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ASSESSMENT OF STRENGTH GAIN USING MENTAL PRACTICE

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ABSTRACT

Purpose of study: Mental Practice is a known documented technique for learning/reacquiring new motor skills. There are very few studies done in India to show the efficacy of mental practice in rehabilitation. This study was attempted to see if mental practice causes change in the neural tissue responsible for controlling hip muscles. **Materials:** Mentamove machine, weight cuffs to measure 1RM, stopwatch to denote unilateral stance time, book and a pen. **Outcome measures:** Unilateral stance test and 1RM of hip muscles were the outcome measures used in the assessment.

Methodology: type of study – experimental type. Unilateral stance test of the dominant leg (left) and 1RM of left hip abductors and extensors of the healthy individual were recorded. Mentamove electrodes were placed on the skin over left hip extensors and abductors. 9 contractions were recorded in each mental practice session. 21 sessions of mental practice were given and a change in 1RM and unilateral stance time was noted. **Results:** On observational analysis it was seen that there was a significant gain in the unilateral stance time and also a change was noted in 1RM of left hip abductors and hip extensors, pre and post mental practice sessions. **Conclusion:** From our study it was concluded that the concept of mental practice lead to an increase in 1RM of hip extensors and hip abductors.

Key words: Mental Practice, Mentamove, one leg stance test, 1RM, strength.

INTRODUCTION

“Motor imagery is the imagining of an action without its physical execution; it is an active process during which the representation of an action is internally reproduced within working memory without any overt output”¹. Mental Imagery combined with physical practice has been effectively used to promote the learning of motor skills in athletes and to preserve skill when physical practice is not possible^{2,3}.

“Mental Practice involves the cognitive rehearsal of a task without overt physical movement”⁴.

“Mental practice or motor imagery practice is the repetition or rehearsing of imagined motor acts with the intention of improving their physical execution”⁵. Rehearsing a simple physical action

in the mind may assist in focusing attention on the action to be performed⁶.

Plasticity is a general term describing the ability to show modification. Plasticity or neural modifiability may be seen as a continuum from short-term changes in the efficiency or strength of synaptic connections, to long-term structural changes in the organization and number of connections among neurons.

The term “plasticity” refers to the capacity of the CNS to adapt to functional demands and therefore to the system’s capacity to reorganize.

The mechanisms underlying recovery from brain damage in human are known to be complex and multi-factorial, including functional and anatomical reorganization, altered neurotransmission and metabolism.

Results suggest that specific training to induce motor learning can shape subsequent reorganization in the undamaged motor cortex and that this may play an important part in functional recovery⁷.

Learning new motor skills with an intact Central Nervous System (CNS) and regaining skill after a lesion of the CNS are similar in many aspects. At the motor performance level, the biomechanical changes in the regaining of skill after stroke are similar to those that occur when non-lesioned individuals are learning a new skill. A study⁸ summarizes the empirical evidence underpinning current understanding of the neuroplasticity that can modulate functional recovery:

- Neural organization and motor skills are optimized when the focus is on tasks that are engaging, challenging and meaningful.
- Many repetitions are required for an individual to become skilled in a complex motor task.
- Repetition of movements that are too easy or of a non-meaningful task is insufficient to produce long-term neural reorganization.

Learning is defined as the acquisition of knowledge permanently; memory is the outcome of learning, including the retention and storage of that knowledge or ability⁹.

Mentally practicing a task therefore results in learning the task along with the storage of that task in the memory. Practicing the task eventually enhances the performance indicating changes occurring at the cellular level.

Unilateral stance is one leg stance i.e. balancing on one leg. This not only requires a good balance but also a good strength of hip abductor muscles to maintain the pelvis in level, also the reliability and validity of this test has been proved in the previous studies^{10,11}. Unilateral standing requires recruitment of hip abductors to oppose the hip adductor moment that gravity produces to prevent pelvic drop on the opposite side. Also standing requires the work of hip extensors which are antigravity muscles.

“One Repetition Maximum (1RM) is the maximum amount of weight one can lift in a single repetition in an exercise. It can also be used as an upper-limit, in order to determine the desired load for an exercise”. The reliability and validity of 1RM has also been proved by studies¹². 1RM of left side Hip abductors and Hip extensors was measured in the standing position.

This study was attempted to see if mental practice results in a change in the neural tissue responsible for controlling hip muscles. Since Mentamove works on the principle of mental practice, it was used to deliver stimulation.

HYPOTHESIS

Null Hypothesis: There is no gain in strength for hip abductors and hip extensors using mental practice.

Experimental Hypothesis: There is gain in strength for hip abductors and hip extensors using mental practice.

AIM

Efficacy of Mental Practice in strengthening Hip Extensors and Hip Abductors.

OBJECTIVE

To assess strength gain for Hip Abductors and Hip Extensors pre and post training using the concept of Mental Practice.

REVIEW OF LITERATURE

1. A research done on 16 healthy, non-athlete men of 22 years of age concluded that mental practice can increase the strength of elbow flexor muscles^{13, 14, 15}.
2. A study conducted on thirty male university athletes of different professions for mental training of hip flexor muscles concluded that their physical strength was increased by 24% through mental practice^{16, 17, 18}.
3. A study done on 320 male and female squash players indicated that there was a significant difference between male and female squash

players in internal and external imagery ability in improving the performance of athletes as well as mean internal and external imagery scores, suggesting that male athletes had higher internal and external imagery ability^{19, 20}.

MATERIALS AND METHODOLOGY

Ethical clearance was obtained from the ethical committee of D.E.Society’s Brijlal Jindal College of Physiotherapy, Pune. One healthy individual was selected for the study as the project was a Case Study. The individual was informed about the project and a written consent was obtained.

STUDY TYPE

Experimental Prospective Type.

Inclusion Criteria

Healthy individual.

Exclusion Criteria

Person with

1. Any systemic Illness at the time of training,
2. Poor concentration and cognitive deficits,

3. A known Neurological and Musculoskeletal disorder and
4. Normal individual training in a gym.

Materials used: Mentamove machine, weight cuffs to measure 1RM, stopwatch to denote the time the person takes for performing unilateral stance test, book and a pen.

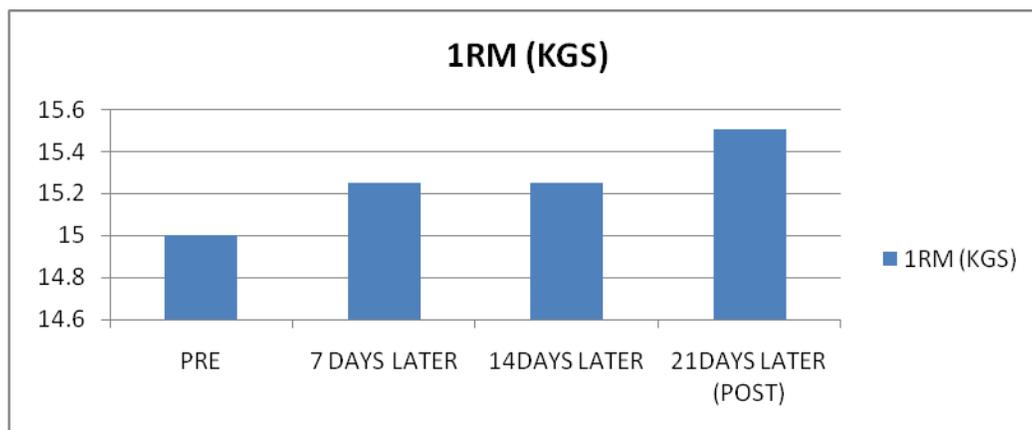
Methodology: Before the commencement of Mental Practice, unilateral stance test and 1RM of the dominant leg (left) were recorded.

Mentamove machine is a hi-tech German technology based therapy for relearning voluntary movements. It is based on the principles of Neuroplasticity and Mental Practice of motor skills. As per the norms of the manual provided with the machine, subject was positioned in a comfortable and supported position and electrodes for myostimulation were placed on the skin over the left hip abductors and extensors. The subject was asked to perform strong mental concentration of hip abduction and extension without its physical execution and isometric contraction; the movement was carried out mentally. The subject practiced mentally.

RESULTS

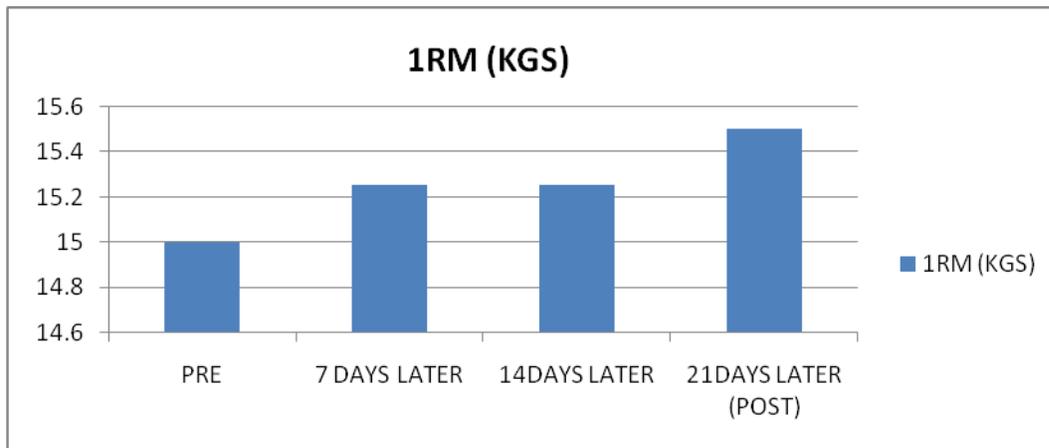
GRAPHS

I. Graph indicating changes in Left Hip Abductor RM:



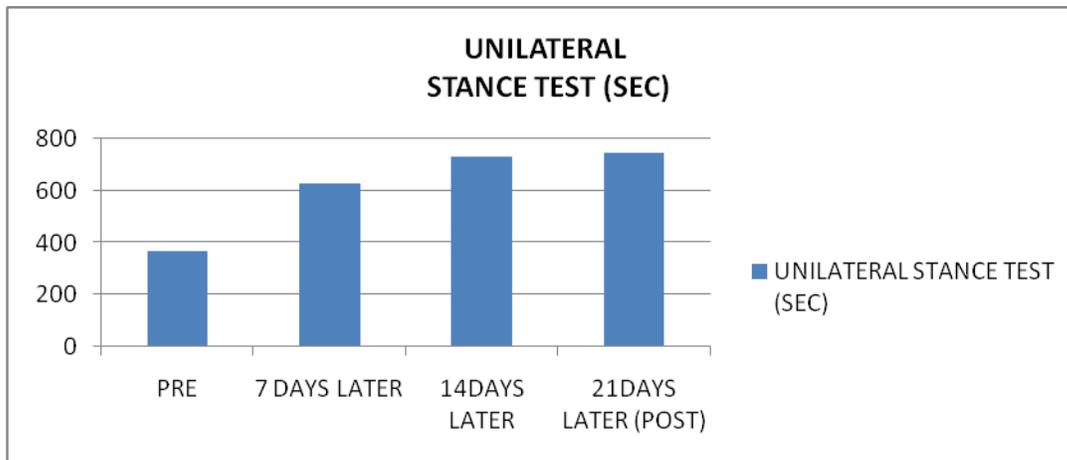
In the above graph, a gain of 0.5kg is seen in 1RM of hip abductors post mental practice, as compared to the pre mental practice value.

II. Graph indicating changes in Left Hip Extensor RM



In the above graph, a gain of 0.5kg is seen in 1RM of hip extensors post mental practice, as compared to the pre mental practice value.

III. Graph indicating changes in the Unilateral Stance Time of the left leg of the individual



A gain of 6min14sec (374sec) in the unilateral stance time is seen in the above graph.

DISCUSSION

Whenever a person mentally practices a movement, appropriate motor connections and the corresponding areas of the motor cortex responsible for that movement are activated⁴. Repeated mental practice of the movement results in learning and the same plastic changes in

the motor system as those occurring with repetitive physical practice²¹. Repetition also enables in making the movement smoother and coordinated thereby reflecting the changes occurring at the neural level.

In this study the subject was asked to imagine movements involving the use of left lower

extremity (more precisely use of the left hip extensors and abductors). With repeated mental practice, changes are seen at the neural tissue level as proved by previous studies^{13, 14,15,16,17,18,19,20}. In this study, these changes are reflected by the gain seen in the unilateral stance test of the dominant leg and 1RM of hip abductors and extensors of left lower extremity.

CONCLUSION

The concept of Mental Practice effectively increased the strength of hip muscles as proved by the increase in the unilateral stance test and 1RM of the respective muscles of the dominant leg (left) before and after the test. Thus, null hypothesis is rejected.

CLINICAL IMPLICATION

Mental practice can be effectively used in patients with neurological damage for increasing muscle strength. We can simply ask the patient to mentally imagine the movement causing mental practice.

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