateral frame on the bottom of the device. Additional pulley placed on the top of the device.

Movement: extension against the weight resistance.



Example 3.

PW: lying supine with KKD bent in the hip and knee. Feet based on the edge of the couch.

Suspension: sling on the thigh in $\frac{1}{2}$ of its length, attached to the lateral frame. The weight placed on the distal part of lower leg.

Movement: extension against the weight resistance.

Mobilization of flexion

Example 1.

PW: lying supine with KKD bent in the hip and knee. Feet based on the couch.

Suspension: sling on the thigh in $\frac{1}{2}$ of its length, attached to the lateral frame. The spat on the foot connected with the cable to the two pulleys. Directional pulley placed perpendicularly over the ankle. Additional pulley placed proximally to the directional one in the same axis.

The other end of the cable held by the unilateral hand of the patient.

Movement: the patient gradually increases the degree of knee flexion.



Example 2.

PW: lying supine with KKD bent in the hip and knee.

Suspension: slings on feet connected to the set of cable and two pulleys.

Movement: alternating flexion and extension of the hip and knee joints - movement as during riding a bike.

Mobilization of the knee - slides



Example 1. - mobilization of extension

PW: lying supine. Not mobilized KD straight. Mobilized KD bent in the hip at 45° . Lower leg parallel to the couch.

Suspension: sling on the thigh in $\frac{1}{2}$ of its length, attached to the lateral frame. The spat on the foot. The point of suspension of the cable connected to the spat perpendicularly over the ankle (the cable should be elastic, Theraband tape may be used instead

of it).

Mobilization: the therapist performs traction in caudal direction with one hand, the other hand (proximal to the knee) performs dorsal slide.



Example 2. - mobilization of the extension

PW: lying prone. KKD straight.

Suspension: sling on the thigh in $\frac{1}{2}$ of its length, sling on the foot. The point of attachment of cables connected to the slings placed perpendicularly over the slings. Kneecap should be placed above the couch.

Mobilization: the therapist performs traction in

caudal direction with one hand, the other hand (proximal to the knee) performs dorsal slide.

Stretching the rectus femoris muscle



Example 1.

PW: lying on the side. KD, on that the patient is lying, stabilized in flexion. Trained KD in neutral position in the hip and maximal flexion in the knee.

Suspension: sling on the thigh in $\frac{1}{2}$ of its length, spat on the foot. The cables connected to the slings arranged divergently, stabilize KD.



Example 2.

PW: lying supine. Not trained KD stabilized in the hip and knee flexion. Trained KD out of couch. The hip in maximal extension, the knee flexed maximally depending on the patient's abilities.

Suspension: two sling on the thigh, one for the foot and one spat. Stabilization of KKD using cables.



Example 3.

PW: lying on the side. KD, on that the patient is lying stabilized in flexion. The hip in maximal extension, the knee flexed maximally depending on the patient's abilities.

Suspension: sling on the thigh in $\frac{1}{2}$ of its length, spat on the foot. Cables attached to slings stabilize KKD in its position.



Example 4.

PW: lying prone. Not trained KD straight. Trained KD in maximal possible extension in the hip, the knee flexed maximally depending on the patient's abilities.

Suspension: sling for the thigh and lower leg, spat on the foot. The cables attached to slings stabilize position of KD. Additionally, on pelvis there is a wide sling stabilizing it.

stabilizing it.

Traction of the knee



Example 1.

PW: lying supine. Not mobilized KD straight. Mobilized KD bent in the knee at 45° . The lower leg parallel to the couch.

Suspension: sling on the thigh in $\frac{1}{2}$ of its length, attached to the lateral frame. Sling on the foot. The point of attachment

of the cable connected to the foot sling perpendicularly over the ankle.

Mobilization: the therapist performs traction in caudal direction. Grip options: a gap of the knee or the distal lower leg.

Example 2.

PW: lying on the side on the not trained KD bent in the hip and the knee at approximately 45°. Trained KD bent in the hip at approximately 45°.

Suspension: self-locking sling on the thigh in ½ of its length attached divergently, spat on the foot. Place of cable connected to the spat attachment in the point located perpendicularly over the knee joint.



Mobilization: the therapist stands behind the patient. He/she stabilizes the patients thigh with one hand. The other KG performs traction in caudal direction and simultaneous movement of flexion and extension of the knee.

Mobilization: the therapist stands behind the patient. He/she stabilizes the patients thigh with one hand. The other KG performs traction in caudal direction and simultaneous movement of flexion and extension of the knee.

Upper limb

Shoulder joint

Adduction and abduction



Muscle strength 1-2

Example 1.

PW: lying supine. KG along trunk.

Suspension: sling for arm in ½ of its length, sling for hand. Point of suspension of cables attached to the slings axially over the shoulder.

Movement: adduction and abduction.

Example 2.

As above, but the trained elbow flexed at 90°. PW - hand supported on the abdomen. Shoulder in internal rotation position.



Example 3.

PW: lying supine. Trained KG bent in elbow at 90°.

Suspension: sling for arm in $\frac{1}{2}$ of its length. Point of suspension of cable attached to the sling over the shoulder. Hand grip for cable.

Movement: adduction and abduction.

Muscle strength 2-3

Example 1. - strengthening the shoulder adduction muscles

PW: lying supine. KG along the trunk.

Suspension: sling for arm in $\frac{1}{2}$ of its length, sling for hand. Point of suspension of cables attached to the slings shifted medially from the axial position over the shoulder.

Movement: adduction and abduction.

Be careful of the compression in the joint during the movement. To reduce the effect of compression force the suspension point should be moved distally.

To strengthen the shoulder adduction muscles the suspension point should be moved laterally.

Mobilization of abduction



Example 1.

PW: lying supine. KG in maximal possible adduction.

Suspension: sling for arm in $\frac{1}{2}$ of its length, sling for hand. Suspension in two points on lateral frame to stabilize fixed position.

Example 2.

PW: lying on the side. Mobilized KG flexed in the elbow at 90° , in maximal possible adduction and external rotation.

Suspension: narrow sling wrapped up by the elbow, sling for hand. Suspension point of the cables connected to the slings selected to maintain the stability of the obtained position.



Example 3.

PW: sitting on the couch. Mobilized KG adducted at 90° .

Suspension: sling for arm in $\frac{1}{2}$ of its length, sling for hand.

Suspension point of cables connected to the slings axially over the shoulder.

Movement: the patient lifts his weight towards the suspended KG - increasing the adduction range.

Mobilization of adduction - manual therapy techniques



Example 1.

PW: lying supine. Mobilized KG adducted at 90°, in maximal possible external rotation.

Suspension: sling for arm in $\frac{1}{2}$ of its length, sling for hand. Neutral multipoint suspension stabilizing position.

Mobilization: the therapist stands behind the patient's KG. The therapist performs traction with



his distal to the patient KG gripping humerus, the other KG performs mobilization of the humeral head in the caudal direction.

Example 2.

PW: lying on the side. Mobilized KG adducted at 90°, the forearm in the intermediate position between external and internal rotation.

Suspension: sling for the forearm, sling for the hand. Neutral multipoint suspension stabilizing position.

Mobilization: the therapist stands between the patient's head and KG. The therapist performs traction with his distal to the patient's head KG gripping humerus, the other KG performs mobilization of the humeral head in the caudal direction.



Example 3.

PW: sitting on the couch. Mobilized KG adducted at 90° with horizontal adduction at 30°.

Suspension: sling for the forearm, sling for the hand. Neutral point of suspension to stabilize position.

Mobilization: the patient lifts weight towards KG - automobilization of adduction, the therapist simultaneously performs

mobilization of the humeral head in the caudal direction.

Traction of the shoulder (analgesic)



Example 1.

PW: lying supine. KG along the trunk.

Suspension: sling for the forearm in 1/2 of its length, sling for the hand. Distal multipoint suspension.



Example 2.

PW: lying on the side. Mobilized KG stabilized in flexion at 70° and horizontal adduction at 30°.

Suspension: sling for forearm. Neutral suspension to stabilize position.

Mobilization: the therapist stabilizes the shoulder blade at its inferior angle with one KG. With the other KG he/she holds the forearm near the elbow and performs traction in the direction of the long axis of the humerus.



Example 3.

PW: lying supine. Mobilized KG along the trunk.
Suspension: sling for the forearm, sling for the hand. Axial suspension.

Mobilization: the therapist puts her/his proximal to the patient KG on the medial part of the arm, the other KG on the lateral, distal part of the arm. Mobilization of the humeral head in the lateral direction.

Self-supporting exercises for adduction movement



Example 1.

PW: sitting on couch.

Suspension: slings on hands. Slings connected to two pulleys with the cable. Pulleys suspended axially over each shoulder.

Movement: extension of one KG supports adduction of the other.

Flexion and extension

Muscle strength 1-2



Example 1.

PW: lying on the side. Trained KG along the trunk.

Suspension: sling for the forearm in $\frac{1}{2}$ of its length , sling for the hand. Axial suspension over the shoulder.

Movement: flexion and extension.

In the case of mm KG paresis or paralysis board or special splint can be used to stabilize the elbow extension. In this group of patients particular attention should be paid to the mobility of the shoulder blade.

Muscle strength 2-3

Example 1.

Suspensions as above. Cables point of suspension moved dorsally - in order to strengthen the shoulder flexing muscles, ventrally - in order to strengthen shoulder extension muscles.

Example 2.

Suspensions as above. Additional load due to the weight mounted on KG. The more distally it is placed the greater load during the exercise.

Muscle strength 3-5

Example 1.

PW: lying supine. Trained KG bent in shoulder. The hand holds the sling connected with the cable to two pulleys and weight.

Movement: KG extension against the resistance of the weight.



Example 2.

PW: lying supine. Trained KG in adduction, flexed in the elbow. The hand holds the sling connected with the cable to two pulleys and weight.

Movement: KG extension against the resistance of the weight.



Example 3.

PW: lying prone. Trained KG along with the trunk. The hand holds the sling connected with the cable to two pulleys and weight.

Movement: KG extension against the resistance of the weight.



Mobilization of flexion and extension



Example 1.

PW: lying on the side. Mobilized KG flexed at 90°.

Suspension: sling for the forearm in ½ of its length , sling for the hand. Cables suspension point shifted cranially and dorsally.

Example 2.

PW: lying on the side. Mobilized KG in maximal possible extension and internal rotation.

Suspension: sling for the forearm in $\frac{1}{2}$ of its length, sling for the hand. Cables suspension point shifted dorsally.



Mobilization of flexion and extension - manual therapy techniques

Example 1, 2, 4 - mobilization of flexion, 3 - mobilization of extension.



Example 1.

PW: lying on the side. Mobilized KG in maximal possible flexion and external rotation. Suspension: sling for the arm on $\frac{1}{3}$ of its distal part. Sling for the hand.

Mobilization: the therapist stands at the front of the patient. One KG stabilizes the lower angle of the shoulder blade,

the other mobilizes the head of the humerus in caudal direction.

Example 2.

PW: sitting on the couch. Mobilized KG bent in shoulder at 90° .

Suspension: sling for the forearm. Suspension point perpendicularly over the sling.

Mobilization: patient shifts the weight load to the front. The therapist stabilizes the arm with one KG,



the other KG mobilizes the head of the humerus in caudal direction.

Example 3.

PW: lying prone. Arm of mobilized KG in adduction. Forearm out of the couch.

Suspension: sling for the arm on 1/3 of its distal part. Sling for the hand. Suspension points perpendicularly over the slings.

Mobilization: the therapist holds patient's forearm with one KG for stability, the second KG performs mobilization of the humeral head in the ventral direction.



Example 4. automobilization

PW: sitting on the couch.

Suspension: Both hands hold slings connected to two pulleys with a cable. Pulleys are suspended perpendicularly over the shoulders.

Movement: extension of one KG supports flexion of the other.



Internal and external rotation

Example 1.

PW: lying supine. Trained KG bent at 90° in the shoulder and the elbow.

Suspension: narrow sling wrapped up by the elbow, sling for the hand. Cables point of suspension in the axis of the shoulder.

Movement: internal and external rotation.

Example 2.

PW: as above

Suspension: narrow sling wrapped up by the elbow, sling for the hand. Cables point of suspension perpendicularly over the slings on moving frame.

Movement: internal and external rotation.



Example 3.

PW: lying on the side. Trained KG in adduction at 90°, elbow flexed at 90°.

Suspension: narrow sling wrapped up by the elbow, sling for the hand. Cables point of suspension in the axis of the shoulder.

Movement: internal and external rotation.

Example 4.

PW: as above

Suspension: narrow sling wrapped up by the elbow, sling for the hand. Cables point of suspension perpendicularly over the slings on moving frame.

Movement: internal and external rotation.



Example 5.

PW: sitting on the couch. KG flexed in elbow at 90°. Towel between the trunk and the arm.

Suspension: sling for the hand or spat on the wrist. Point of suspension over the shoulder.

Movement: internal and external rotation.

Strengthening of rotatory muscles

Example 1.

PW: sitting on the couch. KG flexed in elbow at 90°. Towel between the trunk and the arm.

Suspension: sling for the hand or spat on the wrist. Point of suspension perpendicularly over the shoulder. Additionally, a set of cable with two pulleys and weight, attached with a sling to the forearm.



Movement: external rotation against the resistance of the weight.

The other KG stabilizes arm.

For internal rotatory muscles, the set of the cable with pulleys and weight should be mounted on the other side.

Horizontal adduction and abduction

Example 1.

PW: sitting on the couch. KG adducted

at 90° and flexed in the elbow at 90°.

Suspension: sling for the arm in 1/2 of its length. Sling for the forearm or hand. Suspension points axially over the shoulder.

Movement: adduction and abduction.

Example 2.



PW: sitting on the couch. KG adducted at 90° and straight in elbow.

Suspension: sling for the arm in 1/2 of its length. Sling for the forearm or hand.

Suspension points axially over the shoulder.

Movement: horizontal adduction and abduction.



Example 3.

PW: sitting on the couch. KG adducted at 90° and flexed in elbow at 90°.

Suspension: sling for the arm in 1/2 of its length.

Hands hold at slings. Suspension points axially over the shoulder.

Movement: horizontal adduction and abduction.

Elbow

Flexion and extension

Muscle strength 1-2



Example 1.

PW: lying on the side. Trained KG flexed in shoulder at 80°.

Suspension: Self-locking sling for the arm, suspension divergent for the stabilization of the arm. Sling for hand. Sling attachment point over the elbow joint.

Movement: flexion and extension.



Example 2.

PW: sitting on the couch. Trained KG adducted at 90°. Arm supported.

Suspension: sling for hand. Sling attachment point over the elbow joint.

Movement: flexion and extension.

Muscle strength 3-4

Example 1.

PW: lying supine. KG straight.

Suspension: hand holds the sling connected to two pulleys and the weight with the cable.

Movement: elbow flexion against the resistance.



Example 2.



PW: lying supine. KG flexed in elbow.

Suspension: hand holds the sling connected to two pulleys and the weight with the cable.

Movement: elbow extension against the resistance.

Spine

Cervical spine (C)

PW: lying supine. KG along the trunk. KKD flexed in hips and knees.

Suspension: sling for chest - stabilization of shoulder girdle in caudal direction.

Slings on arms in their $\frac{1}{2}$ of length or without suspension. Head on its sling, out of couch.

Head point of suspension

- for the whole C: over the chin,
- upper part of C (C₀-C₃) between the nose and upper lip,
- lower part of C (C₆-Th₁) between the larynx and suprasternal notch,
- for particular segments of C: C₀-C₂ upper lip-nose, C₂-C₃ mouth, C₄-C₅ chin, C₆-C₇ larynx, Th₁ suprasternal notch.

Example 1.

Patient performs the lateral flexion of cervical spine.

The therapist controls the movement.



Example 2.

Active stabilization of C.

- a) segmental for mm extending the head and C



- therapist pinches the following spinous processes of C in the ventral direction with his finger. The patient presses in the opposite direction.

b) segmental for mm. Rotating the head and C

- therapist pinches the following transverse processes of C with his thumb only on the one side at the ventral direction. The patient presses in the opposite direction.

c) segmental for mm flexing the head and C laterally

- therapist pinches the following transverse processes of C with his finger only on the one side at the lateral direction. The patient presses in the opposite direction.



These exercises should be done in the first place - before the global stabilization.

a) global stabilization of C

For the proper implementation of the following exercises the head sling should be connected to the point of suspension with elastic cable / spring.



- The therapist puts the fingers of one hand on the patient's forehead practitioner, fingers of the other hand on his chin. The patient presses on the therapist's fingers - bending movement. Maintains its position about 30 seconds.

- Therapist places one hand on the back of the patient's head, the other hand on the chin. The patient is trying to perform rotation against the resistance exerted by therapist's hands.

- Therapist places one hand on the side of the patient's head. The patient is trying to make lateral flexion against the



resistance exerted by the therapist.

- Two-dimensional stabilization - the therapist resists simultaneously rotation and lateral flexion
- Three-dimensional stabilization - the therapist resists simultaneously rotation, lateral flexion and bending forward.

Example 3. - traction of C

PW: as above

Exercise: therapist with one hand holds the chin, and the other one the back of the patient's head. Therapist's forearms based on the couch. Traction in the cranial direction.

Contraindications to traction: instability of cervical spine, previous spine surgery, severe degenerative changes, severe osteoporosis, pain during traction.



Thoracic spine (Th)



The following are suggestions of upper body suspension:

Example 1

PM: lying supine. KKD bent at the hip and knee joints. A roll, pillow, square, etc is placed under KKD.

Suspension: sling under the head, chest, and two slings

s under the arms. Attachment points of cables connected to the slings perpendicularly over them.



Example 2.

PW: lying prone. KKD straight. Under lower legs a collar, wedge, etc. KKG adducted at 90° and bent in the elbows at 90°. Head based on the hands.

Suspension: 2 slings under arms, the sling under chest. Points of suspension of the cables connected with slings perpendicularly over the slings.

The following are examples of therapies in above mentioned positions.

Example 1.

PW from Example 1, 2.

Suspension points are located on Levitas moving frame.

Movement: lateral flexion of the trunk.

In order to eliminate the lateral flexion of the lumbar spine the therapist sets his forearm at the level of the lower ribs.

Indications: scoliosis, ankylosing spondylitis, restrictive lung diseases, Parkinson's disease, muscular dystrophy.



Example 2.

PW from Example 1, 2.

Suspension points are located on Levitas moving frame.

Objective: mobilization of lateral flexion, straightening of muscles - locking the movable frame in the desired setting.

Example 3.

PW from Example 1, 2.

Objective: Increase of lateral flexion range

Post-isometric relaxation of muscles. The therapist uses manual resistance on lateral part of the trunk.

Example 4.

PW from Example 1, 2.

Rhythmic stabilization - changes of isometric tension without intention to move.

The therapist instructs the patient "to be stiff as a tree", "do not let moving you". The patient is trying to keep still while the therapist presses his trunk with hands from different directions.

Objective: Strengthening postural mm.



Example 5.

PW from Example 2 - but the head is supported and KKG actively kept at 180°.

The therapist places two fingers on either side of the spine on mm erector spinae.

He/she instructs the patient "press on my fingers with your back."

Objective: To strengthen the erector spinae mm.



Example 6.

PW from Example 2, additionally, the sling for pelvis to stabilize the lower part of the body.

The therapist stands in front of the patient and puts both hands under the lower ribs - performing traction in the cranial direction.



Lumbar spine (L)

The following are suggestions of lower part of the body suspension:

Example 1.

PW: lying supine. KKD bent at approximately 40-50° in the hip.

Sling under the pelvis, two slings under thighs and 2 under feet. Points of attachment of the cables connected to the slings perpendicularly over them.

Example 2.

PW: lying supine. KKD bent at approximately 80-90° in the hip.

Sling under the pelvis, two slings under thighs and 2 under feet. Points of attachment of the cables connected to the slings perpendicularly over them.



Example 3.

PW: lying prone. KKD straight. Sling under the pelvis, two slings under thighs and 2 under feet. Points of attachment of the cables connected to the slings perpendicularly over them.



The following are examples of therapies in above mentioned positions.

Example 1.

PW from Example 1, 2, 3.

Suspension points are located on Levitas moving frame.

Movement: lateral flexion of the trunk.



Example 2.

PW from Examples 1, 2, 3.

Suspension points are located on

Levitas moving frame. Objective: mobilization of lateral flexion, straightening of muscles

Objective: mobilization of lateral flexion, straightening of muscles - locking the movable frame in the desired setting.

Example 3.

PW from Example 1, 2, 3.

Objective: Increase of lateral flexion range. Post-isometric relaxation of muscles. The therapist uses manual resistance on lateral part of the lower leg.



Example 4.

PW from Examples 1, 2, 3.

Rhythmic stabilization - changes of isometric tension without intention to move. The therapist instructs the patient "to be stiff as a tree", "do not let moving you". The patient is trying to keep still while the therapist presses his pelvis or KKD with hands from different directions.

Objective: Strengthening postural mm.



Example 5.

PW from Example 1.

Theraband tape spread between KKD and KKG as shown on Fig. XX. The patient actively maintains his/her position. Then, keeping the tension of abdominal mm straightens KKG.

Objective: Strengthening postural mm.



Example 6.

PW from Example 2.

The patient KKG holds the rod as shown on the figure. The therapist presses in different directions on the rod. The aim of the patient is to maintain a stationary position.

Objective: Strengthening postural mm.

Example 7.

PW from Example 2.

The therapist works in KKG patterns according to PNF concept.

Objective: Strengthening postural mm.

Indications: instability, muscle weakness, spondylolisthesis, conservative treatment of spondylitis.



Traction of lumbar spine

Pillow under the upper part of the body reaches the level of Th12. After traction always perform exercises strengthening the muscles stabilizing the trunk.

Example 1.

PW from Example 2. Additionally sling under the chest and traction set.

The therapist by tilting back performs the traction in caudal direction.



Example 2.

PW from Example 2. Additionally, a sling on the chest.

The therapist holds the proximal part of patient's thighs and performs traction in caudal direction.





Example 3.

PW from Example 2. Additionally, a sling on the chest.

The therapist holds the cables at the sling under patient's pelvis and performs traction in caudal direction.

A three dimensional suspension of lumbar spine on Levitas to reduce pain:

- By adjusting the length of the cables connected to the sling on the pelvis the size of lumbar lordosis can be increased or decreased. For example, shortening of the distal pair of cables reduces lordosis,
- The moving frame enables flexion of lumbar spine to the less painful or painless side,
- Adjustment of the length of the cables enables rotation of the pelvis. If the previous techniques did not bring enough relief, lower pelvis on the painful side - you will obtain a slight widening of intervertebral holes.



Flexion and extension of lumbar spine

PW: lying on the side. KKD flexed in hips and knees.



Suspension: wide sling under pelvis, sling under thighs. Points of attachment of the cables connected to the slings perpendicularly over them.

Example 1.

Movement: flexion and extension of lumbar spine due to movement of suspended part of the body.

Objective: strengthening mm stabilizing lower segment of the spine.



Example 2.

The therapist puts a finger on the following spinous processes of lumbar spine. Command - press my finger - mobilization of L flexion, command - escape from the finger - mobilization of L extension.



Suspension of the whole body

Suspension: slings under feet, thighs, pelvis, chest and head.

Therapeutic possibilities

Example 1.

The therapist holds patient's hands and feet with both hands (in this case, the patient's KKG are flexed at 180° in the



shoulder) and induces vibration movement.

Objective: muscle relaxation, relaxation.

Example 2.

The therapist puts both hands on lateral chest of the patient and induces delicate shaking movement.

Objective: muscle relaxation, relaxation.

Example 3.

Patient's feet based on the therapist's thighs. Patient bends both KKD bend in the knee and hip joints, and then straightens them.

Objective: strengthening KKD mm, functional abilities - standing up and sitting down training.



Example 4.

As above, but only one KD lean against the therapist. The other KD remains without support.

Objective: strengthening KKD mm, functional abilities - climbing the stairs training.



Example 5.

The therapist keeps the patient's heels tightly and pulls them slightly toward him/her. The purpose of exercising is to approach a therapist by bending KKD.



Objective: strengthening KKD mm.

Example 6.

The therapist stands behind the head of the patient. The patient lean his hands against the therapist's thighs. The patient by straightening the elbows pushes himself from the therapist's thighs.

Objective: strengthening KKG mm and KKG supportive functions.



Example 7.

The therapist stands behind the patient's head. The patient holds the therapist's hands. By bending his elbows the patient pulls himself in the direction of the therapist. This exercise can be done using the lateral frame.

Objective: strengthening KKG mm.



Example 8.

The therapist pushes on the patient's pelvis. To facilitate the movement, the therapist places his hand on the opposite side of the pelvis and instructs the patient "push on my hand."

Objective: mobilization of the trunk lateral flexion.

Example 9.

The therapist instructs the patient "be stiff as a tree", then presses with his hands from different directions on the patient's body.

Objective: strengthening the body stabilizing muscles.

Suspension of the half of the body

PW: lying on the side. Suspension: sling under the arm, hand, thigh, foot.

Therapeutic possibilities

Example 1.

The therapist instructs the patient:

"Take your hand" - posterior shoulder blade depression
"Press your hand on mine" - anterior shoulder blade elevation.

Objective: Mobilization of the shoulder blade according to PNF patterns.



Example 2.

The therapist instructs the patient:

"Take your hand" - posterior shoulder blade elevation

"Press your hand on mine" - anterior shoulder blade depression.

Objective: Mobilization of the shoulder blade according to PNF patterns.



Example 3.

The therapist instructs the patient:

"Take your knee" - posterior pelvis elevation.

"Press your knee on my hand" - anterior pelvis depression

Objective: Mobilization of the pelvis according to PNF patterns.



Example 4.

PW: KD suspended in flexion of the hip and knee. The therapist instructs the patient:

"Take your knee" - posterior depression of the pelvis.

"Press your knee on my hand" - anterior elevation of the pelvis

Objective: Mobilization of the pelvis according to PNF patterns.

These techniques can be performed with KKD bent or straightened in the knee joints and KKG bent or straightened in the elbows. Instead of the hand and foot, the therapist's hand can be put respectively on the elbow and knee.

Mobilization of the trunk in sitting position

Example 1.

PW: KKG adducted in the shoulder at 90° and bent in the elbow at 90° .

Suspension: sling covering arms, suspension point perpendicularly over the sling on the moving frame.

Movement: trunk rotation.



Example 2.

PW: KKG bent in the shoulder, hands hold the moving frame.

Movement: trunk rotation.

Example 3.



PM: sit astride on the couch. KKG bent in the shoulder at 90°, a rod held in the hands.

Movement: the patient leans the trunk forwards and sideways - lateral trunk flexion with rotation.

Example 4.

PW: one KG adducted in the shoulder at 90°

Suspension: sling under the arm and hand. Axial suspension over the shoulder.

Movement: the patient shifts his body weight load to the side of suspended KG. Lateral trunk flexion on the opposite side.



Exercises strengthening muscles of the back, KKG and KKD on Levitas

PW: lying supine

Example 1.

PW: lying supine, KKG along with the trunk.

Suspension: two slings under the thighs. Slings approximately 20 cm over the ground.

Movement: the patient straightens both knees by lifting the lower legs, then elevates the pelvis so that his body was placed a straight line. Return to PM.



The above exercise can be made more difficult by moving the slings in the distal direction, e.g.:

a) slings under proximal 1/3 of lower legs. Slings approximately 30 cm over the ground. Movement: the patient elevates the pelvis to place the body in the straight line.

b) slings under distal 1/3 of lower legs. Slings approximately 30-40 cm over the ground. Movement: the patient elevates the pelvis to place the body in the straight line.



c) sling under distal 1/3 of one lower leg. Slings approximately 40 cm over the ground. Movement: the patient elevates the other leg and then the pelvis to place the body in the straight line.



d) sling under distal 1/3 of one lower leg. Movement: the patient elevates the other leg and then the pelvis to place the body in the straight line. Maintaining the position, the patient adducts not suspended KD in the hip, abducts it and returns to PW.

as well as by inserting the balance pillow under the patient's upper body:

e) Example 1. + balance pillow.

Example 2.



PW: lying supine with bent KKD. KKG flexed in the shoulder at 80°.

Suspension: The patient holds slings with hands. Slings are at the level of patient's hands. Suspension points perpendicularly over the pelvic girdle.

Movement: The patient pulls the shoulder blades together, bends elbows and rises the upper body. The head remains in line with the body.

Modifications of the exercise from Example 2.:

a) suspension points of cables connected to the slings shifted approximately 20 cm distally, Movement as above.

b) knees flexed at approximately 90°. Suspension points perpendicularly over the shoulder girdle. Movement: the patient pulls the shoulder blades together, bends elbows and rises the upper body. The head and thighs remain in line with the body.

c) knees flexed at approximately 30 °. Suspension and movement as above.

d) KKD straight. Suspension and movement as above.



- e) Suspension: KKG as above, KKD flexed in the hips at approximately 45°, slings under feet. Movement: the patient pulls the shoulder blades together, bends elbows and rises the upper body. The head and KKD remain in line with the body.

Example 3.

PW: lying supine. KKG over the head, hands hold the lateral frame.

Suspension: slings under thighs. Slings approximately 30 cm over the ground.

Movement: patient pulls the frame with KKG (elbows towards feet), straightens the knees by lifting the lower legs, pressing on slings with KKD lifts the body and keeps it in a straight line.



Modifications of exercise from Example 3.:

1. slings under 1/2 of lower legs length. Slings approximately 40 cm over the ground. Movement: as above.
2. sling under one lower leg at the level of thigh, approximately 30 cm over the ground. Movement: patient pulls the frame with KKG (elbows towards feet), lifts the not suspended KD, lifts the body and maintains the position.
3. as above, sling under the lower leg in its 1/2 of length
4. as above, sling under the lower leg in its distal 1/3 of length



Example 4.

PW: lying supine. KKG along the trunk.

Suspension: slings under the feet, suspension points of the cables connected to the slings positioned in such a way that the hips are bent at about 90°, and the knee joints at about 30°.

Movement: patient presses on the slings with feet, bends knees and rises pelvis above the ground.



Modifications of exercise from Example 4.:

- a) PW as above, but the suspension points of the cables attached to the slings perpendicularly over the pelvis. Movement as above.

Example 5.

PW: lying supine, KKD bent. KKG adducted in shoulder at 90°.

Suspension: slings under the arms. Points of attachment of the cables connected to the slings perpendicularly over them. Slings approximately 10-20 cm over the ground.

Movement: the patient pulls the shoulder blades together, and rises the upper body.



Modifications of exercise from Example 5.:

- 1. as above but the slings on the level of elbows. Slings approximately 20 cm over the ground.



2. as above but the slings on the level of forearms. Slings approximately 20-30 cm over the ground.
3. as above but the slings on the level of wrists/hands. Slings approximately 30 cm over the ground.



Example 6.

PW: lying supine. KKG in adduction and external rotation in the shoulder, elbow bent at 90°. Roller under the thighs.

Suspension: slings under proximal 1/3 of the arm, approximately 20-30 cm over the ground. Movement: the patient presses with the forearms on the slings and rises the upper part of the body.



Modifications of exercise from Example 6 by moving the roller under KKD in distal direction:

- a) roller under the knees.
- b) roller under the lower legs in $\frac{1}{2}$ of their length.
- c) roller under the ankles.

Movement(a, b, c): the patient presses with the forearms on the slings and rises the whole body.

PW: lying prone



Example 1.

PW: front support on KKG. KKD in line with the body.

Suspension: sling under the thighs.

Movement: the patient "walks" forwards, backwards and sideward supporting on KKG.

The difficulty of the exercise can be increased by distal placement of the slings (under the knees, lower legs, ankles).

Example 2.

PW: lying prone supported on forearms. A collar/pillow under the lower trunk.

Suspension: slings under the thighs, on the level of approximately 30-40 cm over the ground.

Movement: The patient lifts the pelvis and maintains the body in the straight line.



The difficulty of the exercise can be increased by distal placement of the slings (under the knees, lower legs, ankles).

Example 3.

PW: lying prone supported on forearms.

A collar/pillow under the lower trunk.

Suspension: sling under one ankle, on the level of approximately 30-40 cm over the ground.

Movement: The patient lifts the not suspended KD and pelvis, maintaining the body in the straight line.



The difficulty of the exercise can be increased by:

- a) adduction and abduction of not suspended KD.
- b) shift of forearms forwards.

Example 4.

PW: upper part of the body supported on forearms.

Suspension: slings under the thighs, on the level of approximately 30-40 cm over the ground.

Movement: the patient lifts the pelvis to place the body in the straight line by flexion of lower spine and KKD approaches the knees to the chest.



Modifications of the exercise from Example 4 (movement as above.):

- a) slings under the ankles on the level of 30-40 cm.
- b) slings under the ankles on the level of 30-40 cm, support on hands.



PW: lying on the side

Example 1.

PW: lying on the side, one KG under the head, the other KG along the trunk. KKD straight.



Suspension: wide sling covers two thighs, suspension approximately 20 cm over the ground.

Movement: the patient lifts the pelvis and keeps the body in the straight line.

Modification of exercise from Example 1.:

1. sling on the level of knees, 20-30 cm over the ground.
2. sling on proximal 1/3 of lower legs, 30 cm over the ground..
3. sling on the level of ankles, 30-40 cm over the ground.

Movement: as in Example 1.



Example 2.

PW: lying on the side, one KG under the head, the other KG along the trunk. KKD straight.

Suspension: sling on the thigh, KD placed higher, suspension 30-40 cm over the ground.

Movement: the patient lifts the pelvis supporting with KD from the top on the sling with simultaneous lift of the other KD and keeps the body in the straight line.

Modifications of exercise from Example 2:

- a) sling on the level of the knee, 40 cm over the ground.
- b) sling on the level of the ankle, 50 cm over the ground.
- c) as above, additionally weight on KD, on which the patient lies.

Movement: as in Example 2.

Example 3.

PW: lying on the side, one KG under the head, the other KG along the trunk. Lower KD straight, upper KD bent in the knee at 90°.

Suspension: sling in the lower leg of upper KD, suspension approximately 40 cm over the ground.

Movement: the patient lifts the pelvis supporting with KD from the top on the sling with simultaneous lift of the other KD and keeps the body in the straight line. The patient keeps the upper KD knee bent at 90°



Modifications of exercise from Example 3.:

- a) sling in $\frac{1}{2}$ of lower leg length, 40 cm over the ground.
- b) sling on the level of the ankle, 40 cm over the ground.
- c) Movement: as in Example 3.

Additionally, the difficulty of exercises from Examples 1, 2, 3 can be increased by placement of balance pillow under the upper trunk.

PW: kneel

Example 1.

PW: kneel down with both feet, KKG bent at 90° in the shoulder.



Suspension: two slings on the level of reached KKG. Suspension points approximately 20 cm behind the knee line.

Movement: keeping the trunk and elbows straight, the patient shifts the weight load forward, and then supporting on the slings returns to PW.

Modifications of exercise from Example 1:

- a) suspension points perpendicularly over the knee line.
- b) suspension points 20 cm before the knee line.
- c) suspension points 40 cm before the knee line.

Movement: a, b, c as in Example 1.



Example 2.

PW: kneel down with both feet, KKG bent at 90° in the shoulder.

Suspension: two slings on the level of the chest. Suspension points perpendicularly over the knee line.

Movement: keeping the trunk and elbows straight, the patient shifts the weight load forward, and then adducts KKG, keeping elbows in a slight flexion, then supporting on the slings returns to PW.



Modifications of exercise from Example 2:

- a) suspension points 40 cm before the knee line, slings approximately 20 cm over the ground.
- b) suspension points 60 cm before the knee line, slings approximately 20 cm over the ground.

Movement: as in Example 2.

PW: sitting

Example 1.

PW: sitting

Suspension: slings on the level of hands, suspension points perpendicularly over the shoulder girdle.

Movement: the patient supporting on the slings, straightens KKG in elbows and lifts the pelvis.



Example 2.

PW: sitting

Suspension: slings on the level of hands, suspension points perpendicularly over the shoulder girdle. Slings under feet

Movement: the patient supporting on the slings, straightens KKG in elbows and lifts the pelvis.



Example 3.

PW: sitting with bent KKD. KKG bent in shoulder and elbow at approximately 90°. The trunk tilted backwards.

Suspension: slings on arms on the level of the head. Cables suspension points 80 cm before the patient.



Movement: by horizontal adduction, the patient lifts the upper part of the body.

Example 4.

PW: sitting on a chair. KKG bent in shoulder at approximately 160°.

Suspension: slings on the level of hands. Cables suspension points over the shoulder girdle.

Movement: by flexion of elbows the patient stands up.



Example 5.

PW: sitting on a sling with bent KKD.

Suspension: wide sling.

Movement: by extension of the knees, the patient shifts the body backwards, returns slowly to PW.



Standing

Example 1.

PW: standing



Suspension: two slings suspended approximately 15 cm over the ground.

Movement: patient holds the fixed frame. Stands with feet on the slings. The patient maximally adducts KKD, then returns to PW.

Example 2.

PW: standing.

Suspension: two slings on the level of both hands with KKG bent in the shoulder. The patient stands on balance pillow with 1 KD.

Movement: the patients supporting on slings shifts the body weight load forwards with simultaneous extension of KD not standing on the pillow in the knee and hip.



Example 3.

PW: standing.

Suspension: spat on the foot. Set of the cable connected to two pulleys and weight. The patient stands on the balance pillow with 1 KD.

Movement: Patient, standing on 1 KD performs flexion of suspended KD against the weight resistance.



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Use of elastic resistance in Levitas

When conducting resistance relief therapy, we can use elastic rubber resistance instead of resistance in the form of a weight. The methodology of the exercise is identical to that of the weights, but the resistance gives us the possibility of a different effect on the joints and muscles. This type of solution has the advantage over weights of using elastic elements that provide gradual resistance as they stretch, adapting to the biomechanical properties of the limbs, whose strength increases as we move from position to position.

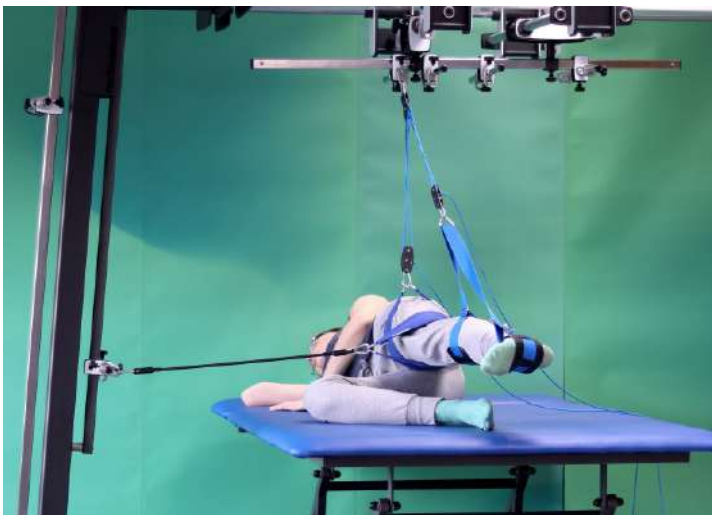
Active exercises in resistance relief are usually applied with axial relief. A cuff is placed halfway along the length of the limb to which one end of the rubber band is attached, the other end should be placed in the plane of movement on the lateral column, so that at mid-range of movement the band is placed at right angles to the part of the body being exercised. In joints with high mobility, the range of movement is divided into two sectors.

Rubbers of different lengths and extensibility:



Exercise 1

Hip joint extension exercise in weight-bearing with elastic resistance



Exercise 2
Horizontal abduction with elastic resistance



Exercise 3
Horizontal adduction with elastic resistance

