EN-Tree

Medical Training Therapy with the EN-Tree

ENRAF NONIUS

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Preface

The purpose of this book is to familiarise you with the training possibilities with the EN-Tree product line. The EN-Tree exist out of four Medical Training Therapy products. With a number of pictures of practical situations the exercise possibilities with EN-Tree are illustrated. We shall start by discussing a number of characteristics of training in general which will be followed by specific characteristics of Medical Training Therapy. Moreover a number of suggestions will be given concerning the design of a balanced training program.

The equipment in this manual is only meant to be used by competent personnel in the field of physiotherapy and rehabilitation training. The manufacturer cannot guarantee the suitability of the equipment for specific therapeutic aims.
All the information in this manual are advices to which no rights can be derived.

If you have any questions, suggestions and/or remarks, please don't hesitate to contact us.

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Content

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1.1 Training

1.1.1 The basic principles of training

There are a number of basic principles that should be incorporated in training in order to be effective.

1.1.2 The principle of decreasing profit

Regular exercising like sports causes a functional adaptation of the body. These adaptations will approximate the required load. If the load is kept constant the adaptation will be completed after some time. Therefore training with one load level will initially cause improvements but when these improvements are established no further increase of organic functions can be expected. In order to further improve these functions, the load should be increased. The continuation of a training program at one load level is useful in order to prevent decrease. A second result of this functional adaptation is that the biggest gain will be realised during the first training sessions and that the adaptation per session will be decreased over time. Finally one will come to a maximum level which is individually specific and which is genetically defined with respect to constitution physiological response and coordination.

1.1.3 The principle of overload

In order to realise training effects there should be a substantial load on the body. The duration of the intensity and frequency of the load application defines the intensity of the exercise. The muscular adaptations will depend on the level of exercising being within the level of maximal aerobic capacity (aerobic training) or above this level (anaerobic training). The anaerobic energy form is often realised at the beginning of exercising when the aerobic metabolism has not yet adapted or during very heavy exercising where the aerobic metabolism is not sufficient.

1.1.4 The principle of specificity

Over the past decade there has been an increased tendency to train specifically. This means that the increase of strength and endurance of muscles is maximum for a certain movement when this specific movement is exercised. The overflow of substitute movement exists but maximum results can only be realised when the training is specific, for example a marathon runner has some profit by training long distance swimming but maximum profit will be gained by long distance running.

1.1.5 The principle of individual sensitivity

Not every person reacts in the same way to training and exercising. Probably the most important factor is the individual ability and motivation to take part in the training sessions. For example with aerobic training to improve endurance there only will be an increase in this performance capability when the training intensity is at least at 70% of the subjects maximum heart frequency.

1.1.6 The principle of reversibility

When the training is stopped the effects will soon reduce and return to the initial stage before the training was started. Generally one can say that the training effect disappears quicker than it was gained and that the effects which were realised over a longer period will be lost less quickly.

1.2 Training goals

The most important goals for training are:
1. Improvement of strength
2. Improvement of endurance
3. Improvement of coordination
4. Improvement of mobility

Ad 1.
If strength improvement is the major goal for exercising than weight training is effective. When 5 to 10 contractions with 80% of maximum strength is realised for two weeks an improvement can be seen.

Ad 2.
The training of endurance is a functional improvement of a metabolism. There is a distinction of aerobic and anaerobic training. The anaerobic training will be realised by short periods (max. 1 min.) of maximum

intensity followed by longer periods of rest. If longer periods of sub maximal exercising are realised (3 to 5 min.) followed by shorter periods of rest the aerobic capacity is improved.

Ad 3.
The coordination can be trained in order to increase the efficiency and accuracy of the execution of movements. Coordination is extremely movement specific and is mostly trained by repeating the predefined movement for numerous times.

Ad 4.
By improving the flexibility the range of motion of a certain movement direction is increased.

1.3 Forms of training

In general there are two training methods:

1.3.1 Anaerobic training

The anaerobic training can lead to complete exhaustion of the muscle and will lead to an increased capability of the muscle to produce power without the use of oxygen. Anaerobic metabolism is realised during extreme heavy, sometimes explosive exercising like strength training, sprinting or jumping. As a result of heavy exercising the type II (fast twitch) muscle are mostly effected. The anaerobic metabolism can be divided in two components: a lactic and a non-lactic component.

When short periods of extreme heavy exercising (10 sec.) are followed by periods of rest of 30 to 60 seconds, than there is an increase of especially the non-lactic component (more ATP and CP in the muscles). When this period of 10 seconds is increased to 30 seconds or more, then the lactic phase will start by which the lactic acid is released. The training in the lactic phase stimulates the production of enzymes in the muscle. During the lactic phase the lactic acid concentrations in the muscle can cause sever instantaneous muscle soreness.

1.3.2 Aerobic training

The aerobic training is required for improvement of the maximum aerobic capacity. Aerobic metabolism is realised during long term sub maximal training like running, aerobics, cycling and swimming. If aerobic effects are to be realised, a minimal duration of 30 minutes per training session at 70% of the maximum heart rate for at least two to three times per weeks is needed.

1.4 Training effects

Training effects are physical adaptations as a result of exercising. Frequent evaluations can give insight in the adaptation of the body.

1.4.1 Muscle changes

As a result of training the volume of the muscle increases. This growth is the result of an increase in the number of myofibrils and myofilaments. Besides this hypertrophia there is an increase in strength which is partly due to the above mentioned as well as to improved coordination (better timing of activated agonist and inivated antagonist). Also a number of biochemical changes in the muscle take place like an increase in the number of enzymes and mitochondrias that are involved in the metabolism. Because of the improved enzymematic activity the oxygen consumption of the muscle is increased which is effectuated in a higher oxygen gradient over the cell membrane. Because of the improved vascularisation the flow has decreased and the diffusion service has increased. As a result the diffusion of oxygen and nutritions will improve.

1.4.2 Changes in heart and circulation

The oxygen transport systems will also change as a result of training. The heart volume can change as well as the maximum aerobic capacity. With endurance training the heart frequency impressed and during exercise will decrease while the volume per stroke will increase. The vascularisation of the myocard is optimised. Also the absolute volume of blood can be increased.

2 Medical Training Therapy (MTT)

2.1 Introduction MTT

In the first chapter a number of general characteristics of training are described. In this second chapter we will describe the specific therapeutical load that can be used in order to improve the physical capacity of patients and former patients. This method is known as the Medical Training Therapy (MTT).
MTT (Gustavsen, Streeck, 1991) exists out of four major subjects:

1. muscle training
2. joint training
3. coordination training
4. rehabilitation (the use of learned movements in daily life)

This booklet is specifically written with respect to the muscle training (chapter 5) and the mobilization (chapter 6). Both exercise modalities can improve coordination if functional patterns are stimulated. The goal of MTT is to reduce pain, to improve body functions and to increase the load capability of a patient.

2.2 Criteria MTT

The criteria for MTT are:

1. MTT exist of active exercises without manual assistance of a physical therapist. It is a direct, accurate and individual method of training.
2. MTT requires a number of simple training systems as are defined in the EN-Tree productline.
3. The exact dose of exercising is defined in MTT by the movement definition, the range of motion the load, frequency and training program. It is possible to make strong localization in the exercising as well as to impose complex movement patterns.
4. The training program is designed at an individual basis, by which the normal daily load of a patient is involved. The medical diagnoses and functional examination are used as input for the program.
5. For each patient the training should consist of at least 60 minutes of exercise and rest, in order to be effective. A patient should be guided during his treatment up to the point where he can train completely independent.
6. MTT is a training method which motivates the patient as he can see his improvements. Combining patients in training groups can also positively improve the motivation of the individual.
7. The exact dosage of load application and the registration of progressing with traditional manual treatment is difficult. As such, medical training therapy can be a useful addition.

2.3 Points of interest for MTT

There are a number of general indications that should be incorporated in the MTT session:

1. When a patient is physically or mentally tired there should be no extensive or coordinative exercising. The effect is low while the motivation is negatively influenced.
2. The duration and the contents of the training program should be in balance with the motivation of the patient.
3. Coordination training will require long duration and exact application. Realise that ones a movement is learned incorrectly the modification can require extreme long time.
4. It is better to train several times to realise a certain effect than to impose maximum concentrated training in minimal frequency.
5. The frequency of training is recommended to be at least three times a week.

2.4 Contra-indications

When using MTT the following contra-indications should be considered:

1. When a shortened muscle acts over hypo-mobile or painful joint, the active roll-gliding mechanism of the joint should be recovered in advance before treating the shortened muscle.
2. When a weakened muscle over a hypo-mobile joint shortens, the active roll-gliding mechanism in the joint should be recovered before the weakened muscle is strengthened.
3. When the antagonist of a weak muscle is shortened, this antagonist should be stretched before the weak muscle is strengthened.
4. When a weak painful muscle must be strengthened, during the initial phase of the training this muscle should not be activated in a maximal stretched position.

5. It is very effective to break complex movements down in simple partial movements. After a while these partial movements can be integrated to a complete complex movement.
6. It is strongly advised not to start training without a kind of medical examination or in case the patient is not well.
7. Medical training therapy should not cause soreness on the joints. Muscle soreness however can be a normal result of intensive training. The patient should therefore be informed in advance of this muscle soreness.
8. Patients with lumbar problems should avoid compressive loads on the low back. Heavy load compressive exercises should be avoided or replaced by less strenuous exercises.

3 Composing a training program

3.1 Introduction

When composing a muscle training program a number of questions occur which shall be answered in this chapter:

- What is the effect of external load on muscle tension
- What should be the load for different training purposes
- What should be the number of repetitions in sets for the different load levels and training purposes
- What should be the number of exercises per muscle group
- What should be the choice of specific exercises (for technical explanation see chapter 5)
- What is the duration of a session
- How many sessions per week should be executed

3.2 The effect of external load on the muscle tension

By making a choice for an external load in a certain exercise, the effect of this load on muscularisation should always be considered.
Training with a constant external load is often referred to as isotonic training. This terminology suggests that tension in the muscle is constant over the entire range of motion. This however is not the case. The tension developed in the muscle depends on the instantaneous lever arm of the muscle with respect to the joint excursion and the speed of contraction.

3.2.1 Length-tension relations

The tension which a muscle can develop maximally depends on the overlap of the actine and myosine filaments in the muscle. With limited overlap, or when the muscle is maximally stretched, only little force can be produced. With maximum overlap, when the muscle is maximally active shortened, this will also result in a immunised force production capacity.

3.2.2 Lever arm of the external load

The lever arm of the external load changes during a movement because of the changing distance between the line of action of the force and the sometimes changing point of rotation of the different involved joints. Sometimes these lever arms can be regulated by the patients for example in the Bench Press by widening the arm position which results in a heavier load for the pectorals muscles. The reversed goes for the triceps which will be more intensely used when the arms are closer together. This is a result of the distance of the line of action of the pulley with respect to the instantaneous point of rotation of the shoulder and elbow.

3.2.3 Lever arm of the muscle tension

In the human body the muscle produce forces which are effectuated over a certain lever arm. The lever arm's magnitude of the action line of muscle force is determinated by the perpendicular distance between the line of action and the instantaneous rotation point of a joint. This distance depends on the origin and insertion of the muscle and the active part within the muscle. An example of a changing lever arm of a muscle during a movement is schematically drawn in figure 1. If the knee is maximally extended the lever arm over the knee is minimal (distance A). If the knee is flexed, the distance between the lines of origin and insertions are increasing. This indicates an increasing lever arm for strength over the knee (distance B).

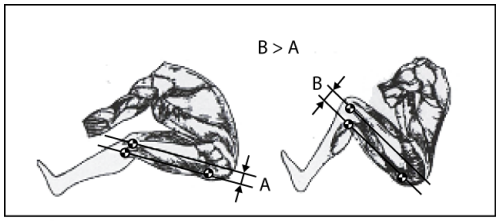


Figure 1 Change of lever arm of the hamstrings

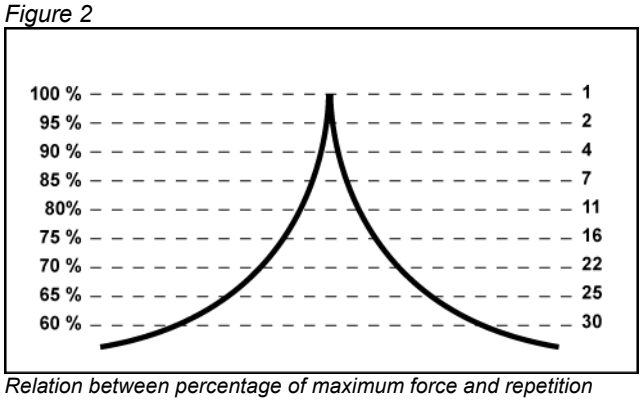
3.3 Repetition maximum test (1 R.M.)

When creating a training program one should have a clear idea of the load capability of a person. A well known method for estimation of this load capability is the 1 repetition maximum test. The 1 repetition maximum is the ability of a person to exert a certain weight lift for 1 repetition only. For every separate movement this should be tested. A maximum strength test starts by the estimation of the therapist of the maximum strength he expects the patient to exert. A load which is less than the expectation is set at the system and the patient is asked to exert the maximum number of repetitions he can achieve whith the set load. By means of the following algorithm the 1 repetition maximum (1.R.M.) for a certain exercise is:

$$\frac{\text{A kg x 100\%}}{\text{B\%}} = \text{1 R.M.}$$

A = Set resistance (kg)
B = Strength percentage with respect to the number of repetitions (see *figure 2*)

Figure 2



Relation between percentage of maximum force and repetition

Example:
With 24 kg in a certain exercise 16 reps can be executed. Figure 2 shows that 16 reps = 75%.
The 1 repetition maximum = 32,66 kg

$$\text{1 R.M.} = \frac{\text{24,0 kg x 100\%}}{\text{75\%}} = \text{32,66 kg (= 326,6 Newton)}$$

3.4 Set intensity

The intensity of a set should be adjusted to the defined training goals. These goals can be an increase of muscle strength, an increase of muscle endurance, an increase of endurance or an increase of flexibility mobility. The training intensity is related to the percentage of the 1 repetition maximum where a patient should be trained at. With the number of repetitions per set that should be executed. The relation between the set resistance and the number of repetitions was shown in figure 2. Depending on the training goal the number of criteria can be established concerning the number of repetitions, the set resistance and the velocity of the movement that should be exerted during the different exercises.

Criteria for increased strength:
- 5 to 12 repetitions
- 1.5 to 2 minutes pause between the sets
- Sub-maximal to maximal resistance, 80 - 90% of 1 repetition maximum
- Exerted movement with maximum, but controlled velocity

Criteria for increase of muscle endurance:
- 12 to 20 repetitions
- 1.5 to 2 minutes pause between the sets
- Sub-maximal resistance, 70 - 80% of 1 repetition maximum
- Movements in breathing rhythm; 12 to 16 per minute

Criteria for increase of endurance:
- 20 to 30 repetitions
- 1 minute pause
- 55 - 70% of 1 repetitions maximum
- Move with a velocity of 25 - 30 repetitions per minute

3.5 Split routine principle

By dividing all the exercises for the body over two equal sessions the best results are realised. This method is know as the split routine principle. The principle means that on day 1 the breast, the back, the shoulders and the arms are trained and on day 2 the hips, the thighs, calves and abdominal. Dividing this training over two days, this does not indicate that only two days per week should be trained. If more training sessions per week are realised, every consecutive training should be different from the other. Meaning that if an unequal number of sessions per week are used, in one week the upper body is trained relative more and in the other week the lower body is trained more. The basic idea of the split routine principle is by exercising a number of conjunctive functional overlapping muscle groups the vascularization and coordination of these muscle groups are improved. An other advantage is that because of the overlap of functionality the number of isolated muscle exercises can be diminished in favour of the more complex movements. If this happens with a smaller number of total sets there shall be a higher result. With the split routine principle, trained muscles will also get more time to recover before the next session.

3.6 Session intensity

Session intensity means the total of sets per session and the number of sets per specific muscle group. The length of a session medical training therapy should be at least 60 minutes (Gustavsen, Streeck, 1991). This time frame of minimal 60 minutes indicates automatically a minimum amount of sets, relating to the training principles. The relation of the muscle group and amount of sets is related to the relative volume and importance of this muscle group. In the following load criteria the split routine principle is used with a proportional load for the different muscle groups.

3.6.1 Session load for strength improvement:

- 24 sets (set-time max. 0.5 min. + rest-time 2 min. = 2.5 min., 60 min. : 2.5 min. = 24 sets)
- 2 min. rest between the sets

Day 1: Chest, back, shoulders, arms
Chest : 6 sets
Back : 7 sets
Shoulders : 5 sets
Arms : 6 sets

Day 2: Hips, thighs, calves, abdominal
Hips : 5 sets
Thighs : 9 sets
Calves : 5 sets
Abdominal : 5 sets

3.6.2 Session load for the strength improvement endurance:

- 20 sets (set-time max. 1.5 min. + rest-time 2.5 min. = 3 min., 60 min. : 3 min. = 20 sets)
- 1.5 min. rest between the sets

Day 1: Chest, back, shoulders, arms
Chest : 5 sets
Back : 6 sets
Shoulders : 4 sets
Arms : 5 sets

Day 2: Hips, thighs, calves, abdominal
Hips : 4 sets
Thighs : 7 sets
Calves : 5 sets
Abdominal : 4 sets

3.6.3 Session load for the strength of endurance:

- 22 sets (set-time 1.25 min. + rest-time 1.5 min. = 2.75 min., 60 min. : 2.5 min. = 22 sets)
- 1 min. rest between the sets

Day 1: Chest, back, shoulders, arms
Chest : 6 sets
Back : 6 sets
Shoulders : 5 sets
Arms : 5 sets

Day 2: Hips, thighs, calves, abdominal
Hips : 4 sets
Thighs : 8 sets
Calves : 5 sets
Abdominal : 5 sets

In case it is relevant for a certain patient to prioritize certain muscle groups or to exclude muscle groups, the program should be adapted accordingly.

3.7 Choice of exercise

In the previous chapters it was described how the training goals, a total number of sets and the different muscle groups should be divided over a training. In this chapter we shall give a number of examples of combinations of exercises and some implications with respect to the number of repetitions per muscle group. For a more exact description and explication we refer to chapter 5.
When defining a number of different exercises there should be a balance between the advantage of variability in training and the disadvantage or adjusting training equipment or load setting. For smaller muscle groups like arms and shoulders the number of different exercises per session should be limited. For larger complex muscle groups like trunk, back and thighs there should be more sessions per exercise. For the abdominal and the hips, where limited adjusting is required, there is no limitation in the number of variances.
If using different training sessions it is recommended to regularly change the program in order to keep the patient motivated. However, it also is recommended to always do some basic fundamental exercises in order to get maximum effect. Next an example is given of a balanced program.

Program 1:

Chest : Bench press, Incline press, Flyes
Back : Wide grip pull-down, Seated row I, Back extensions I
Shoulders : Military press, Lateral raises, Bent over lateral raises
Arms : Arms curls, Triceps push down, Wrist curls

Abdominal : Sit-ups, Transverse sit-ups, Leg raises
Hips : Abduction I, Adduction, Ante-flexion, Retro-flexion
Thighs : Squats, Leg curls, Leg extension
Calves : Standing calves raises, Seated calves raises

Program 2:

Chest Back : Bench press. Dips, Flyes, Pullovers I
Back : Wide grip pull-down, Small grip pull down, Bent over rowing
Shoulders : Lateral raises, Upright rowing, Forward raises
Arms : Scott curls, Seated triceps extension, Reversed wrist curls

Abdominal : Sit-ups, Crunches, Leg raises
Hips : Abduction II, Adduction, Ante-flexion, Retro-flexion
Thighs : Squats, Straight leg dead lift, Leg curls
Calves : Standing calves raises, Reversed calves raises

Program 3:

Chest : Bench press, Incline press, Crossing overs
Back : Wide grip pull-down. Seated row II, Back extensions II
Shoulders : Military press, Upright rowing, Forward raises
Arms : Arms curls. Concentration curls, Seated triceps extension, Triceps push down

Abdominal : Sit-ups, Crunches, Lateral-flexion II
Hips : Abduction, Adduction, Ante-flexion, Retro-flexion
Thighs : Squats, Leg extension, Straight leg dead lift
Calves : Standing calves raises, Reversed calves raises

4 EN-Tree

4.1 The EN-Tree products

EN-Tree basically exists out of four different products which combined allows to perform a maximum number of exercises.
EN-Tree is especially developed for the use of medical training therapy. The package allows for an enormous variety and flexibility in training possibilities. The EN-Tree product package exists of:

- 5 different EN-Tree Pulleys
- EN-Tree Bench (two-piece bench)
- EN-Tree Train (angle bench)
- numerous accessories for training of different movements and for simulation of functional movements

It should be noticed that excessive and/or improper training can cause damage to the health. It is therefore recommended that during a training session with EN-Tree there always should be an accompanying physical therapist. It is therefore not recommended to use EN-Tree in an unguarded room for example, a hotel or swimming pool.

4.2 The different EN-Tree Pulleys:

4.2.1 EN-Tree Pulley 24 kg

Within $2m^2$ the EN-Tree Pulley with a load variance between 0 and 24 kg provides you with a user-friendly, comfortable and multi-functional exercise machine. The EN-Tree Pulley is easy to stow, allows fine adjustments of the weights and makes dumb-bells superfluous. It can be combined with handgrips, large or small rods, slings or other parts. The wide variety of load application and the ease of adaptation of the EN-Tree makes it adaptable to every individual's need. The pulley has two rope-endings which are connected. If used with one attachment the full load will be imposed; if used with one cable only half the load will be imposed. The length of the cable is independent of the height of the pulleys. Active exercising for all! *See figure 1*

4.2.2 EN-Tree Pulley MDD 24 kg incl. cover

This fine multifunctional EN-Tree Pulley is equipped with a tasteful solid cover. This pulley complies with the Medical Device Directive (MDD) 93/42/EEG and is therefore extremely well suited for medical use. *See figure 2*

4.2.3 EN-Tree Pulley Explosive 54 kg

The EN-Tree Pulley Explosive 54 kg makes it possible to exercise at high speed, explosive movements, without the inertial forces of the weights. The load variance of the EN-Tree Pulley Explosive 54 kg is between 0 and 54 kg. Due to the ingenious triple pulley mechanism the effective exercise is performed at a maximum of 18 kg. With the Explosive Pulley you can obtain a perfect balance between acceleration and resistance for practicing explosive movements. *See figure 3*

4.2.4 EN-Tree Pulley Explosive MDD 54 kg incl. cover

The EN-Tree Pulley Explosive MDD 54 kg includes a cover. As the EN-Tree Pulley MDD 24 kg this makes the unit the choice for healthcare professionals. *See figure 4*

Figure 1

Figure 2

Figure 3

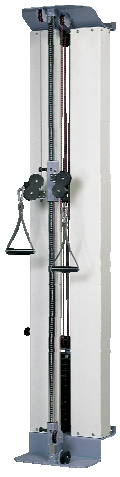


Figure 4

4.2.5 EN-TreeP Pulley

The EN-Tree P Pulley is the pneumatic version in the EN-Tree series. A valuable asset to the EN-Track concept. The EN-Tree P Pulley is a silent, compact, multifunctional exercise unit to be used both for training of dynamic and non-dynamic functional movements.
The precise setting possibilities makes this an unique machine, without any unnecessary high peak forces. The LED display clearly states the given values and feedback, which can be individually stored on the patient/client's chip-card for follow up in the EN-Track system. The EN-Tree P has a wide variety in load setting capabilities, from as low as 1 kg to a maximum of 72 kg effective force. The EN-Tree P is the all-round machine that adds great value at a minimum of space. *See figure 5*

Figure 5

4.3 EN-Tree Bench

The EN-Tree Bench, is fitted for a large number of exercises as well as sitting as in lying position. The external load is most often created by the use of the flexible EN-Tree pulley. The EN-Tree Bench exist of a seating part and a back support. The seat can be removed from the front-side and inserted on the backside in order to execute some supported exercising for the shoulder. The EN-Tree Bench has an adjustable back support, in order that every individual can use it. EN-Tree Bench has a number of characteristics which is comfortable and easy to use :

- All parts are round or finished with covers.
- The upholstery of the back is folded around the edge, so it is comfortable if used as a support.
- The EN-Tree Bench has two wheels on one side, for easy transportation.
- The upholstery is made of high quality skai.

4.4 EN-Tree Train

The EN-Tree Train can also be used for a number of exercises as well in sitting as in lying position. With these exercises ,external load as well as the mass and inertion of the own body can be used. By using the manchets and the adjustable front-side, numerous positions can be realised and a flexible point of fixation is within hand. The characteristics of the EN-Tree Train for comfort are :

- All parts are round or finished with covers.
- The front has a open space for facial composition.
- The angle bench has wheels for easy transport.
- The top part of the frame is covered with rubber blinds so feet can be placed on it without sliding of the upholstery.
- The upholstery is made of high quality skai.

4.5 Installing EN-Tree

The EN-Tree Bench and the EN-Tree Train are mobile and can be moved within the therapy as desired. The EN-Tree Pulleys are to be fixed to the wall, for technical instructions see the instructions booklet of the EN-Tree Pulley. We recommend to place the pulleys at least 250 cm apart from each other in an angle.

5 Muscle exercises

5.1 Introduction

The exercises on the EN-Tree for the different muscles are in groups according to its functionality:

1. Pectoral
2. Back
3. Shoulders
4. Arms
5. Abdominal
6. Hips
7. Thighs
8. Calves

5.2 Exercises

Muscles are rarely working isolated. In functional movement it is the outcome of the collaboration of stabilisation and shortening or lengthening muscles. With a number of exercises the same muscles are used. However each exercise requires a different contribution of every individual muscle. It is therefore recommended to use a wide variability of exercises if related to one muscle. The more demands imposed upon a muscle the better it shall develop.

5.3 Involved muscles

Per exercise we shall indicate which muscles are dynamical active (concentric or eccentric), even if the muscle is only partially effective or involved in smaller parts of original motion. The muscles which are active isometric in order to sustain a certain posture are not indicated. Sometimes a certain part of a muscle is mentioned. This however does not indicate that only this part of the muscle is involved, as it is most unlikely to isolate certain muscle parts. This however indicates which specific part of that muscle is maximally involved in the external produced power.

5.4 Respiration

Because respiration during exercising is very important, we will give a separate remark with each exercise. The frequency of respiration is recommended to be synchronised to the frequency of the exercise.

5.5 Pectoral

	Bench Press	Incline Press	Pullovers 1	Pullovers II	Flyes	Dips	Crossing overs
m. pectoralis major	●	●	●	●	●	●	●
m. pectoralis minor	●					●	●
m. serratus anterior			●	●			
m. deltoldeus	●	●	●	●	●	●	
m. triceps brachi	●	●	●	●			●
m. coraco brachialis					●		●
m. anconeus	●	●				●	
m. biceps brachi c.l.					●	●	
m. latissimus dorsi						●	
m. rectus abdominus				●			
m. obliquus intemus abdominus				●			
m. obliquus internus abdominus				●			

Bench press

Requirements:
EN-Tree Bench and EN-Tree Pulley

Used muscles:
m. pectoralis major
m. pectoralis minor
m. deltoïdeus pars clavicularis
m. triceps brachi
m.anconeus

Remarks:
The handgrips are to be positioned lateral of the shoulder and pushed forward.

Respiration:
Exhale during pressing out, inhale during the return movement

Incline press

Requirements:
EN-Tree Bench and EN-Tree Pulley

Used muscles:
m. pectoralis major
m. deltoïdeus pars clavicularis et acromialis
m. triceps brachi
m. anconeus

Remarks:
The difference with the bench press is that the upper part of the muscle pectorals major are trained. The handgrips are hold lateral of the shoulder and pressed forward under an angle of 45 degrees upward.

Respiration:
Exhale during pressing out, inhale during the return movement

Pull-overs I

Requirements:
EN-Tree Bench and EN-Tree Pulley

Used muscles:
m. serratus anterior
m. pectoralis major
m. triceps brachi
m. deltoïdeus pars spinalis

Remarks:
With stretched arms keep the handgrips above the head and push forward and downward.

Respiration:
Exhale when the arms goes forward, inhale when the arms go backward

Pull-overs II

Requirements:
EN-Tree Pulley

Used muscles:
m. serratus anterior
m. pectoralis major
m. triceps brachi
m. delto'ideus pars spinalis
m. rectus abdominus
m. obliquus internus abdominus
m. obliquus extemus abdominus

Remarks:
The exercise resembles Pullovers I, but the initial position is the knee sitting position. The trunk should be kept as fixed as possible to minimize dynamic use of the abdominal musculature. In practice however this is always difficult, therefore the abdominal is also involved in the dynamic involved muscles.

Respiration:
Exhale when the handgrips are pushed upwards, inhale during the return movement.

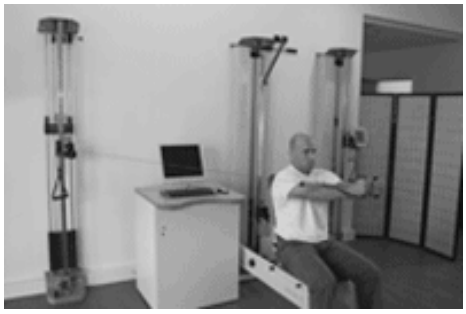
Flyes

Requirements:
EN-Tree Bench and 2 EN-Tree Pulleys

Used muscles:
m. pectoralis major
m. deltoïdeus pars clavicularis
m. biceps brachi caput longum
m. coraco brachialis

Remarks:
Both arms are to be stretched sidewards after which they are to be rotated forwards. The advantage of this exercise with respect to chest-press exercise is that the pectorals muscles can be trained rather isolated with low triceps brachi activity. As a variety the direction of the rotation the upper or lower part of the pectorals can be emphasized.

Respiration:
Exhale during the movement forward, inhale during the return movement.



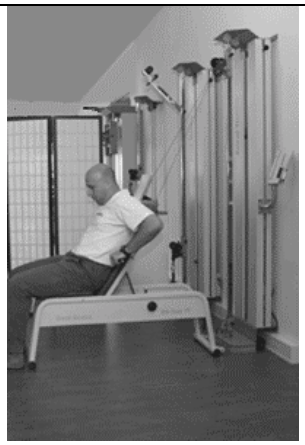
Dips

Requirements :
EN-Tree Bench, EN-Tree Pulley and gallows

Used muscles:
m. pectoralis minor
m. pectoralis major
m. latissimus dorsi
m. triceps brachi
m. deltoldeus pars clavicularis
m. anconeus

Remarks:
The pulley handgrips are kept lateral of the body just below the axilla and are pushed downwards.

Respiration:
Exhale during pushing downwards, inhale during the upward movements.



Crossing overs

Requirements: 2 EN-Tree Pulleys

Used muscles:
m. pectoralis major
m. pectoralis minor
m. biceps brachi caput longum
m. coraco brachialis

Remarks:
The handgrips are to be crossed in front of the body with stretched arms. This exercise is to be performed in a kneeling position in order to stabilize the trunk as much as possible.

Respiration:
Inhale during the upward movement, exhale when the arms are crossed in front of the body.

5.6 Back

	Wide-grip pull down	Small-grip pull down	Seated row I	Seated row II	Behind back crossing overs	Bent over rowing	Rowing	Back extension I	Back extension II	Low back rotation-extension
m. latissimus dorsi	●	●	●	●	●	●	●			
m. trapezius	●	●	●	●		●	●			
m. biceps brachi	●	●	●	●		●	●			
m. brachialis	●	●	●	●		●	●			
m. teres major	●	●	●	●	●	●	●			
m. teres minor	●	●	●	●	●	●	●			
m. serratus anterior	●	●								
m. deltoideus	●	●	●	●	●	●	●			
m. brachioradialis	●	●	●	●		●	●			
m. rhomboTdeus	●	●	●	●		●	●			J
m. infraspinatus	●	●	●	●	●	●	●			
m. gluteus maximus								●	●	
m. erector spinae			●			●		●	●	●
m. semitendinosis								●	●	
m. semimembranosis								●	●	n
m. biceps femoris c.l.								●	●	
m. longissimus thoracis								●	●	●
m. iliocostalis thoracis								●	●	●
m. iliocostalis lumborum								●	●	●
m. spinalis thoracis								●	●	●
m. semispinalis th.										●
m. quadratus lumborum										●
m. obiiquus internus abdominus										●
m. obiiquus externus abdominus										●
m. pectoralis major	●				●					

Wide-grip pull down

Requirements: EN-Tree Bench, EN-Tree Pulley, latbar and gallows

Used muscles:
m. latissimus dorsi
m. trapezius pars ascendens et transversale
m. biceps brachi
m. brachialis
m. teres major
m. teres minor
m. serratus anterior
m. deltoïdeus pars spinalis
m. brachioradialis
m. rhomboïdeus
m. infraspinatus
m. pectoralis major

Remarks:
The latbar should be hold wide and alternately pulled in front or behind the head.

Respiration:
Exhale during downward movement, inhale during upward movement.

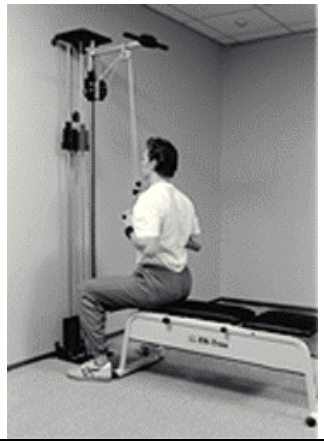
Small-grip pull down

Requirements: EN-Tree Bench, EN-Tree Pulley, triceps rod and gallows.

Used muscles:
m. latissimus dorsi
m. trapezius pars ascendens et transversale
m. biceps brachi
m. brachialis
m. teres major
m. teres minor
m. serratus anterior
m. delto'ideus pars spinalis
m. brachioradialis
m. rhomboTdeus
m. infraspinatus

Remarks:
The triceps rod to be held in undergrip and pulled up on the chest.

Respiration:
Exhale when triceps rod is pulled downward, inhale during return movement



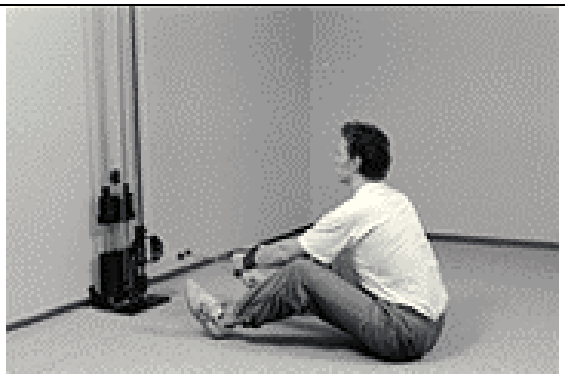
Seated row I

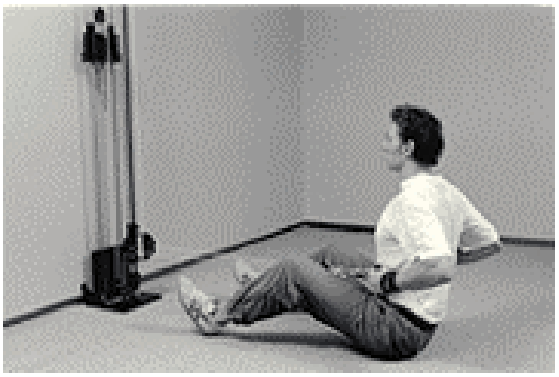
Requirements: EN-Tree Pulley

Used muscles:
m. trapezius
m. latissimus dorsi
m. erector spinae
m. deltoideus pars spinalis
m. biceps brachi
m. brachialis
m. brachioradialis
m. teres major
m. teres minor
m. rhomboldeus
m. infraspinatus

Remarks:
It is important that during the pulling of the handgrips the back should not be overexerted. Note that this is an exercise for shoulder and arm muscles and not primarily for the muscle erector spinae.

Respiration:
Inhale when the handgrips are pulled to the body, exhale when the handgrips are back in start position.





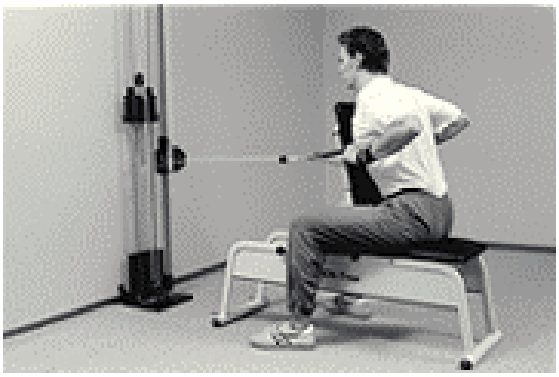
Seated row II

Requirements:
EN-Tree Bench and EN-Tree Pulley

Used muscles:
m. trapezius
m. latissimus dorsi
m. deltoïdeus pars spinalis
m. biceps brachi
m. brachialis
m. brachioradialis
m. teres major
m. teres minor
m. rhomboTdeus
m. infraspinatus

Remarks:
This exercise is similar to seated row I, but by using the EN-Tree Bench the low-back musculature activity is minimized. Especially when having low back problems this exercise can be used in this combination.

Respiration:
Inhale when the handgrips are pulled to the body, exhale during the return movement.



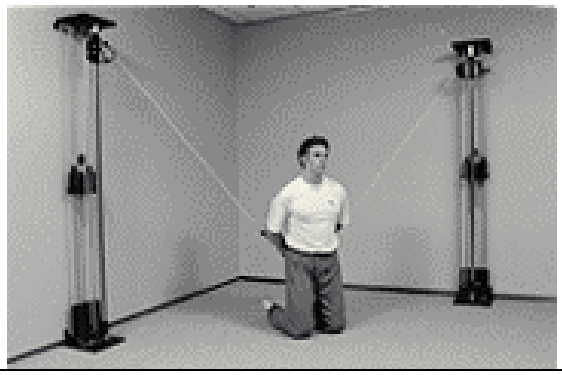
Behind back crossing overs

Requirements: 2 EN-Tree Pulleys

Used muscles:
m. latissimus dorsi
m. teres major
m. teres minor
m. deltoïdeus pars spinalis
m. infraspinatus
m. pectoralis major

Remarks:
The handgrips are to be crossed behind the body. The exercise is performed in a kneeling position in order to stabilize the trunk as much as possible.

Respiration:
Exhale when the handgrips are brought together, inhale during the raising of the handgrips.



Bent over rowing

Requirements: EN-Tree Pulley

Used muscles:
m. trapezius
m. latissimus dorsi
m. deltoïdeus pars spinalis
m. biceps brachi
m. brachialis
m. brachioradialis
m. teres major
m. teres minor
m. rhombo'ideus
m. infraspinatus
m. erector spinae

Remarks:
The legs and the upperbody should be kept straight in order to use it adequately for the upperback.

Respiration:
Inhale during upwards movement of the arms, exhale during the return movement.

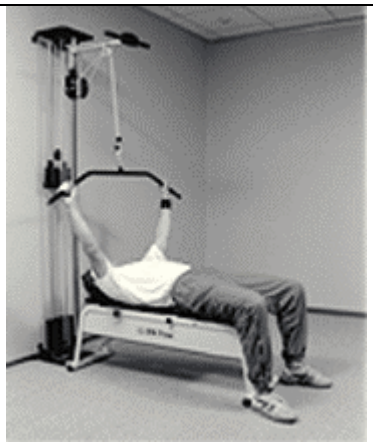
Rowing

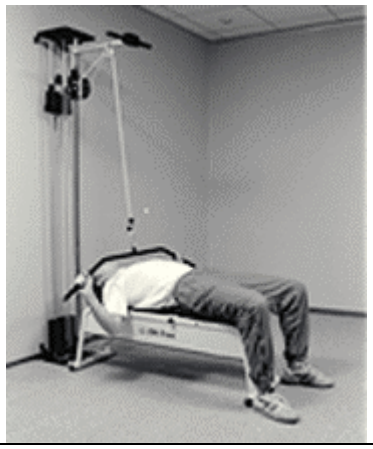
Requirements: EN-Tree Bench, EN-Tree Pulley, latbar and gallows

Used muscles:
m. trapezius
m. latissimus dorsi
m. deltoïdeus pars spinalis
m. biceps brachi
m. brachialis
m. brachioradialis
m. teres major
m. teres minor
m. rhomboideus
m. infraspinatus

Remarks:
The legs can be placed on the bench in order to reduce pressure on the lower back.

Respiration:
Inhale during upwards movement of the arms, exhale during downward pulling of the arms.





Back extension I

Requirements: EN-Tree Train

Used muscles:
m. erector spinae
m. gluteus maximus
m. biceps femoris caput longum
m. semitendinosis
m. semimembranosis
m. longissimus thoracis
m. iliocostalis thoracis
m. iliocostalis lumborum
m. spinalis thoracis

Remarks:
The pelvis should rest stabilized on the end of the bench and move as less as possible. The load can be reduced by placing the hands in the sides.

Respiration:
Inhale during the upwards movement, exhale during the return movement.

Back extension II

Requirements: EN-Tree Train

Used muscles:
m. erector spinae
m. gluteus maximus
m. biceps femoris caput longum
m. semitendinosis
m. semimembranosis
m. longissimus thoracis
m. iliocostals thoracis
m. iliocostals lumborum
m. spinalis thoracis

Remarks:
Is similar to the previous exercise, but the trunk is now fixed and the legs are moving. By bending the legs the intensity is diminished

Respiration:
Inhale during the downwards movement of the legs, exhale during the return movement

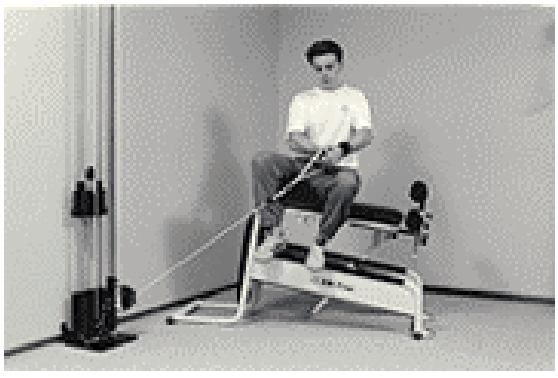
Low back rotation-extension

Requirements:
EN-Tree Train and EN-Tree Pulley

Used muscles:
m. erector spinae
m. longissimus thoracis
m. iliocostalis thoracis
m. iliocostalis lumborum
m. spinalis thoracis
m. semispinalis thoracis
m. quadratus lumborum
m. obliquus internus abdominus
m. obliquus externus abdominus

Remarks:
Arms and shoulders are moving as one and are only partially statically tensed. The seating is tilted in order to increase stability. The higher the handgrips are pulled the more complete the contribution of the individual muscles.

Respiration:
Exhale during the rotation of the trunk, inhale during backwards movement.



5.7 Shoulders

	Upright rowing	Lateral raises	Bent over lateral raises I	Bent over lateral raises II	Bent over lateral raises III	Forward raises	Military press	Shoulder lift	Crawl	Endo-rotation	Exo-rotation
m. delto'ideus	♦	●	●	●	●	●	●		●	●	●
m. trapezius	●	●	●	●	●		●	●			
m. supraspinatus	●	●					●				
m. biceps brachi	●					●					
m. brachialis	●										
m. brachioradialis	●										
m. rhombo'ideus	●	●	●	●	●		●	●			
m. levator scapulae	●	●						●			
m. triceps brachi							●				
m.anconeus							●				
m. latissimus dorsi									●		
m. serratus anterior									●		
m. teres major									●	●	
m. teres minor									●		●
m. pectoralis major										●	
m. coraco brachialis									●		
m. subscapularis										●	
m. infraspinatus											●

Upright rowing

<u>Requirements:</u> EN-Tree Pulley

<u>Used muscles:</u>
m. deltoïdeus
m. trapezius
m. supraspinatus
m. biceps brachi
m. brachialis
m. brachioradialis
m. rhomboïdeus
m. levator scapulae

<u>Remarks:</u>
With higher elevation the muscles will contract more completely.

<u>Respiration:</u>
Inhale during moving the arms up, exhale during the downward movement.

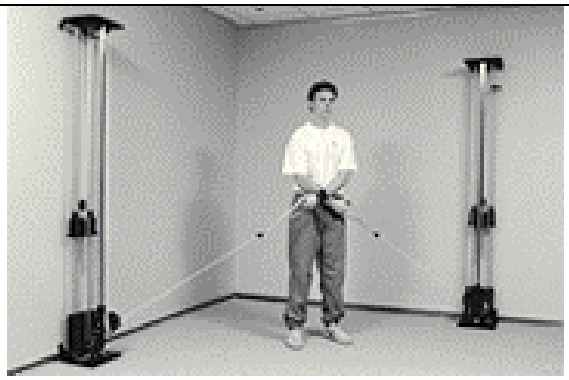
Lateral raises

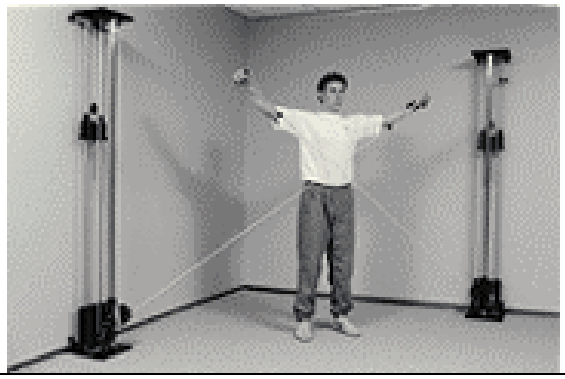
Requirements: 2 EN-Tree Pulleys

Used muscles:
m. deltoïdeus
m. trapezius
m. rhomboïdeus
m. supraspinatus
m. levator scapulae

Remarks:
It is important that in this exercise only the arms move while the rest of the body is steady. With this restriction it is not possible to use other muscles than the above described.

Respiration:
Inhale during moving up the arms, exhale during the downward movement.





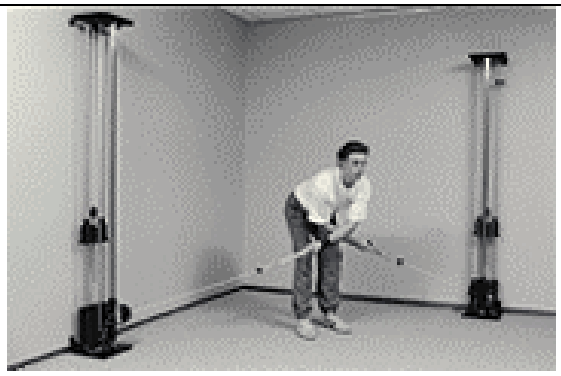
Bent over lateral raises I

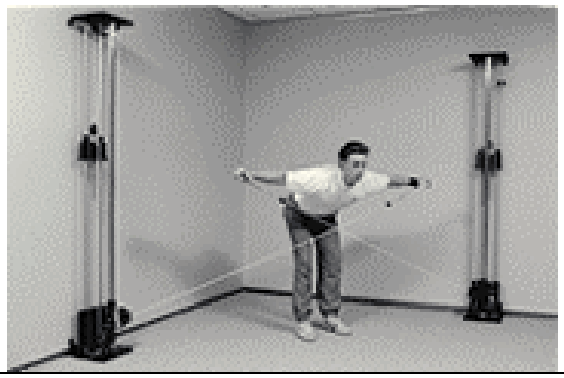
Requirements: 2 EN-Tree Pulleys

Used muscles:
m. detoïdeus pars spinalis et acromialis
m. trapezius
m. rhomboïdeus

Remarks:
Do note that the patient moves his arms in the same plane as the ropes, as a result an isolated movement of the shoulder is realized.

Respiration:
The breathing for this exercise is different from the normal rule : exhale during moving up the arms, inhale during downwards movement.





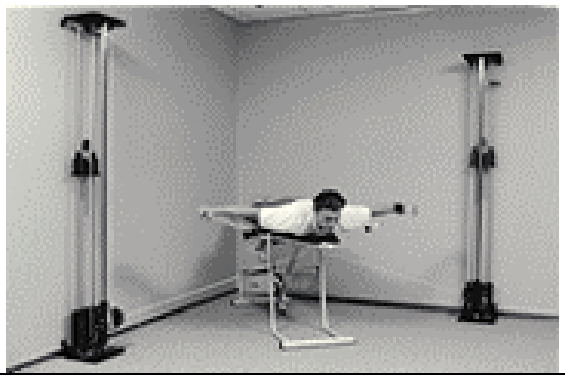
Bent over lateral raises II

Requirements:
EN-Tree Train and 2 EN-Tree Pulleys

Used muscles:
m. detoïdeus pars spinalis et acromialis
m. trapezius
m. rhomboïdeus

Remarks:
This exercise reduces the press on the lower back which makes it suitable for patients with back problems. Also note that the arms move in the same plane as the ropes in order to reduce involvement of the latissimus.

Respiration:
The breathing for this exercise is different from the normal rule: exhale during moving up the arms, inhale during downwards movement.



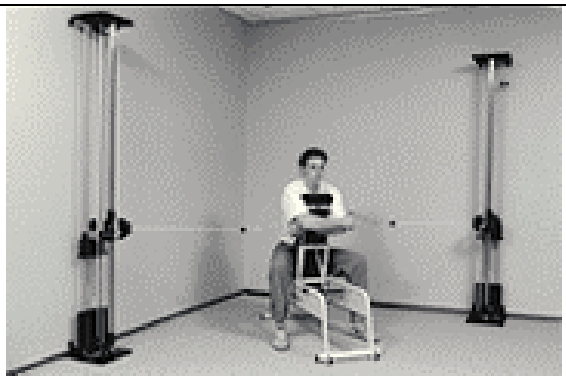
Bent over lateral raises III

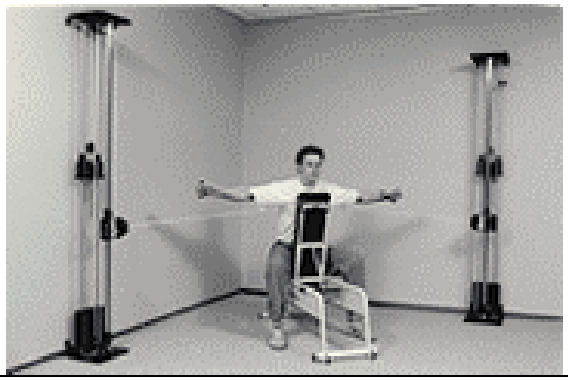
Requirements:
EN-Tree Bench en 2 EN-Tree Pulleys

Used muscles:
m. detoïdeus pars spinalis et acromialis
m. trapezius
m. rhomboïdeus

Remarks:
During this exercise the low back stress is also minimized.

Respiration:
The breathing for this exercise is different from the normal rule : exhale during moving arms backwards, inhale during the return movement.





Forward raises

Requirements: EN-Tree Pulley

Used muscles:
m. deltoideus pars claviculare
m. biceps brachi caput longum

Remarks:
The exercise is recommended to be executed alternating the left - and right arm.

Respiration:
Inhale during the upwards movement of the arm, exhale during the return movement.

Military press

Requirements:
EN-Tree Bench, EN-Tree Pulley and gallows

Used muscles:
m. deltoideus
m. trapezius
m. supraspinatus
m. rhomboideus
m. triceps brachi
m. anconeus
m. levator scapulae

Remarks:
Do note that the movement is in the direction of the ropes.

Respire:
Exhale during pressing out, inhale during the downward movement.

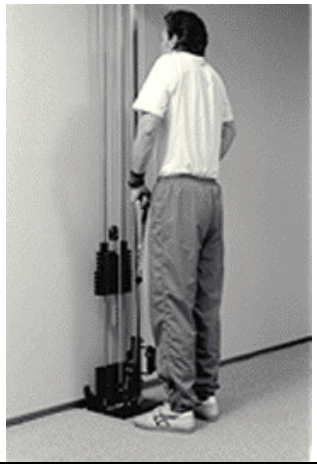
Shoulder lift

Requirements: EN-Tree Pulley

Used muscles:
m. trapezius
m. rhomboideus
m. levator scapulae

Remarks:
Crawl, this exercise is extremely suited for swimmers, should be performed alternating and the exo-rotation. The elbow should be in an angle of 90 degrees.

Respiration:
Inhale during upwards movement of the handgrips, exhale during the return movement.



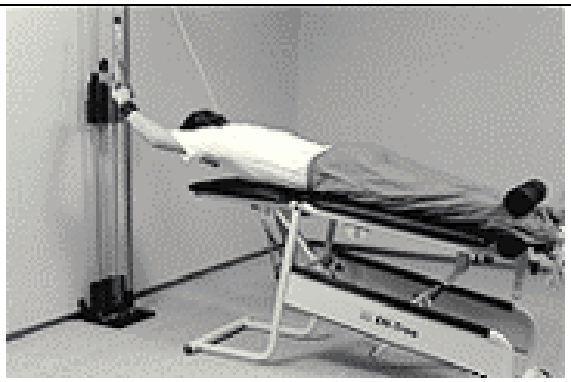
Crawl

Requirements:
EN-Tree Train and EN-Tree Pulley

Used muscles:
m. latissimus dorsi
m. serratus anterior
m. coraco brachialis
m. deltoïdeus pars spinalis et claviculare
m. teres major
m. teres minor

Remarks:
This exercise is well suited for swimmers to train functional force. The exercise resembles the alternating movement while swimming.

Respiration:
Identical as while swimming



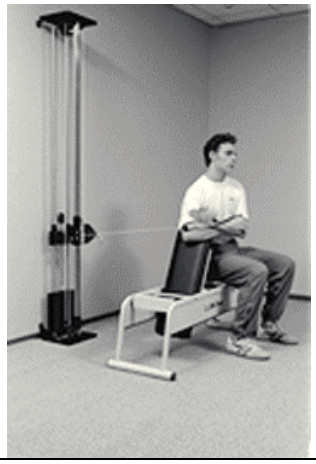
Endo-rotation

Requirements:
EN-Tree Bench and EN-Tree Pulley

Used muscles:
m. deltoïdeus pars clavicularis
m. teres major
m. pectoralis major
m. subscapularis

Remarks:
The elbow should be placed in a 90 degrees position. Rotate the underarm to the body.

Respiration:
Inhale during concentric endo-rotation, exhale during excentric exo-rotation.



Exo-rotation

Requirements:
EN-Tree Bench and EN-Tree Pulley

Used muscles:
m. deltoïdeus pars spinalis
m. infraspinatus
m. teres minor

Remarks:
The underarm should be in a 90 degrees angle with respect to the upperarm.

Respiration:
Exhale during the external rotation of the arm, inhale during the internal rotation.

5.8 Arms

	Arm curl	Scott-curl	Concentration curls	Triceps push-down	Seated triceps extension	Reversed triceps extension	Wrist curl	Reversed Wrist curl
m. biceps brachi	●	●	●					
m. brachialis	●	●	●					
m. brachioradialis	●	●	●					
m. pronator teres	●	●	●					
jm. triceps brachi				●	●	●		
|m. anconeus				●	●	●		
flexors of wrist and fingers	●	●	●					
m. flexor carpi radialis							●	
m. flexor carpi ulnaris							●	
m. palmaris longis							●	
m. flexor digitorum superficialis							●	
m. flexor digitorum profundus							●	
m. extensor carpi radialis longus								●
m. extensor carpi radialis brevis								●
m. extensor carpi ulnaris								●
m. extensor digitorum								●
m. extensor digiti minimi								●

Arm curl

Requirements: EN-Tree Pulley

Used muscles:
m. biceps brachi
m. brachialis
m. brachioradialis
m. pronator teres
flexors of wrist and fingers

Remarks:
The hand palms should be directed inwards. By pulling further the biceps will be more involved.

Respiration:
Inhale during bending the arms, exhale during stretching the arms.

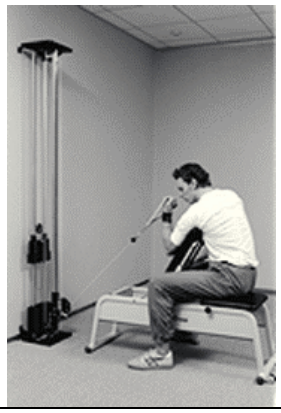
Scott-curl

Requirements:
EN-Tree Bench and EN-Tree Pulley

Used muscles:
m. biceps brachi
m. brachialis
m. brachioradialis
m. pronator teres
flexors of wrist and fingers

Remarks:
This exercise excludes most activity of the shoulder muscles.

Respiration:
Inhale during bending the arms, exhale during stretching the arms.



Concentration curls

Requirements : EN-Tree Pulley

Used muscles:
m. biceps brachi
m. brachialis
m. brachioradialis
m. pronator teres
flexors of wrist and fingers

Remarks:
The upperarm should be as steady as possible on order to exclude any shoulder involvement.

Respiration:
Exhale during pulling up the handgrips, inhale during the return movement.

Triceps push-down

Requirements:
EN-Tree Pulley and triceps rod

Used muscles:
m. triceps brachi
m. anconeus

Remarks:
It is important to keep the upperarms steady against the body to exclude any shoulder involvement.

Respiration:
Exhale during pressing out, inhale during the return movement.

Seated triceps extension

Requirements: EN-Tree Bench, EN-Tree Pulley and triceps rod

Used muscles:
m. triceps brachi
m. anconeus

Remarks:
Note that the upperarms are steady as possible.

Respiration:
Exhale during pressing out, inhale during bending the arms.

Reversed triceps extension

Requirements: EN-Tree Pulley and triceps rod

Used muscles:
m. triceps brachi
m. anconeus

Remarks:
By varying with the handgrip the triceps is involved separately.

Respiration:
Exhale during pressing out, inhale during bending the arms.

Wrist curl

Requirements: EN-Tree Bench, EN-Tree Pulley and triceps rod

Used muscles:
m. flexor carpiradialis
m. flexor carpiulnaris
m. palmares longis
m. flexor digitorum superficialis
m. flexor digitorum profundus

Remarks:
The hand must be placed just over the edge of the bench.

Respiration:
For this movement the breathing rhythm is not important.

Reversed Wrist curl

Requirements: EN-Tree Bench, EN-Tree Pulley and triceps rod

Used muscles:
m. extensor carpi radialis longus
m. extensor carpi radialis brevis
m. extensor carpi ulnaris
m. extensor digitorum
m. extensor digiti minimi

Remarks:
The hand must be placed just over the edge of the bench.

Respiration:
For this movement the breathing rhythm is not important.

	Sit-ups	Crunches	Transverse sit-ups	Transverse abdominal press	Latero-flexie I	Latero-flexie II	Leg raises	Seated abdominal twist
m. rectus abdominus	●	●	●	●			●	
m. obliquus externus abdominus	●	●	●	●	●	●	●	●
m. obliquus internus abdominus	●	●	●	●	●	●	●	●
m. quadratus lumborum					●	●		●
m. longissimus thoracis					●	●		
m. iliocostalis thoracis					●	●		
m. iliocostalis lumborum					●	●		
m. spinalis thracis					●	●		
m. semispinalis thoracis					●	●		
m. iliopsoas							●	
m. rectus femoris							●	
m. latissimus dorsi				●				

Sit-ups

Requirements: EN-Tree Train

Used muscles:
m. rectus abdominus
m. obliquus externus abdominus
m. obliquus internus abdominus

Remarks:
To exclude the involvement of the m. iliopsoas, the back should be flexed and the pelvis can be fixed to the bench with a strip.

Respiration:
Exhale during the upwards movement, inhale during the return movement.

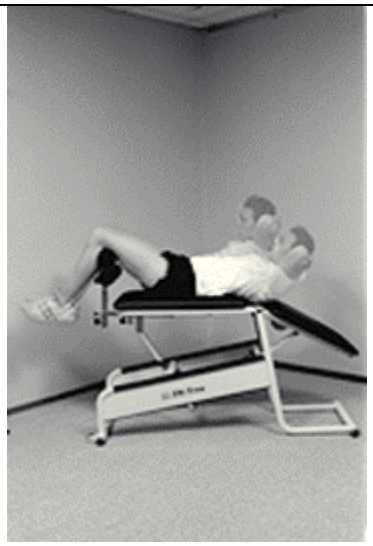
Crunches

Requirements: EN-Tree Train

Used muscles:
m. rectus abdominus
m. obliquus internus abdominus
m. obliquus externus abdominus

Remarks:
The legs should remain fixated over the rolls in order to exclude the m. iliopsoas. This exercise can also be bend unilaterally (with some rotation).

Respiration:
Exhale during upwards movement, inhale during the downwards movement.



Transverse sit-ups

Requirements: EN-Tree Train

Used muscles:
m. obliquus internus abdominus
m. obliquus externus abdominus
m. rectus abdominus

Remarks:
The same as above but with alternating left- and right shoulder pinpointing.

Respiration:
Exhale during upwards movement, inhale during the downwards movement.

Transverse abdominal press

Requirements:
EN-Tree Bench and EN-Tree Pulley

Used muscles:
m. obliquus internus abdominus
m. obliquus externus abdominus
m. rectus abdominus
m. latissimus dorsi

Remarks:
The arm and shoulder must be involved statically.

Respiration:
Exhale during turn-bending movement. Inhale during the return movement.

Lateral-flexion I

Requirements:
EN-Tree Train and EN-Tree Pulley

Used muscles:
m. quadratus lumborum
m. obliquus intemus abdominus
m. obliquus extemus abdominus
m. longissimus thoracis
m. iliocostalis thoracis
m. iliocostalis lumborum
m. spinalis thoracis
m. semispinalis thoracis

Remarks:
The stabilizing roll should be at the height of the lower rib. The to be trained pelvis side should not be supported by the bench.

Respiration:
Exhale during the lean-over position of the trunk, inhale during the upright movement.

Lateral-flexion II

Requirements: EN-Tree Train

Used muscles:
m. quadratus lumborum
m. obliquus intemus abdominus
m. obliquus externus abdominus
m. longissimus thoracis
m. iliocostalis thoracis
m. iliocostalis lumborum
m. spinalis thoracis
m. semispinalis thoracis

Remarks:
The legs should be crossed under the fixating rolls.

Respiration:
Exhale during the lean-over position of the trunk, inhale during the upright movement.

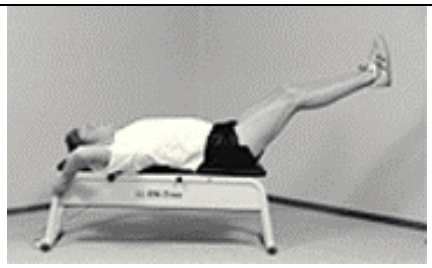
Leg raises

Requirements: EN-Tree Bench

Used muscles:
m. rectus abdominus
m. obliquus internus abdominus
m. obliquus externus abdominus
m. iliopsoas
m. rectus femoris

Remarks:
The legs are slightly flexed and should be lowered until almost complete extension.

Respiration:
Inhale during upward movement of the legs, exhale during the downwards movement.



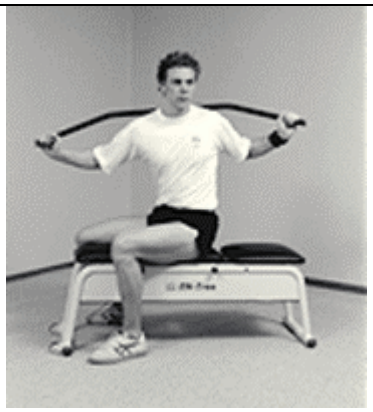
Seated abdominal twist

Requirements: EN-Tree Bench and lat bar

Used muscles:
m. obliquus internus abdominus
m. obliquus externus abdominus
m. quadratus lumborum

Remarks:
The rod should be parallel to the bench in parallel position.

Respiration:
Exhale when end position is reached, inhale during the middle position.



5.9 Hips

	Ab-duction 1	Ab-duction II	Retro-flexion 1	Retro-flexion II	Ad-duction	Ante-flexion
m. tensor fascia latae	●	●				●
m. gluteus maximus			●	●	●	
m. gluteus medius	●	●				
m. gluteus minimus	●	●				
m. biceps femoris caput longum			●	●	●	
m. semimembranosis			●	●	●	
m. semitendinosis			●	●	●	
m. pectineus					●	●
m. aductor longus					●	●
m. gracilis					●	
m. adductor magnus					●	
m. adductor brevis					●	●
|m. iliopsoas						●
|m. rectus femoris						●
|m. sartorius						●
|m. erector spinae				●		
|m. rectus femoris						●

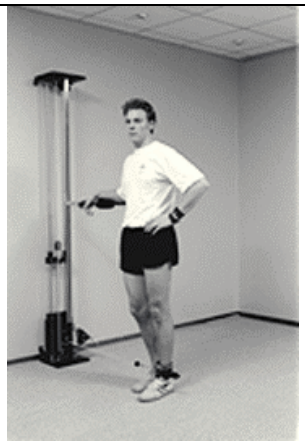
Ab-duction I

Requirements:
EN-Tree Pulley, ankle sling and gallows

Used muscles:
m. tensor fascia latae
m. gluteus medius
m. gluteus minimus

Remarks:
The gallow is used for stabilisation.

Respiration:
Exhale during the outwards movement of the leg, inhale during the inwards movement.



Ab-duction II

Requirements: EN-Tree Train

Used muscles:
m. tensor fascia latae
m. gluteus medius
m. gluteus minimus

Remarks:
Like ab-duction I, but now in side position.

Respiration:
Exhale during the upwards movement of the leg, inhale during the downwards movement.

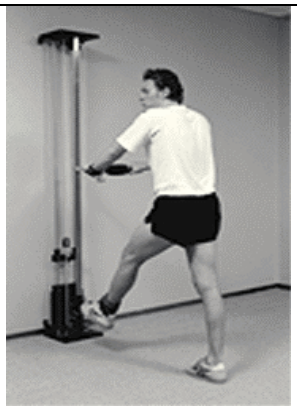
Retro-flexion I

Requirements:
EN-Tree Pulley, ankle sling and gallows

Used muscles:
m. gluteus maximus
m. biceps femoris caput longum
m. semitendinosis
m. semimembranosis

Remarks:
The angle sling to be fixed at the smallest part of the calves. The gallows to be used for stabilisation.

Respiration:
Exhale during the backwards movement of the leg, inhale during the forwards movement.



Retro-flexion II

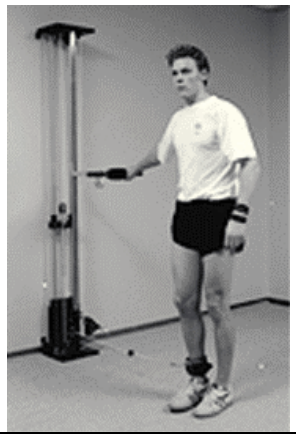
Requirements: EN-Train

Used muscles:
m. gluteus maximus
m. biceps femoris caput longum
m. semitendinosis
m. semimembranosis
m. erector spinae

Remarks:
Ad-duction the gallow to be used for stabilisation.

Respiration:
Exhale during the upwards movement of the leg, inhale during the downwards movement of the leg.

Ad-duction



Requirements:
EN-Tree Pulley, ankle sling and gallows

Used muscles:
m. pectineus
m. adductor longus
m. gracilis
m. adductor magnus
m. adductor brevis
m. semitendinosis
m. semimembranosis
m. biceps femoris caput longum
m. gluteus maximus

Remarks:
The ankle sling is positioned just above the malleoli to prevent displacement. The support bar is held for support.

Respiration:
Exhale during adduction, inhale during excentric abduction.

Ante-flexion

Requirements:
EN-Tree Pulley, ankle sling and gallows

Used muscles:
m. iliopsoas
m. rectus femoris
m. pectineus
m. adductor longus
m. adductor brevis
m. tensor fasciae latae
m. sartorius
m. rectus femoris

Remarks:
The gallows is used for stabilization. When the foot is exorotated the fascias medias is more involved and at the end rotated fascias lateralis.

Respiration:
Exhale during forwards movement of the leg, inhale during the backwards movement of the leg.

5.10 Thighs

	Leg extension	Squats	Leg curl	Straight leg dead lift
m. quadriceps femoris	●	●		
m. gluteus maximus		●		●
m. gluteus medius		●		●
m. semitendinosis		●	●	●
m. semimembranosis		●	●	●
m. biceps femoris		●	●	●
m. articularis genus	●	●		
m. erector spinae		●		●
m. gastrocnemius			●	
m. plantaris			●	
m. popliteus			●	
jm. sartorius			●	
[m. gracilis			●	
jm. tensor fascia latae	●			

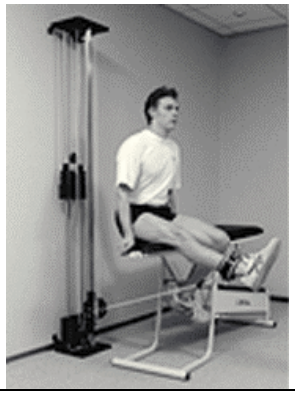
Leg extension

Requirements:
EN-Tree Train, EN-Tree Pulley and ankle sling

Used muscles:
m. quadriceps femoris
m. articularis genus
m. tensor fascia latae

Remarks:
This exercise allows an isolated training of the knee-extensor muscles. By endo-rotation of the foot the medial extensors are more pronounced. By endo-rotation the vastus lateralis is stronger charged.

Respiration:
Exhale during extension, inhale during excentric flexion



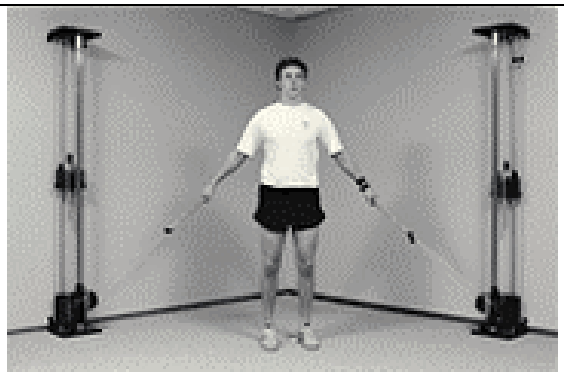
Squats

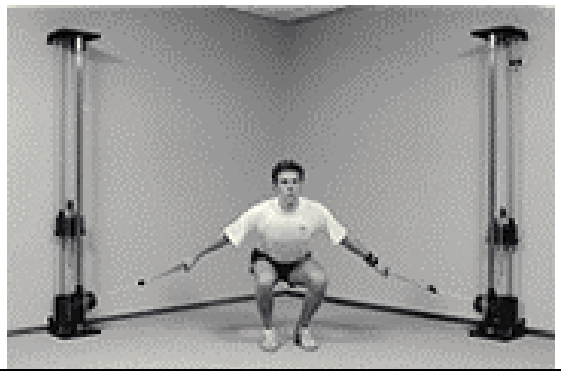
Requirements: 2 EN-Tree Pulleys

Used muscles:
m. quadriceps femoris
m. gluteus maximus
m. gluteus medius
m. semitendinosis
m. semimembranosis
m. biceps femoris caput longum
m. articularis genus
m. erector spinae

Remarks:
The back should be kept as straight as possible.

Respiration:
Exhale during the upright movement, inhale during bending.





Leg curl

Requirements:
EN-Tree Train, EN-Tree Pulley and ankle sling

Used muscles:
m. biceps femoris
m. semitendinosis
m. semimembranosis
m. gastrocnemius
m. plantaris
m. popliteus
m. sartorius
m. gracilis

Remarks:
The knees should be placed just over the edge of the EN-Tree Train.

Respiration:
Exhale during the flexion, inhale during extension.

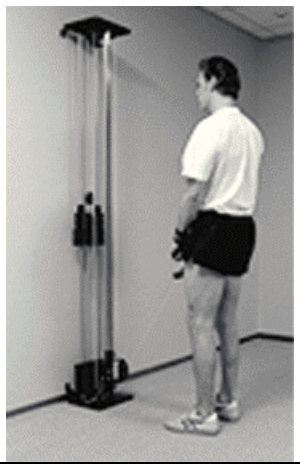
Straight leg dead lift

Requirements: 2 EN-Tree Pulleys

Used muscles:
m. biceps femoris caput longum
m. semimembranosis
m. semitendinosis
m. gluteus maximus
m. gluteus medius
m. erector spinae

Remarks:
By using the hip as much as possible and not bending the back, the mono- and biarticulair hip extensors will be trained.

Respiration:
Exhale during forwards bending, inhale during the return movement.



5.11 Calves

	Standing calf raises	Seated calf raises	Reversed calf raises
m. gastrocnemius	●	●	
m. soleus	●	●	
m. tibialis posterior	●	●	
m. peroneus longus	●	●	
m. peroneus brevis	●	●	
m. plantaris	●	●	
m. flexor digitorum longus	●	●	
m. flexor hallucis logus	●	●	
m. tibialis anterior			●
m. extensor hallucis longus			●
m. extensor digitorum longus			●

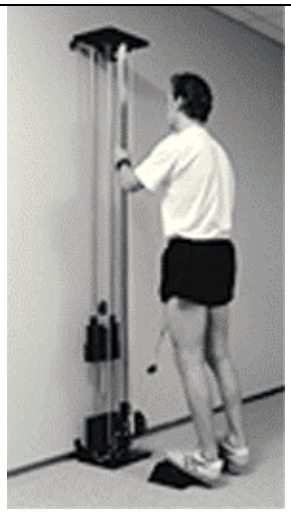
Standing calf raises

Requirements:
EN-Tree Pulley en EN-Tree Train

Used muscles:
m. gastrocnemius
m. soleus
m. tibialis posterior
m. peroneus longus
m. peroneus brevis
m. plantaris
m. flexor digitorum longus
m. flexor hallucis longus

Remarks:
The handgrip should be kept in front of the midline of the body in order to balance the load over the left- and right leg. The front of the foot is supported on a rod.

Respiration:
Exhale during the upwards movement, inhale during the downwards movement.



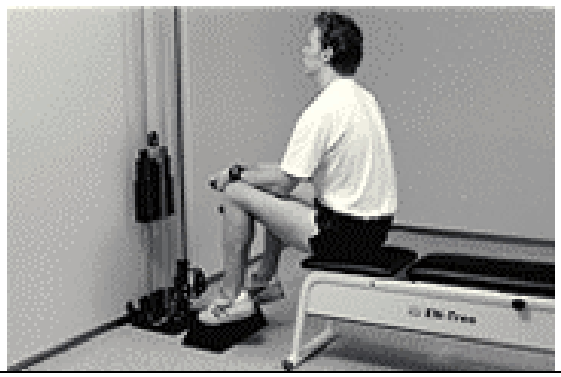
Seated calf raises

Requirements:
EN-Tree Bench, EN-Tree Pulley

Used muscles:
m. gastrocnemius
m. soleus
m. tibialis posterior
m. peroneus longus
m. peroneus brevis
m. plantaris
m. flexor digitorum longus
m. flexor hallucis longus

Remarks:
Support the handgrips on the knees.

Respiration:
Exhale during the upwards movement, inhale during the downwards movement.



Reversed calf raises

Requirements: EN-Tree Pulley

Used muscles:
m. tibialis anterior
m. extensor hallucis longus
m. extensor digitorum longus

Remarks:
For a symmetric load, position the handgrip in front of the body. The heel is placed on a small platform.

Respiration:
Exhale during the upwards movement, inhale during the downwards movement.

6 Mobilization exercises

6.1 Introduction

Mobilization exercises are a form of exercising. The goal of mobilization exercising is improving the mobility of the joints. The position of the mobilization exercises should be switched if painful or hypermobile joints are involved. It is therefore that stabilization rolls are sometimes recommended. Isolated movements are mostly preferred.

6.2 Cervical spine

Mobilization of the flexion head

Requirements:
EN-Tree Train and stabilization role

Mobilized joints: C0-C2

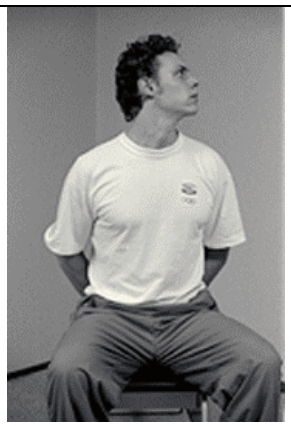
Remarks: The initial position is an extension of the cervical spine. Movement is slowly performed to a flexion of the cervical spine.

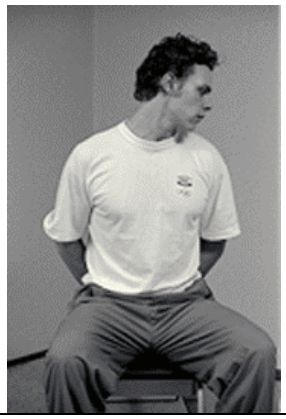
Mobilization of the flexion head

Requirements: EN-Tree Bench

Mobilized joints: CO-C2

Remarks: The initial position is rotation left, with a lateral flexion right and dorsal flexion of the head.





Mobilization of the neck extension

Requirements:
EN-Tree Bench, EN-Tree Pulley and headband

Mobilized joints: cervical spine

Remarks: The initial position is in flexion. Movement is directed to extension.

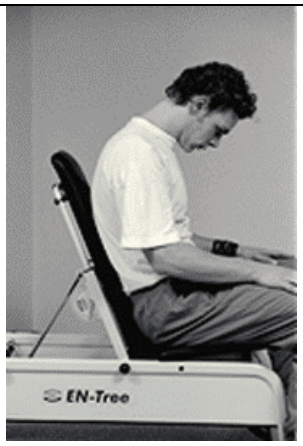
6.3 Cervico thoracic region

Seated extension of spine

Requirements: EN-Tree Bench

Mobilized joints: Cervico thoracic region

Remarks: By cervical thoracic junction the initial position is a kyphoses in the lumbar region and flexion in the cervical thoracic region. The patient now exerts a cervical thoracic extension, the hands are supporting the knee and the arms are helping with extending the back.

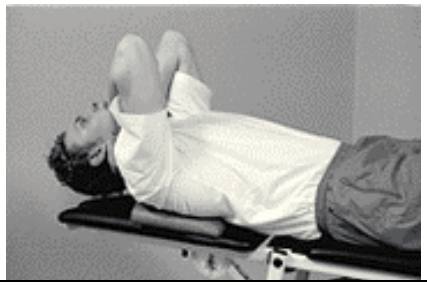


The cervical extension CT spine

Requirements: EN-Tree Train

Mobilized joints: Cervico thoracic region

Remarks: The cervical thoracic junction is in flexion, the cervical spine is stabilized with the hands and the lordosis in the lumbar spine is prevented by pulling up the legs and placing them on the bench. A patient now exerts a cervical thoracic extension.

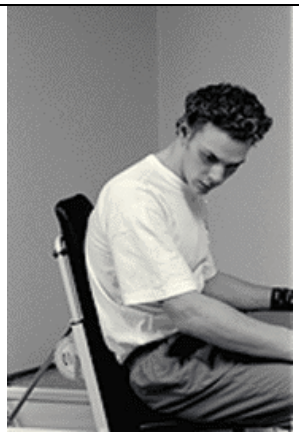


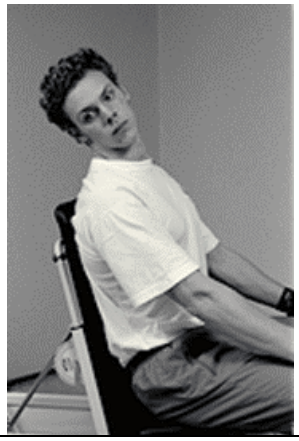
Extension of C/Th spine with right rotation and lateral bending

Requirements: EN-Tree Bench

Mobilized joints: Cervico thoracic region

Remarks: The initial position is with extension of the lumbar spine and flexion, right rotation and right lateral bending of cervico thoracic region. The patient performs a cervico thoracic extension. Hands positioned on the knees are supporting the extension. Repeat the exercise bilateral.





6.4 Thoracic spine

Mobilization thoracic spine, sitting

Requirements: EN-Tree Train

Mobilized joints: Thoracic spine

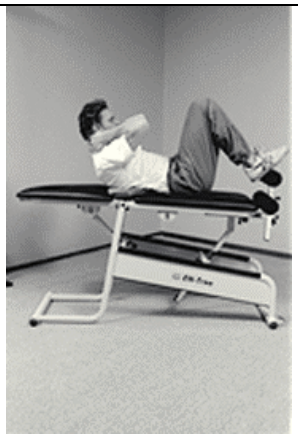
Remarks: The stabilization roll is set up in the right position on the thoracic level, the thoracic spine is in kyphoses while the cervical spine is stabilized by the hands. The patient now exerts extension over the roll.

Mobilization thoracic spine, lying

Requirements: EN-Tree Train

Mobilized joints : Thoracic spine

Remarks: In the start position the lumbar spine is in kyphoses and the cervical spine is stabilized by the hands. The thoracic spine is flexed. The stabilization pillow is the axes of the mobile.

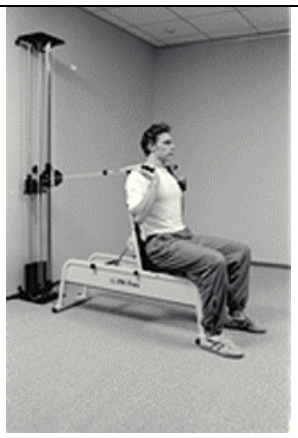


Mobilization flexion thoracic spine, sit

Requirements:
EN-Tree Bench and EN-Tree Pulley

Mobilized joints: Thoracic spine

Remarks: While the lumbar spine is in kyphoses, the pulley handgrips are kept on he shoulder. The patient is extended by the Pulley's resistance and moved against it in flexion.

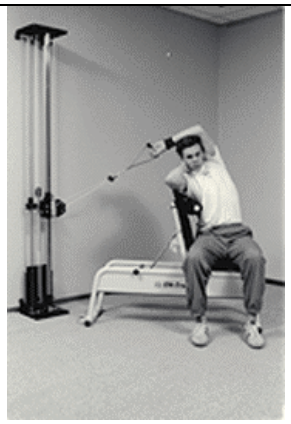


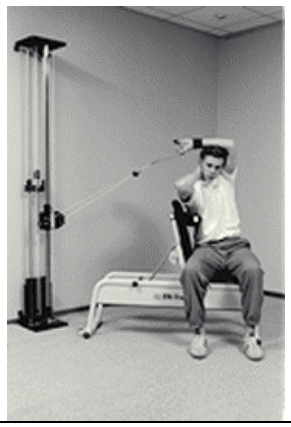
Mobilization lateral flexion thoracic spine, sit

Requirements:
EN-Tree Bench and EN-Tree Pulley

Mobilized joints: Thoracic spine

Remarks: The lumbar spine positioned in a extension with a side flexion to the right. The right pelvis is supported. The left hand supports the thoracic spine. The pulley handgrip is kept over the head with the right hand. The patient pulls in to opposite lateral flexion direction.





6.5 Lumbar spine

Mobilization extension lumbar spine, sit I

Requirements: EN-Tree Bench, EN-Tree Pulley and triceps gallows

Mobilized joints: Lumbar and thoracic spine

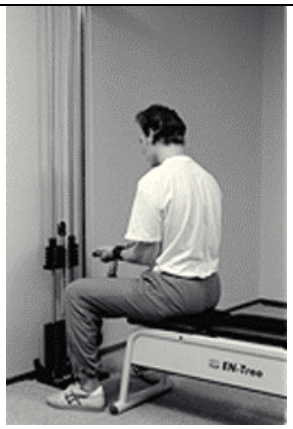
Remarks: The lumbar spine is in flexion. The patient is pulled towards in flexion by the pulley and moves against it towards extension.

Mobilization extension lumbar spine, sit II

Requirements: EN-Tree Bench, EN-Tree Pulley and triceps gallows

Mobilized joints: Lumbar spine

Remarks: In the initial position the right knee is free of the bench while the right foot is supported. The knee is now pulled up as far as possible.



6.6 Sacro-iliac joint

Kneeled mobilisation sacro-iliac joint

Requirements: EN-Tree Bench

Mobilized joints:
Sacro-iliac joints and lumbar spine

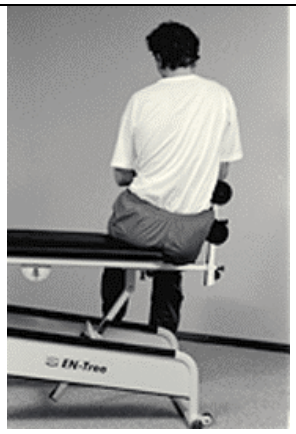
Remarks: The initial position is with one leg on the couch, the other leg is not supported. The hip of the free leg is lifted as high as possible.

Seated mobilization sacro-iliac joint

Requirements: EN-Tree Train

Mobilized joints:
Sacro-iliac joints and lumbar spine

Remarks: The person is seated on the EN-Tree Train with one hip positioned on the bench and one next to the bench. The free side is maximally lifted. Repeat the exercise in alternate position.



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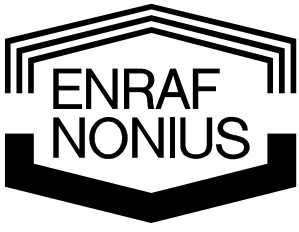
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