



CLINICAL GUIDANCE

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WHY USE PHYSIOPLUX IN THE MOTOR RELEARNING PROCESS?

FOR MOST CASES
PREVENT INCIDENT RECURRENCE

IMPROVE OUTCOMES, LESSEN NUMBER
OF SESSIONS REQUIRED AND REDUCE
INCIDENT RECURRENCE

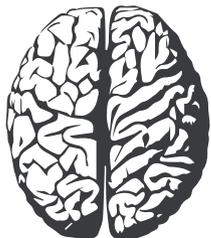
REAL TIME VISUAL FEEDBACK,
WITH APPEALING GRAPHICS
THAT REPRESENT MUSCLES ACTIVITY
TO MORE EFFECTIVELY LEARN THE RIGHT PATTERN
AND AVOID MUSCLE ADAPTATIONS

OBJECTIVELY TRACK
THE MOTOR CONTROL RELEARNING PROGRESS
USING ACTIVATION TIMINGS & COMPARE
AGAINST ASYMPTOMATIC SIDE



MOTOR RELEARNING MODEL

FITTS & POSNER ¹



COGNITIVE STAGE



AWARENESS EXERCISES SHOULD BE MAINTAINED FOR **10SECS**² FOR EACH LOCAL STABILIZER MUSCLE, WITHOUT COMPENSATIONS, IN DIFFERENT POSITIONS (SUPINE, PRONE, SITTING, STANDING)

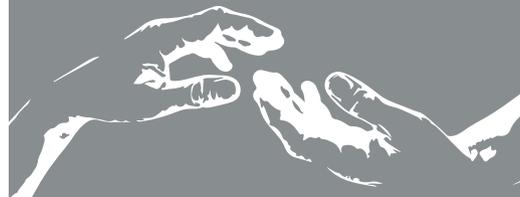
RECOGNIZE NEUTRAL ZONE AND MAINTAIN LOCAL STABILIZERS CONTRACTION

EXERCISES SHOULD BE SIMPLE

THIS STAGE REQUIRES HIGH ATTENTION LEVELS AND COGNITIVE DEMAND WITH VARIABILITY OF THE INITIAL PERFORMANCE

THERE IS A TENDENCY TO OPTIMIZE THE TASK, DUE TO THE REPETITION OF THE ACTION

SHOULD BE GIVEN A HIGH FEEDBACK LEVEL AND HIGH FREQUENCY OF TREATMENT SESSIONS



ASSOCIATIVE STAGE



MAINTAINED ACTIVATION OF THE LOCAL STABILIZERS FOR **2X 30SECS**² IN THE NEUTRAL ZONE

MAINTAINED SAME ACTIVATION LEVELS IN DIFFERENT POSITIONS AND PLANES OF MOVEMENT AND WITH REDUCED FEEDBACK

MAINTAINED ACTIVATION DISSOCIATED OF NORMAL BREATHING

MAINTAINED ACTIVATION WITHOUT BIG EFFORT REQUIRED

LOWER PERFORMANCE VARIABILITY

LONGEST PHASE OF MOTOR LEARNING



AUTONOMOUS STAGE

MAINTAINED ACTIVATION IN DIFFERENT DAILY LIFE ACTIVITIES, WITH REDUCED FEEDBACK AND PROGRESSIVELY WITHOUT FEEDBACK

GREATER FOCUS ON FUNCTIONAL TASKS

REDUCED LEVELS OF ATTENTION AND EFFORT REQUIRED

GOAL IS TO ACHIEVE AUTOMATISM AND EASE IN PERFORMING TASKS

LOWER FREQUENCY OF TREATMENT SESSIONS

¹ Fitts & Posner, cit. by Wulf, 2007

² Santos e Matias, 2007

SHOULDER TREATMENT PLAN SAMPLES PER CONDITION

IMPINGEMENT ¹

COGNITIVE	ASSOCIATIVE	AUTONOMOUS			
1-2	4-8	2-4	WEEKS	2-4	
1-3	4-12	2-6	SESSIONS	4-8	
APPLICATIONS: EVALUATION, GENERIC, DYNAMIC STABILITY SHOULDER					

POST-OP ²

COGNITIVE	ASSOCIATIVE	AUTONOMOUS			
2-4	4-12	2-6	WEEKS	2-4	
4-8	4-16	2-6	SESSIONS	4-8	
APPLICATIONS: POST-OP, EVALUATION, GENERIC, DYNAMIC STABILITY SHOULDER					

EVALUATION

APPLICATION

8 CHANNELS TO EVALUATE AND COMPARE THE MAIN 4 SUPERFICIAL MUSCLES IN BOTH SHOULDERS, ACCORDING TO THE DYNAMIC STABILITY PRINCIPLE

(NEW APPLICATION COMING SOON!)

DYNAMIC STABILITY SHOULDER APPLICATION

DESIGNED TO ASSESS ORDERS OF ACTIVATION AND MAXIMUM VOLUNTARY CONTRACTION BETWEEN 4 IMPORTANT MUSCLES:

SERRATUS ANTERIOR AND INFERIOR TRAPEZIUS (LOCAL STABILIZERS) & ANTERIOR DELTOID AND UPPER TRAPEZIUS (GLOBAL SYSTEM MUSCLES)

DYNAMIC STABILITY GENERIC

USEFUL TO COMPARE 2 MUSCLES IN EACH SHOULDER WITH THE PURPOSE OF TRAINING AND HAVE FEEDBACK

¹ Santos e Matias, 2007
² Clinical Reasoning

MOTOR RELEARNING PROGRESSION OBJECTIVES¹

IMPINGEMENT

COGNITIVE STAGE

ASSESS AND PROMOTE LOCAL STABILIZER MUSCLES (**INFERIOR TRAPEZIUS & SERRATUS ANTERIOR**) ACTIVATION DISSOCIATED FROM GLOBAL SYSTEM MUSCLES (**DELTOID ANTERIOR & UPPER TRAPEZIUS**)

ACTIVATION FIRST WITH FEEDBACK AND WHEN WELL EXECUTED, WITHOUT FEEDBACK

RECOVERY OF NEUTRAL ZONE ((RE)PUT SCAPULA ON AN IDEAL POSITION) AND MAINTAINING LOCAL STABILIZERS CONTRACTION WITHOUT OVERLAPPING OF THE GLOBAL SYSTEM

ASSOCIATIVE STAGE

MAINTAINING THE SAME LEVELS OF CONTRACTION IN DIFFERENT POSITIONS (SUPINE, PRONE, SITTING, STANDING) WITH THE SCAPULA IN THE IDEAL POSITION

AND WITH LOW FEEDBACK (JUST WATCHING THE GRAPHICS IN CASE OF GREAT NEED)

AUTONOMOUS STAGE

MAINTAINING CONTRACTION IN DIFFERENT DAILY ACTIVITIES, WITH GOOD CONTROL OF THE SCAPULA ACROSS THE MOVEMENT, WITHOUT DECOAPTATION OF THE LOWER ANGLE AND/OR THE INNER EDGE OF THE SCAPULA THE GOAL IS TO DECREASE FEEDBACK LEVELS

MAINTAINING CONTRACTION IN DIFFERENT DAILY ACTIVITIES WITHOUT FEEDBACK

USUALLY PEOPLE HAVE PAIN WHEN THEY HAVE A WRONG PATTERN OF MOVEMENT

MOVEMENT ASSESSMENT

mobilizers stabilizers	superior trapezius	1	20.0 ms
	inferior trapezius	2	-10.0 ms
	serratus anterior	3	-4.0 ms
	deltoid anterior	4	0.0 ms

STABILIZER MUSCLES SHOULD PRE-ACTIVATE THE MOVEMENT

ASSESS E.1

ACTIVATION TIMINGS (PER PLANE)

		ACT. TIMING	MVC
superior trapezius	1	-15.0 ms	0.45 v
inferior trapezius	2	30.0 ms LATE	0.15 v LOW
serratus anterior	3	41.0 ms	0.18 v
deltoid anterior	4	0.0 ms	0.42 v

COMMON PATIENT ISSUES

(representative values)

USUALLY PATIENTS HAVE AN OVER ACTIVATION OF SUPERIOR TRAPEZIUS AND DELTOID ANTERIOR, WITH LATE AND/OR LOW ACTIVATION OF THE SHOULDER STABILIZERS, NAMELY INFERIOR TRAPEZIUS AND SERRATUS ANTERIOR

REST ASSESSMENT

mobilizers stabilizers	superior trapezius	1	0.01 v
	inferior trapezius	2	0.03 v
	serratus anterior	3	0.00 v
	deltoid anterior	4	0.00 v

MUSCLES AT REST CAN HAVE A RESIDUAL ACTIVATION

MOTOR RELEARNING PROGRESSION EXERCISES ¹

(suggestions)

COGNITIVE STAGE

AWARENESS OF THE INFERIOR TRAPEZIUS MUSCLE IN SITTING POSITION, ASK THE PATIENT TO PULL THE SCAPULA TOWARD HIS CONTRA-LATERAL HIP AND PUT THE SCAPULA IN THE NEUTRAL ZONE

AWARENESS OF THE SERRATUS ANTERIOR MUSCLE IN 4 SUPPORT POSITION, WITH KNEES AND ELBOW IN FLECTION, IS ASKED TO THE PATIENT TO EXTEND THE ELBOW

SHOULD REPEATEDLY PERFORM THE EXERCISE FOR 10S, APPLYING THE SAME STIMULUS FOR NO LONGER THAN 5 MINUTES. CHANGE POSITIONS (SUPINE, PRONE, SITTING, STANDING) AND ASK THE SAME ACTIVATION.

¹ Santos e Matias, 2007

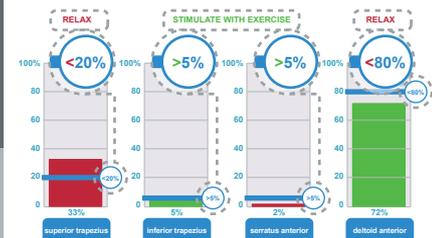
ASSESS E.2

AT REST

superior trapezius	1	MVC 0.05 v
inferior trapezius	2	0.01 v
serratus anterior	3	0.01 v
deltoid anterior	4	0.00 v

OCCASIONALLY PATIENTS HAVE HYPERACTIVITY ON THE UPPER TRAPEZIUS, A VERY RECRUITED MOBILIZER

TREATMENT



USUALLY PATIENTS HAVE INFERIOR TRAPEZIUS AND SERRATUS ANTERIOR WITH VERY LOW LEVELS OF ELECTRICAL ACTIVITY, WHICH MEANS THEY ARE NOT VERY ACTIVE AND INDIRECTLY THAT THEY ARE NOT RESISTANT

ASSOCIATIVE STAGE

PERFORM THE PREVIOUSLY DESCRIBED EXERCISES FOR 2X30S IN THE NEUTRAL ZONE, IN SUPINE, PRONE, SITTING AND STANDING, FOR BOTH LOCAL STABILIZER MUSCLES

ADD MOVEMENT TO THE TRAINING PLAN, STARTING WITH SMALL RANGES OF ANALYTICAL MOVEMENTS IN THE DIFFERENT PLANES OF MOVEMENT

START PROGRESSIVELY TO ADD RESISTANCE TO THE MOVEMENT, USING A WEIGHT

AUTONOMOUS STAGE

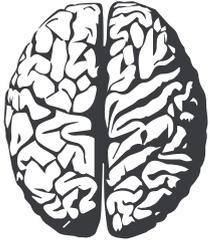
ADD FUNCTIONAL MOVEMENTS AND TRAIN THEM IN DIFFERENT POSITIONS

EXAMPLE: IN SITTING POSITION, IN FRONT OF A TABLE, HOLD AN OBJECT AS A BOTTLE OF WATER, WITH CONTROL OF THE SCAPULA, AND TAKE IT ABOVE YOUR HEAD

CHECK IF THE PATIENT IS ABLE TO PERFORM MULTIPLE TASKS WITH CONTROL OF THE SCAPULA IN DIFFERENT POSITIONS & SPEED OF MOVEMENT

MOTOR RELEARNING MODEL

FITTS & POSNER ¹



COGNITIVE STAGE



AWARENESS EXERCISES SHOULD BE PERFORMED FOR THE STABILIZER (VASTUS MEDIALIS) AND MAINTAINED FOR **10SECS**²

EXERCISES SHOULD BE SIMPLE

THIS STAGE REQUIRES HIGH ATTENTION LEVELS AND COGNITIVE DEMAND WITH VARIABILITY OF THE INITIAL PERFORMANCE

THERE IS A TENDENCY TO OPTIMIZE THE TASK, DUE TO THE REPETITION OF THE ACTION

SHOULD BE GIVEN A HIGH FEEDBACK LEVEL AND HIGH FREQUENCY OF TREATMENT SESSIONS



ASSOCIATIVE STAGE



MAINTAINED ACTIVATION OF THE STABILIZER (VASTUS MEDIALIS) FOR **2X 30SECS**²

MAINTAINED SAME ACTIVATION LEVELS IN DIFFERENT POSITIONS AND WITH REDUCED FEEDBACK

MAINTAINED ACTIVATION DISSOCIATED OF NORMAL BREATHING

MAINTAINED ACTIVATION WITHOUT BIG EFFORT REQUIRED

LOWER PERFORMANCE VARIABILITY

LONGEST PHASE OF MOTOR LEARNING



AUTONOMOUS STAGE

MAINTAINED ACTIVATION IN DIFFERENT DAILY LIFE ACTIVITIES, WITH REDUCED FEEDBACK AND PROGRESSIVELY WITHOUT FEEDBACK

GREATER FOCUS ON FUNCTIONAL TASKS

REDUCED LEVELS OF ATTENTION AND EFFORT REQUIRED

GOAL IS TO ACHIEVE AUTONOMOUS MOVEMENTS AND EASE IN PERFORMING TASKS

LOWER FREQUENCY OF TREATMENT SESSIONS

¹ Fitts & Posner, cit. by Wulf, 2007

² Santos e Matias, 2007

KNEE TREATMENT PLAN SAMPLES ¹

PATELLOFEMORAL PAIN SYNDROME

COGNITIVE	ASSOCIATIVE	AUTONOMOUS
1-2	4-6	2-4
1-4	4-12	2-4

APPLICATIONS: EVALUATION, GENERIC, DYNAMIC STABILITY KNEE

WEEKS

SESSIONS

PHASES ²

I	II	III	IV	V
1	2	3	6	3
DAILY	DAILY	3	3	1-2

APPLICATIONS: ACL, POST-OP

EVALUATION

APPLICATION: 8 CHANNELS TO EVALUATE AND COMPARE THE MAIN SUPERFICIAL MUSCLES IN BOTH KNEES

ACL

APPLICATION: DESIGNED TO ASSESS AND EXERCISE QUADRICEPS AND HAMSTRINGS WITH AN ADEQUATE RATIO

POST-OPERATIVE RECOVERY

ONE CHANNEL APPLICATION: INDICATED WHEN THE AIM IS TO FOCUS IN A SINGLE MUSCLE ACTION

DYNAMIC STABILITY PATELLOFEMORAL

VERY INTUITIVE GRAPHICS WITH A BALANCE BAR TO PROMOTE SIMILAR ACTIVATION BETWEEN VMO AND VL INDICATED TO USE ON A MORE ADVANCED STAGE

DYNAMIC STABILITY GENERIC

USEFUL FOR THE INITIAL STAGE OF TREATMENT, TO GIVE AWARENESS OF THE STABILIZER MUSCLES ACTIVATION

¹ Clinical Reasoning
² Almeida, 2005

MOTOR RELEARNING PROGRESSION OBJECTIVES¹

COGNITIVE STAGE

RESTORING THE CONTRACTION LEVELS OF THE VMO IN ORDER TO INCREASE THE VMO/VL RATIO (1:1)² AND ALSO ONSETS OF BOTH MUSCLES OCCURRING SIMULTANEOUSLY^{3 4 5}.

A 5ms⁵ DELAY IN VMO ACTIVATION IS ASSOCIATED WITH A SIGNIFICANT INCREASE IN LATERAL PATELLOFEMORAL JOINT LOADING⁴.

STABILIZERS (VMO AND VL) SHOULD PRE ACTIVATE THE MAIN MOBILIZER (RECTUS FEMORIS).

ACTIVATION FIRST WITH FEEDBACK AND WHEN WELL EXECUTED, WITHOUT FEEDBACK

1 Fitts & Posner, Cit. By Wulf, 2007
 2 Souza & Gross, 1991 Cit. By Ng, Zhang & Li, 2008
 3 Ng, Zhang & Li, 2008
 4 Cowan, Bennell, Hodges; Crossley & McConnell, 2003
 5 Kushion, Rheaume, Kopchitz, Glass, Alderink And Jinn, 2012

MOVEMENT ASSESSMENT			
		ACT. TIMING	MVC
stabilizers	vastus medialis	1	-0.15 ms 0.40 v
	vastus lateralis	2	-0.15 ms 0.40 v
mobilizer	rectus femoris	3	0.0 ms 0.45 v

BOTH STABILIZER MUSCLES SHOULD PRE-ACTIVATE THE MOVEMENT AND SHOULD ALSO ACTIVATE SIMULTANEOUSLY WITH A BALANCED LEVEL OF ELECTRIC ACTIVITY

ASSOCIATIVE STAGE

MAINTAINING THE SAME LEVELS OF CONTRACTION IN DIFFERENT POSITIONS AND WITH LOW FEEDBACK

(JUST WATCHING THE GRAPHICS IN CASE OF GREAT NEED)

AUTONOMOUS STAGE

MAINTAINING CONTRACTION IN DIFFERENT DAILY ACTIVITIES, WITH GOOD CONTROL ACROSS THE MOVEMENT

THE GOAL IS TO DECREASE FEEDBACK LEVELS UNTIL NO FEEDBACK IS NEEDED



ASSESS E.1

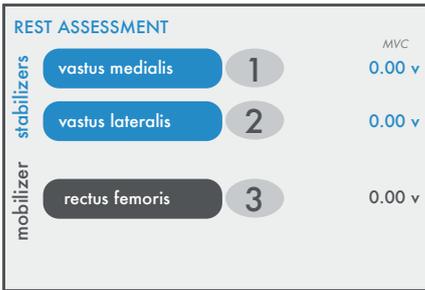
ACTIVATION TIMINGS

		ACT. TIMING	MVC
stabilizers	vastus medialis	1	10.0 ms 0.25 v
	vastus lateralis	2	-5.0 ms 0.40 v
mobilizer	rectus femoris	3	0.0 ms 0.45 v

USUALLY PATIENS HAVE AN OVER ACTIVATION OF VASTUS LATERALIS COMPARING TO VASTUS MEDIALIS AND ALSO A LATE ACTIVATION OF VASTUS MEDIALIS

COMMON PATIENT ISSUES

(representative values)



MUSCLES AT REST SHOULD HAVE A RESIDUAL ACTIVATION OR NON ACTIVATION

MOTOR RELEARNING PROGRESSION EXERCISES ¹

(suggestions)

COGNITIVE STAGE

SHOULD REPEATEDLY PERFORM THE EXERCISE FOR 10s x 10s¹, APPLYING THE SAME STIMULUS FOR NO LONGER THAN 5 MINUTES

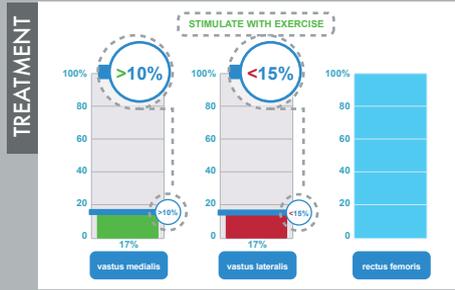
AS THE ANTEICIPATORY OR FEEDFORWARD POSTURAL RESPONSES OCCUR IN ADVANCE OF A MOVEMENT, THEY MUST BE PREPLANNED BY THE CENTRAL NERVOUS SYSTEM

A STRATEGY TO RETRAIN NORMAL COORDINATION INVOLVES VOLUNTARY ACTIVATION OF THE SPECIFIC MUSCLES THAT ARE AFFECTED BY PAIN, DURING FUNCTIONAL MOVEMENTS²

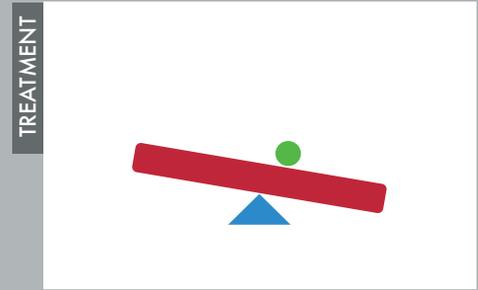
¹ Santos e Matias, 2007

² Cowan, Bennel, Hodges; Crossley & MacConnell, 2003

³ Kusion, Rheume, Kopchitz, Glass, Alderink And Jinn, 2012



USUALLY PATIENTS HAVE VASTUS MEDIALIS LOW ACTIVITY UNBALANCED WITH VASTUS LATERALIS



USUALLY PATIENTS HAVE VASTUS MEDIALIS WITH VERY LOW LEVELS OF ELECTRICAL ACTIVITY, WHICH MEANS IS NOT VERY ACTIVE COMPARING WITH VASTUS LATERALIS

RECOMMENDED EXERCISES

- gentle isometric contractions focused on VMO in sitting position, with knee flexed in various ranges between 0 and 90°; in the same position, push the ground without movement of the feet; foot in external rotation, without leaning back in the chair, push the ground again (cognitive stage);
- as a progression, we move to standing position: gait simulation, with symptomatic side stepping forward, with progressive higher load and repeat this movement; squats 2 legs first and only one after (associative stage);
- move to increased knee flexion activities, as climb and descend stairs, with increased higher stairs; daily functional activities; running (autonomous stage).

ASSOCIATIVE STAGE

ADD MOVEMENT TO THE TRAINING PLAN, STARTING WITH SMALL RANGES OF ANALYTICAL MOVEMENTS

START PROGRESSIVELY TO ADD RESISTANCE TO THE MOVEMENT, USING AN ELASTIC RUBBER

AUTONOMOUS STAGE

CHECK IF THE PATIENT IS ABLE TO PERFORM MULTIPLE TASKS WITH CONTROL OF THE STABILIZERS IN DIFFERENT POSITIONS & SPEED OF MOVEMENT

ADD FUNCTIONAL MOVEMENTS AND TRAIN THEM IN DIFFERENT WAYS

ACL POST-OP RECOVERY PHASES ^{1 2}

THE FOLLOWING PROTOCOL WAS DEFINED ACCORDING TO THE PHYSIOLOGICAL RECOVERY PHASES OF THE LIGAMENT. HOWEVER, IS POSSIBLE TO CO-RELATE THESE STAGES WITH THE MOTOR RELEARNING STAGES, DEFINED BY FITTS & POSNER, USED IN ALL THE OTHER TEMPLATES.

WE START THE INTERVENTION BY GIVING AWARENESS OF THE ACTIVITY OF THE VMO AND AWARENESS OF THE HAMSTRING, TRAINING THESE ACTIVATIONS IN SEPARATE (COGNITIVE STAGE). AFTER THIS WE LOOK FOR A CO-ACTIVATION OF QUADS AND HAMS (ASSOCIATIVE STAGE).

IN THE END OF THE INTERVENTION, WE LOOK FOR A FUNCTIONAL RESPONSE, BY PERFORMING DAILY TASKS (AUTONOMOUS STAGE).

PHASE I POST-OP 1ST WEEK

GOALS

- CONTROL EDEMA AND PAIN
- ACHIEVE A GOOD MOBILITY OF PATELLOFEMORAL JOINT
- KNEE FLEXION BETWEEN 75° & 90° AND A GOOD NEURO MOTOR CONTROL OF THE QUADRICEPS
- PRIORITY IS TO ACHIEVE FULL EXTENSION OF THE KNEE

ACTIONS DAY 0-5

- ICE THERAPY
- MOBILIZATION OF PATELLOFEMORAL JOINT
- GAIT WITH 2 CRUTCHES
- FLEXION TO AT LEAST 90° WHILE SITTING FOR MEALS
- REST WITH LIMB ELEVATION, CHANGING FROM ICE THERAPY TO CONTINUOUS PASSIVE MOTION (CPM) FROM 0-90°, TILL HOSPITAL DISCHARGE
- SHORT-ARC QUADRICEPS MUSCLE EXERCISES WITH A ROLL UNDER THE KNEE - BIOFEEDBACK MONITORIZATION OF THE VMO, TO GIVE AWARENESS ABOUT IT'S ACTIVATION - USE POSTOPERATIVE RECOVERY APP/ BIOFEEDBACK GENERIC APP/ ACL APP (FOCUS ON THE QUADRICEPS)

PHASE II BETWEEN 2ND & 3RD WEEK

GOALS

- CONTROL EDEMA AND PASSIVE RANGE OF MOTION OF EXTENSION/FLEXION (0-100/115°) AND ACTIVE (0-90°)
- GAIT WITH PARTIAL LOAD > 50% OF THE BODY WEIGHT, WITH SUPPORT OF ONE CRUTCH AND NO SUPPORT IN THE END OF THE PHASE
- MUSCULAR STRENGTH OF IN MAXIMUM 60% DEFICIT IN THE QUADRICEPS AND 35% IN THE HAMSTRINGS WHEN COMPARING WITH THE HEALTHY LIMB
- PROPRIOCEPTION IMPROVEMENT

ACTIONS

- REPETITION OF THE PREVIOUS PROCEDURES
- SPECIFIC TECHNIQUES FOR RANGE OF MOTION IMPROVEMENT
- TRAINING WITH SCALES TO VERIFY % OF LOAD
- MUSCULAR STRENGTHENING WITH ISOMETRIC CONTRACTIONS OF QUADRICEPS AND HAMSTRINGS AT 0, 30, 60 AND 90°, FLOWED BY MANUAL RESISTENCE, INSISTING IN CO-CONTRACTIONS BETWEEN Q/H, TAKING IN ACCOUNT THE ACTIVE ARCH OF MOVEMENT FROM FLEXION TO EXTENSION BETWEEN 100-45° TO AVOID TENSION ON THE PLASTY - BIOFEEDBACK TRAINING OF Q AND H IN SEPARATE AND WITH CO-CONTRACTION - USE ACL APP, WORKING Q AND H ISOLATED AND THEN BOTH AT THE SAME TIME

PHASE III BETWEEN 4TH & 6TH WEEK

GOALS

- CONTROL EDEMA & PASSIVE RANGE OF MOTION OF EXTENSION/FLEXION (0-120/135°) & ACTIVE (0-120°)
- MUSCULAR STRENGTH OF IN MAXIMUM 40% DEFICIT IN THE QUADRICEPS AND 20% IN THE HAMSTRINGS WHEN COMPARING WITH THE HEALTHY LIMB
- PROPRIOCEPTION AND DYNAMIC STABILITY IMPROVEMENT
- AVOID STRESS IN THE PLASTY
- GAIT WITH 100% OF LOAD & WITH NO COMPENSATIONS

ACTIONS

- IN THE END OF THIS PHASE THE NEO-LIGAMENT IS IN THE END OF THE NECROSIS PERIOD, AND SO, ALL THE ACTIONS SHOULD BE INTRODUCED ACCORDING TO THE INFLAMMATORY ANSWER.
- REPETITION OF THE NEEDED PREVIOUS PROCEDURES
 - BIPODAL STABILIZATION TRAINING, BALANCE AND GAIT - BIOFEEDBACK MONITORIZATION OF Q AND H DURING THE TASKS, RECRUITING DIFFERENTLY THE GROUPS ACCORDING TO THE AMPLITUDE OF MOVEMENT - USE ACL APP
 - STEP-UPS AND MINI-SQUATS - BIOFEEDBACK MONITORIZATION OF Q AND H DURING THE TASKS, RECRUITING DIFFERENTLY THE GROUPS ACCORDING TO THE AMPLITUDE OF MOVEMENT - USE ACL APP

-HEEL DROPS, WITH A TOWEL ROLL IN THE AQUILES TENDON REGION AND THE PATIENT IN SUPINE; GOAL IS TO PRESS THE TOWEL IN ORDER TO MOVE THE KNEE AWAY FROM THE GURNEY, TRAINING HAMSTRING MUSCLES AND EXTENSION AMPLITUDE - USE BIOFEEDBACK GENERIC APP/ ACL APP (FOCUS ON THE HAMSTRINGS)

- PRONE HANG, WITH THE MID PART OF THE THIGH SUPPORTED ON THE END OF THE GURNEY (AVOIDING KNEE CONTACT WITH THE GURNEY), WORKING EXTENSION BY GRAVITY ACTION AND FROM THIS POSITION, RECRUIT HAMSTRINGS BY BENDING AND EXTENDING THE KNEE - USE BIOFEEDBACK GENERIC APP OR ACL APP (FOCUS ON THE HAMSTRINGS)

DAY 5-8

- MOBILIZATION OF PATELLOFEMORAL JOINT

- ANKLE FLEXION/EXTENSION WITH ELEVATION

- PASSIVE MOBILIZATION IN OPEN KINETIC CHAIN

- GAIT WITH NO LOAD, BUT WITH SUPPORT - TRAIN WITH 2 WALKING AIDS (BIOFEEDBACK MONITORIZATION OF THE VMO, TO START TO GIVE AWARENESS ABOUT IT'S ACTIVATION)

- PROPRIOCEPTION TRAINING IN CLOSED KINETIC CHAIN WITH A BALL ON THE WALL - (BIOFEEDBACK MONITORIZATION OF THE VMO, TO GIVE AWARENESS ABOUT IT'S ACTIVATION) - USE POSTOPERATIVE RECOVERY APP/ BIOFEEDBACK GENERIC APP/ ACL APP (FOCUS ON QUADRICEPS)

- CO-CONTRACTIONS OF QUADRICEPS AND HAMSTRINGS, SEATED, WITH THE LIMB SUPPORTED - BIOFEEDBACK MONITORIZATION OF BOTH MUSCULAR GROUPS TO WORK ON A GOOD RATIO OF ACTIVATION) - USE ACL APP

- ELECTROSTIMULATION ALTERNATE WITH BIOFEEDBACK EXERCISES

- ELECTROSTIMULATION OF THE QUADRICEPS
- STRETCHING OF THE HAMSTRINGS
- PROPRIOCEPTION TRAINING WITH BALANCE PLATFORMS IN THE END OF THIS PHASE WHEN PAIN IS CONTROLLED - BIOFEEDBACK MONITORIZATION OF BOTH GROUPS TO ENSURE A CORRECT PARTICIPATION DURING THE EXERCISE - USE ACL APP TO CONTROL RATION BETWEEN Q/H
- GAIT TRAINING TO LEAVE CRUTCHES

PHASE IV BETWEEN 7TH & 12TH WEEK

GOALS

- ACHIVE RANGE OF MOTION EXTENSION/FEXION 0-130/135°, WITH END-FEEL CLOSE OH THE CONTRALATERAL KNEE
- MUSCULAR STRENGTH OF IN MAXIMUM 35% DEFICIT IN THE QUADRICEPS AND 15% IN THE HAMSTRINGS WHEN COMPARING WITH THE HEALTHY LIMB AND ACHIEVE A GOOD STABILITY AND PROPRIOCEPTION.

ACTIONS

- REPETITION OF THE NEEDED PREVIOUS PROCEDURES
- MUSCULAR STRENGTHENING BY PERFORMING EXERCISES AS SQUATS, LUNGES, LEG PRESS, GAIT TRAINING WITH ELASTIC RUBBER, SINGLE LIMB DEAD LIFT - BIOFEEDBACK MONITORIZATION OF Q AND H DURING THE TASKS, RECRUITING DIFFERENTLY THE GROUPS ACCORDING TO THE AMPLITUDE OF MOVEMENT - USE ACL APP
- FLEXIBILITY/ STRETCHING
- TREADMILL RUNNING AT 10TH WEEK - BIOFEEDBACK MONITORIZATION PAYING SPECIAL ATTENTION TO THE LANDING PHASE- USE ACL APP
- TRAINING OF UNIPODAL STABILIZATION - BIOFEEDBACK TRAINING OF Q AND H CO-CONTRACTION - USE ACL APP
- PLYOMETRIC EXERCISES (LATERAL, FORWARD, BACKWARD HOPS OVER CONE; SINGLE LEG HOPS OVER CONE; VERTICAL JUMPS; SCISSORS JUMPS) - BIOFEEDBACK MONITORIZATION OF Q AND H CO-CONTRACTION WITH SPECIAL ATTENTION TO LANDING PHASE - USE ACL APP

- BI-CYCLING

- EXERCISES IN CLOSED KINETIC CHAIN WITH TOTAL LOAD TO POTENTIATE Q AND H (LEG PRESSES AND SQUATS) - BIOFEEDBACK MONITORIZATION OF Q AND H DURING THE TASKS, RECRUITING DIFFERENTLY THE GROUPS ACCORDING TO THE AMPLITUDE OF MOVEMENT - USE ACL APP
- EXTENSION/FLEXION ALMOST TOTAL RANGES OF MOTION (0-135°) AND TOTAL LOAD OF THE LIMB.

PHASE V BETWEEN 13TH & 15TH WEEK

GOALS

- MUSCULAR STRENGTH OF IN MAXIMUM 30% DEFICIT IN THE QUADRICEPS AND 10% IN THE HAMSTRINGS WHEN COMPARING WITH THE HEALTHY LIMB AND PROPRIOCEPTION CLOSE TO NORMAL
- IN THE FINAL OF THIS PHASE IS POSSIBLE TO START SPORTS, WITHOUT CONTACT, IF ALL GOALS WERE ACHIEVED

ACTIONS

- REPETITION OF THE NEEDED PREVIOUS PROCEDURES
- READAPTATION TO THE SPECIFIC SPORT GESTURE - IN THIS PHASE IS VERY IMPORTANT TO MAKE SURE ALL THE PREVIOUS MOTOR LEARNINGS ARE CONSISTENT AND ALLOW A CORRECT PERFORMANCE IN THE SPORT GESTURE OR ANY OTHER FUNCTIONAL ACTIVITY - USE ACL APP
- SPORT ACTIVITY WITHOUT CONTACT

AT HIS TIME THE INTERVENTION PROGRAM IS OVER, SINCE THE PATIENT HAS A FUNCTIONAL LIMB, ACCORDING TO THE HEALTHY SIDE.

CAN START GYM EXERCISES AND SPORT ACTIVITY WITH NO CONTACT, SHOULD RETURN EVERY MONTH TILL 6 MONTH OF SURGERY.

¹ Shelbourne & Gray, 1997
² Almeida, 2005

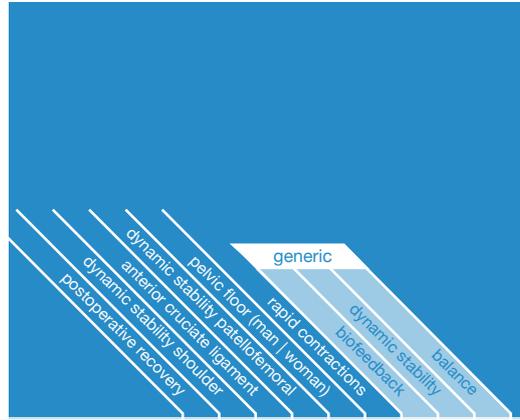
CONTRAINDICATIONS

PLACEMENT OF THE SURFACES ON DAMAGED SKIN (OPEN WOUND OR BURN).

Note: Biofeedback is less effective in teaching motor control with those with cognitive impairment. The therapist should decide if the level of impairment makes it a useful tool for treatment. Anyway, physioplux can remain useful for assessment in this cases.

APPLICATIONS

MOST FREQUENTLY USED



	generic	pelvic floor (man / woman)	rapid contractions	dynamic stability	biofeedback	balance
shoulder pain	•	•				•
work-related neck pain	•					•
chronic pain	•				•	•
repetitive strain injury		•	•	•		•
fibromyalgia						•
arthritis		•	•			•
urinary incontinence				•	•	
fecal incontinence				•	•	
stroke	•	•	•		•	•
subacromial impingement syndrome		•				•
glenohumeral instability		•				•
low back pain	•					•
headache						•
patellofemoral pain syndrome	•		•			•
levator ani syndrome				•		
ACL ligamentoplasty			•			•

¹ Santos e Matias, 2007

² Clinical Reasoning

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