FEEDBACK IN PHYSICAL REHABILITATION

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INTRODUCTION

MOTOR LEARNING

BIOFEEDBACK

CLINICAL APPLICATIONS
Motor learning

MOTOR LEARNING IN REHABILITATION
DISABILITY

NEUROMUSCULAR / MUSCULOSKELETAL INJURIES

SENSORIMOTOR IMPAIRMENTS

DISABILITIES
DISABILITY

BODY FUNCTION

FUNCTIONAL ACTIVITIES

SOCIAL PARTICIPATION
APPROACHES

FUNCTIONAL PRACTICE

IMPAIRED IMPROVEMENT
APPROACHES

IMPAIRMENT
PRACTICE

FUNCTIONAL IMPROVEMENT
CLINICAL REASONING

Motor learning

- DIAGNOSIS
- PHASE
- MOVEMENT ABILITY
BRAIN PLASTICITY

BRAIN'S ABILITY TO CHANGE PHYSICALLY, CHEMICALLY AND FUNCTIONALLY THROUGHOUT LIFE.
MOVEMENT INSTRUCTIONS

MOTOR CORTEX RECEIVES INSTRUCTION AND FEEDBACK INPUT FROM VISUAL AND AUDITORY CORTEX
MOTOR CORTEX

RESPONSIBLE TO PLAN, CONTROL AND EXECUTE VOLUNTARY MOVEMENTS
MOVEMENT INSTRUCTIONS

VISUAL INPUT IS RESPONSIBLE FOR SELF-OBJECTIVE UNDERSTANDING OF MOVEMENT
MOVEMENT INSTRUCTIONS

AUDITORY INPUT IS RESPONSIBLE FOR SELF SUBJECTIVE UNDERSTANDING OF MOVEMENT
MOVEMENT INSTRUCTIONS

OPTIMAL VOLUNTARY MOVEMENTS ARE EXECUTED BY **OBJECTIVE AND SUBJECTIVE INPUTS**

Motor learning
SPATIAL ORIENTATION

VISUAL SYSTEM

VESTIBULAR SYSTEM

PERIPHERAL SENSATION

PERIPHERAL MECHANOCEPTORS
PERIPHERAL MECHANOCEPTORS

MUSCLE SPINDLE

TENDON GOLGI

LIGAMENT ARTICULAR RECEPTORS

SKIN RECEPTORS
PERIPHERAL SENSATION

DEEP SENSATION
- PROPERIOCEPTION - JOINT POSITION INFORMATION
- KINESTHESIA - JOINT MOVEMENT INFORMATION
- JOINT RESISTANCE - FORCE GENERATED WITHIN A JOINT

CUTANEOUS SENSATION
- TEMPERATURE
- PAIN
- PRESSURE
SPATIAL ORIENTATION HELPS TO MAXIMIZE BODY FUNCTION
PERIPHERAL SENSATION

PROPrioception
joint position
information

KineSThesia
joint movement
information

Motor learning
PERIPHERAL SENSATION HELPS TO MINIMIZE BODY DAMAGE

Motor learning
POSITIVE BRAIN REORGANIZATION

OPTIMAL BRAIN ORGANIZATION MOVEMENT USING AMPLIFICATION OF WEAK AND REDUCTION OF DOMINANT INPUT
REHABILITATION METHODS

IOT – Impairment Oriented Training

- OPEN KINETIC CHAIN
- HIGH RESOLUTION
- OBJECTIVE EVALUATION

TOT – Task Oriented Training

- CLOSED KINETIC CHAIN
- HIGH COORDINATION
- SUBJECTIVE EVALUATION
Motor learning

PRACTICE TYPE

BLOCKED
A SERIES OF IDENTICAL PRACTICE

RANDOM
A SERIES OF DIFFERENT PRACTICE

DISTRIBUTED
MORE REST TIME THAN PRACTICE TIME

MASSED
MORE PRACTICE TIME THAN REST TIME
PRACTICE METHOD

LOCAL DEEP SENSATION
- KINESTHESIA
- PROPRIORECEPTION
- JOINT RESISTANCE

LOW MUSCLE STRENGTH
- LIMITED MUSCLE RECRUITMENT
- LOW BALANCE ABILITY

NO GROUND REACTION FORCE
PRACTICE METHOD

MULTI DEEP SENSATION
KINESTHESIA
PROPRIOCEPTION
JOINT RESISTANCE

HIGH MUSCLE STRENGTH
MULTI MUSCLE RECRUITMENT
HIGH BALANCE ABILITY

WITH GROUND REACTION FORCE

CLOSED KINETIC CHAIN

Motor learning
PRACTICE METHOD

FOR MOBILITY
OPEN CHAIN SHOULD BE USED

FOR STABILITY
STATIC CLOSED CHAIN SHOULD BE USED

FOR CONTROLLED MOBILITY
DYNAMIC CLOSED CHAIN SHOULD BE USED
IMPAIRMENT FOCUS

SELECTIVE PRACTICE LEADS TO PREVENT COMPENSATORY MOVEMENT DEVELOPMENT
DIFFICULTY LEVEL CUSTOMIZATION

TASK DIFFICULTY LEVEL CUSTOMIZED TO PATIENT PHYSICAL ABILITY
INTENSIVE PRACTICE

INTENSIVE REPETITION OF CUSTOMIZED TASK ARE REQUIRED FOR MOTOR LEANING AND PHYSICAL REHABILITATION
REACTION TIME

TIME PREDICTION AND TASK INSTRUCTION AFFECT ON REACTION TIME

Motor learning
KNOWLEDGE OF RESULT (KR)

DEFINITION
KR IS THE INFORMATION ABOUT THE PERFORMANCE OUTCOME

DESCRIPTION
FEEDBACK WITH LESS SENSORIMOTOR INVOLVEMENT IN THE CORRECT MOVEMENT PERFORMANCE
KNOWLEDGE OF RESULT (KR)

ADVANTAGES

KR USED BY PATIENTS WITH BROAD SPECTRUM OF MOVEMENT ABILITIES

DISADVANTAGES

KR CAN CAUSE COMPENSATORY MOVEMENT DEVELOPMENT
KNOWLEDGE OF PERFORMANCE (KP)

DEFINITION

KP IS THE INFORMATION ABOUT THE QUALITY OF PERFORMANCE

DESCRIPTION

FEEDBACK WITH MORE SENSORIMOTOR INVOLVEMENT IN THE CORRECT MOVEMENT PERFORMANCE
KNOWLEDGE OF PERFORMANCE (KP)

ADVANTAGES

USED IN BROAD SPECTRUM OF MOVEMENT ABILITIES

PROVIDES CONTINUING AND TERMINAL FEEDBACK

PROVIDES PROFESSIONAL TRAINING

PREVENTS COMPENSATORY MOVEMENT DEVELOPMENT
FEEDBACK TYPES

INTERNAL
- PERIPHERAL SENSATION
- VISION
- AUDITION

EXTERNAL
- REAL
- AUGMENTED
FEEDBACK ACCURACY

PRECISE FEEDBACK COMPARED TO GENERAL ENCOURAGEMENT
FEEDBACK DOSAGE

FEEDBACK INTENSITY NEEDS TO INCREASE AS IMPAIRMENT SEVERITY INCREASES
TASK INTRINSIC FEEDBACK

PROVIDES VISION, AUDITION AND SENSATION INFORMATION
FEEDBACK SHOULD BE PROVIDED IN DEVIATION LIMIT
REAL TIME FEEDBACK

PROVIDES IMMEDIATE INFORMATION, SHORT TERM MEMORY NOT REQUIRED
TERMINAL FEEDBACK

DEFINITION

KR AND KP INFORMATION THAT IS PROVIDED AFTER MOVEMENT PERFORMANCE

TERMINAL KR

INFORMATION PROVIDED AFTER PERFORMANCE ON HOW TO IMPROVE MOVEMENT

TERMINAL KP

A COMBINATION OF INFORMATION AND INSTRUCTION PROVIDED AFTER PERFORMANCE ON HOW TO IMPROVE MOVEMENT
EXTERNAL FEEDBACK

EXTERNAL DEVICES PROVIDE INFORMATION DURING TASK PERFORMANCE

NON MEASURABLE DEVICES

AUGMENTED FEEDBACK

MEASURABLE DEVICES

REAL FEEDBACK
CHALLENGE EFFECT

CHALLENGING TASK

INCREASE MOTIVATION

REPETITIVE PERFORMANCE

BETTER OUTCOME

BEFORE CHALLENGE

AFTER CHALLENGE
MOTION FEEDBACK

LEADS TO SELF OBJECTIVE UNDERSTANDING OF PERFORMANCE

POSITIVE FEEDBACK

NEGATIVE FEEDBACK

PERFORMANCE CONTINUATION

PERFORMANCE CORRECTION
Clinical applications

1.
2.
3.
DETAILED JOINT/S MOVEMENT INSTRUCTIONS CAN BE CUSTOMIZED
TIME LINE FEEDBACK

CONCOMITANT FEEDBACK IS PROVIDED ON PAST AND PRESENT PERFORMANCE
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FADED FEEDBACK

DEVIAITON LIMIT CAN BE CUSTOMIZED
POSITIVE FEEDBACK

NO EXTRA AUDITORY / VISUAL FEEDBACK IS PROVIDED WHEN IN DEVIATION LIMIT
NEGATIVE FEEDBACK

**EXTRA** AUDITORY / VISUAL FEEDBACK IS PROVIDED WHEN OUT OF DEVIATION LIMIT
QUANTITATIVE FEEDBACK

QUANTITATIVE INFORMATION IS PROVIDED DURING AND AT THE END OF THE TASK

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QUALITATIVE FEEDBACK

QUALITATIVE INFORMATION IS PROVIDED DURING PERFORMANCE
INTENSIVE TASK

THE TASK CAN BE REPEATED FOR INTENSIVE PRACTICE
SUMMARY

- Intensive practice
- Motivation
- Functional practice
- Motor learning
- Repetitive practice
- Difficulty levels
- Real feedback

SUCCESSFUL FUNCTIONAL RECOVERY

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THANK YOU!

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