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Efficacy of Physical and Mental Practice in Improving Strength of Biceps Brachi in Youngadults

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Abstract:

Background: This study aimed to investigate the efficacy of physical and mental practice in enhancing the strength of the biceps brachii muscle in young adults.

Given the growing interest in mental training techniques in sports and rehabilitation, understanding their impact on muscular strength could provide valuable insights into optimizing training protocols.

Methods: 60 subjects were assessed and then included in the study with a sample of young adults (age range: 19-26years) divided into three groups. physical practice, mental practice, combined mental and physical practice group. In the physical practice group, the subjects were given verbal instruction to flex the elbow as hard as they can press for a seconds of isometric contraction and was always performed on strain gauge. The mental practice group engaged in mental imagery sessions focusing on visualizing and mentally rehearsing biceps brachii contractions. Combined physical and mental practice group- this practice group were imagined and performed the maximal isometric contraction.

Results: After the intervention period, combined of physical and mental practice group showed significant improvements in biceps brachii strength more than either physical or mental practice when worked alone.

Conclusion: The current study said that the combined of mental practice and physical practice is effective in increasing the biceps brachii strength in subjects without impairments. The elbow muscle were chosen because they are a clinically significant muscle group in activities of daily living. The next step then is to examine the role of mental practice in strength improvements in patients with neuromuscular or musculoskeletal pathological involvement.

CHAPTER-1 INTRODUCTION

INTRODUCTION

Treatment plans developed for a wide variety of orthopedic and neurological diagnoses frequently include the goal of increasing the strength (force production) of specific muscles or muscle groups. Techniques used by physical therapists to improve muscle strength frequently include resistance exercises with weights, elastic bands, and isotonic and isokinetic machines and the use of neuromuscular electrical stimulation. In all of these techniques, the patient is required to contract the muscles being trained. With some orthopedic and neurological lesions, however, muscle contraction may cause pain or may not even be possible. Neurophysiological research[1,2] has suggested that, through the use of mental practice, it may be possible to improve muscle strength without actually requiring significant muscle contraction.

Mental practice is the cognitive rehearsal of a task in the absence of movement.[3] numerous studies[3-9] have shown mental practice to be an effective training technique for enhancing the performance of motor skills when used in combination with physical practice and even when used in isolation. Although research examining the efficacy of mental practice for motor skill acquisition is common, the effect of mental practice on muscle strength has received much less attention. Notably, 2 studies[1, 2] have examined the ability of mental practice to improve the strength of an isolated muscle in the hand, the abductor digitiminimi. This study will expand on the work by examining whether mental practice and physical practice can improve the strength of biceps brachi muscle, a clinically important muscle group necessary for activity of daily living.'°

The most supported explanation of why imagery improves motor learning psycho neuromuscular (PM) theory. Based on the precept that individuals have stored motor plans, or 'schema' for executing movements, [11-12] Psycho neuromuscular (PM) theory posits that the motor schema involved in the actual activity are reinforced during imagery. Specifically, since imagery involves the same motor schema as the actual movement[3-15] events during imagery aid performance by reinforcing the co-ordination patterns for the development of motor skills, and by providing the muscles with extra practice of the skill. [16] There is considerable evidence supporting PM theory, as studies have repeatedly shown that the same muscles, and regions of the motor cortex, basal ganglia and cerebellum, are activated when imagery is used as when the physical activities are actually performed.17-21.

Strength training may cause adaptive changes within the nervous system that allow a trainee to more fully activate prime movers in specific movements and to better coordinate the activation of all relevant muscles, thereby effecting a greater net force in the intended direction of movement.

Electromyographic studies have provided the most direct evidence. They have shown that increases in peak force and rate offeree development are associated with increased activation of prime mover muscles. Possible reflex adaptations related to high stretch loads in jumping and rapid reciprocal movements have also been revealed. Other Neural adaptation performance depends not only on the quantity and quality studies, including those that demonstrate the "cross-training" effect and specificity of training, provide further evidence of neural adaptation. The possible mechanisms of neural adaptation are discussed in relation to motor unit recruitment and firing patterns. The relative roles of neural and muscular adaptation in short- and long-term strength training are evaluated

50.

Patients with stroke learn or relearn competencies necessary to perform activities of daily living (ADL). Frequent practice of skills enhances motor learning and skill acquisition. [11- 12]Traditionally, the practice provided in neurologic rehabilitation has focused on reducing motor impairment and minimising physical disability. Intensive rehabilitation is expensive, however, and many managed care organisations provide their clients with a limited number of therapy sessions before they stop financing rehabilitation. Furthermore, the limited number of sessions can cover a wide range of services (e.g., physical therapy, occupational therapy, speech therapy) and a large number of skills (e.g., transfers, use of the affected arm, balance retraining), and, therefore, repetitive practice may not be provided at appropriate frequencies for motor learning to occur. As a result, therapy intended to improve upper-extremity function following a stroke, which may involve less repetitive practice of skills than is needed, is not as effective as it could be. Given these practice limitations, therapists seek strategies that minimise the use of costly resources while maximising practice opportunities that would enable motor learning to occur.

For decades, authors have reported that mental practice (also known as "imagery"), when combined with physical practice, accelerates motor learning and improves subsequent physical performance. Because of its positive effects on strength, endurance, and aim and precision, mental practice is frequently used by professional and amateur athletes Mental practice has also been suggested to be a viable tool for improving motor learning and performance in rehabilitative settings. During mental practice, correlative activations occur at the cortical level as well as in the musculature imagined as being used. For example, Breitling and colleagues reported similar activity in the motor execution cortical areas when subjects imagined finger movements in a relaxed state as when they actually performed the movements

NEED FOR STUDY:

To determine the Efficacy of Physical and Mental Practice in Improving Strength of Biceps Brachii Muscle

AIMS AND OBJECTIVE OF STUDY:

- To evaluate the change on biceps brachi strength when physical practice is combinedwith mental practice.
- To determine effectiveness of biceps brachi strength physical practice when combined with mental practice.

HYPOTHESIS:

Null Hypothesis:

There is no significant change in the biceps brachi strength of the group performing physical and mental practice combined together when compared to the group which is performing either physical mental practice.

Alternative Hypothesis:

There is significant change in the biceps brachi strength for the group withmental practice along with physical practice.

OPERATIONAL DEFINITION:

- **Mental Practice:** It is defined as the process of imagin and rehearsing the performance of a skill with no related overt actions. [22]
- **Physical Practice:** It is defined as process of developing motor skill by related overtactions.[23]
- **Strength:** Strength is the ability of muscle (or) group pf muscle to produce resulting force in one maximal resistance (1 RM) effort, either statically (or) dynamically. [24]
- **Young Adult:** It is the period when growth and ossification are virtually complete,beginning at approximately 18 to 25 years of age.

PROJECT OUTCOME

- It may prove to be effective in improving the strength of biceps brachi muscles.
- This technique may be particularly valuable in the treatment of patients in the initial stages of neuromuscular or musculoskeletal damage when they may be confined to a bed or physical contractions may not be appropriate or even possible.
- It may also help strengthen muscles later in rehabilitation when traditional resistance exercises are

being prescribed.

- The study may provide a simple and cost effective tool in facilitating biceps brachi strength

CHAPTER-2 REVIEW OF LITERATURE

MENTAL PRACTICE

- **Paivio et al (1985)** said that mental practice enhances performance by acting on both the motivational and cognitive components of an activity at either general e.g. the degree of physiologic arousal of an individual) or specific levels (eg. the actual practice of a motor task using motor imagery.[25]
- **Breitling D et al (1986)** reported similar activity in the motor execution cortical areas when subjects imagined finger movement in a relaxed state as when they actually performed [26]
- **Warner Let al (1988)** said that advantages and disadvantages of using mental imagery for physical therapy patients are discussed with the conclusion that mental imagery has the potential to be a viable technique for physical therapists. Physical therapy [27]
- **Cornwall et al (1991)** , have found that subject who trained mentally to contract their quadriceps[28]
- **Murphy and Jowdy et al (1992)** based on the two main theoretical explanations, psycho neuromuscular theory and symbolic learning theory, mental practice helps to deepen trainees' motor program thus facilitating automation under stress conditions and provides opportunities for rehearsal prior to execution. [29]
- **Pascual Leon et al (1995)** said that mental practice has been shown to be sufficient to promote modulation of neural circuit in the early stage of learning. In mental stimulation of motor action, cerebral blood flow studies suggest that prefrontal and supplementary motor areas, basal ganglia and cerebellum (the same central structures required for performance of actual movements) are part of the network involved. Furthermore changes to cortical motor output maps show that mental practice alone can lead to the same plastic changes in the motor system as those occurring with repetitive physical practice. [30]
- **Leeuwen et al (1998)** concluded that mental practice help patient focus on specific goals and could contribute to a reduction of the depressive state frequently observed in neurological disorder.[31]
- **Yaguez et al (1998)** said that 10 minute of mental practice was sufficient to improve theperformance of task in which healthy subjects were required to draw the ideogram of different size.[9]
- **Magill et al (1998)** said that mental practice is effective because it augments existing motor schema.[16]
- **Roure et al (1999)** said that better imagers (i.e. individual who produced autonomic nervous system responses on greater number of trials in the imagined condition) improved more on the task than other subjects, supporting the idea that better the imagery, the better the outcome of mental practice [32]
- **Stephan J Page et al (2000)** Imagery is a clinically feasible, cost-effective complement to therapy that may improve outcomes more than participation in therapy only.[33]
- **KasanP.Liu et al (2004)** said that mental imagery can be used as a training strategy to promote the relearning of daily tasks people after an acute stroke. The imagery process is likely to improve the planning and execution of both trained and untrained (novel) tasks. The effect of its relearning appears to help patient to retain and generalise the skills and tasks learned in the rehabilitation programme. [34]

- **Ben Sidaway et al (2005)** said that mental practice in people without impairments can lead to an increase in torque production similar to that produced by physical practice. Such a technique may prove to be a useful adjunct to traditional treatment options aimed at increasing muscle strength.[35]
- **NiamhJunney et al (2006)** said that for older adults, mental practice facilitates retention of a newly learned functional motor task. [36]

Summary:
Through all these literature it is concluded that mental practice is effective, it facilitates retention of learned task.

MENTAL AND PHYSICAL PRACTICES

- **Hird et al (1991)** said that mental practice combined with physical training is better than physical training alone.[37]
- **Yue and Cole et al (1992)** were the first to compare strength increases in the abductor digitiminimi muscle in mental practice and physical practice groups after 4 weeks of training. Increases in muscle strength were found in both groups when compared with control group, with muscle force improvements of 30% and 22% for the physical and mental practice groups.[1]
- **Pascual-Leone et al (1995)** said that mental training produces representational changes in the brain comparable with those yielded by physical practice, and that part of behavioural improvement seen in the mental practice condition may be latent, awaiting to be expressed after minimal physical practice, mental practice could have a preparatory effect on the task which increases the efficiency of subsequent physical training. [39]
- **Herbert et al (1998)** found that compared with physical practice (PP) mental practice (MP) did not produce any increase in voluntary isometric strength of the elbow flexor. Moreover the neural training hypothesis was tested in the experiment by measuring maximal voluntary contraction with the twitch interpolation technique before and after training. [40]
- **JulionDyon et al (2004)** they have shown that mental practice, when combined with physical practice, can improve the performance of a sequential motor skill in people who had a stroke, and suggest that mental practice could play a role in the retention of newly acquired abilities.[41]
- **Mark Sadoski et al (2004)** said that initial physical practice followed by mental imagery rehearsal may be a cost effective method of training medical students in learning basic surgical skills. 42
- **Philip L Jackson et al (2004)** said that mental practice when combined with physical practice can improve the performance of a sequential motor skill in people who had a stroke; and suggest that mental practice could play a role in the retention of newly acquired abilities.[43]
- **R.Gentilli et al (2005)** said that mental training facilitates motor learning and allows its partial transfer to nearby workspaces. They further suggest that motor prediction, a common process during both actual and imagined movements, is a fundamental operation for both sensorimotor control and learning.[44]
- **ReethTamir et al (2007)** said that the combination of imagery and real practice may be effective in the treatment of Parkinson's Disease especially for reducing bradykinesia.
- The implementation of treatment regimen allows for the extension of practice time with negligible risk and low cost. [45]

Summary:

All the above literature it concluded that mental practice when combined with physical practice can be effective in neurological conditions and it also improves sequential motor skill

CHAPTER-3 MATERIALS AND METHODOLOGY

STUDY DESIGN:

The study is experimental based comparative study, to see the effect of combination of physical and mental practice on biceps brachi strength in young adults.

STUDY SETTING:

Study was performed in the Uttranchal (p.G) college of biomedical and hospital & Visual Institute, Amritsar.

CONSENT AND ETHICAL CONSIDERATION:

Ethical approval was taken from the institute to conduct the study. Informed consent wassigned by all the subjects prior to the study. Subjects were explained about the procedureof the study and written signed consent forms were taken.

POPULATION:

Sixty students studying at Uttranchal (p.G) college of biomedical and hospital& VisualInstitute, Amritsar constituted the population for the study.

DURATION OF STUDY:

The study started at month of June 2022 to 2023 May, for the period of 1 year to confirmthe research duration only.

SAMPLE & METHOD OF SELECTION:

In the present study, random sampling method was used on the basis of inclusion and exclusion criteria and subjects were allowed to participate in reference to their willingnessto be a subject in the study.

SAMPLE SIZE:

- 20 subjects were in mental group.
- 20 subjects were in physical group
- 20 subjects were in both physical and mental group.

SELECTION CRITERIA:

Inclusion criteria:

1. Normal (physically and mentally fit) students between 19 to 26 years of either sex were taken as subjects.
2. Height of the subjects 5 to 6.0 feet.
3. Weight of the subject between 50 to 70kg.
4. BMI between 19 to 24.
5. Subjects free from shoulder, elbow, wrist and hand pain.
6. Subjects with no hearing loss.
7. Subjects who were willing to participate.
8. No recent upper quadrant musculoskeletal injury.
9. Subjects with normal muscle strength with grade five for upper limb.
10. Subjects who were willing to co-operate & were able to follow the instruction given bythe therapist.
11. Subjects who were not doing exercise during the time of training session.

Exclusion criteria:

1. Subjects having hearing or visual deficits.

2. Subjects with any neurological deficits. 3. Subjects having anysystemic disease.
3. Subjects unwilling to participate.
4. Subjects suffering from pyrexia.

VARIABLES OF THE

STUDY: A. DependentVariable:

a. Elbow strength.

B. Independent Variables:

1. Physical Practice
2. Mental Practice.

INSTRUMENTS AND TOOLS:

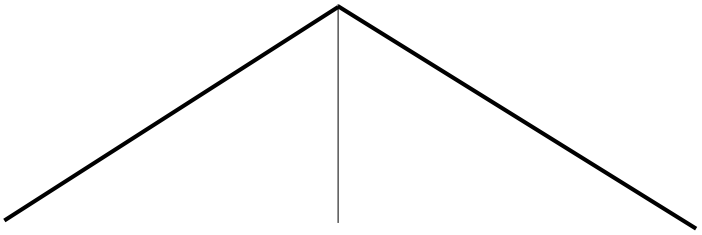
- Strain gauge.
- Strap.
- Pillow.
- Chair
- Stopwatch

Material/Instrument

TECHNIQUE OF DATA COLLECTION

PROTOCOL

60 subjects were assessed and taken for the studies. Then these subjects were divided in three groups.



Physical and mental practice (20) | Physical practice . (20) | Mental practise (20) | Group

Training continued for 4 week

Analysis were done after four weeks

Analysis of results after 4 weeks of protocol.

PROCEDURE

Group A : Mental Practice group

Group B: Physical Practice group

Group C: Physical and Mental Practice group

STEP 1:

60 subjects were assessed and then included in the study. These subjects were divided into 3 groups. The subjects were participated in pre assessment session to confirm the inclusion criteria. All subjects were provided a written consent and instructions given to them prior to the study.

Subject Preparation:

The procedure was thoroughly explained to the subjects prior to the study.

Subject Position:

Subjects were positioned comfortably in straight back chair with back supported and with both feet flat on the floor. Arm position was demonstrated by therapist. The subjects were seated with their arm dependent at an angle of 90 degrees. A strap was applied at the wrist and attached to an isometric strain gauge transducer bar.

Therapist Position:
The therapist was standing behind the subject so that presence of the therapist did not affect the task by the subject.

STEP 2:
1st day - Ability of all subjects to produce maximal strength using strain gauge.

STEP 3:
Physical Practice Group:
The subjects were given verbal instruction to flex the elbow as hard as they can press for a 5 second of isometric contraction. 10 repetitions of isometric contraction in 3sets within their assigned practice regime individually. This was done 3 times per week for 4 weeks.
All procedure was identical to those of the baseline testing phase and was always performed on strain gauge. Subjects were given 20second of rest between sets of 10 repetitions.

STEP 4:
At the start of each training session subjects were received the mental practice instructionsread the same script given on day 1.
Mental practice group were imagined and performed the maximal isometric contraction for 3 sets of 10 repetitions under the same schedule as the physical practice group. This process was repeated 3 times with a 10 isometric contractions and 5 second holds betweencontractions.
Three readings were recorded to increase reliability of subsequent data analysis.
Mental Practice Group:
They had given instruction from a prepared script on how to use Mental Imagery.
Script for the Mental Practice Group:

- Close your eyes.
- Take in a deep breath and focus on a white screen in front of you.
- Now, think back to the sensations you felt as you performed your maximal contractions.
- Feel the muscles on the front of your arm, from your shoulder down to your elbowbegin to tense up .
- Now, feel the biceps brachi tendon pressing harder and harder into your hand.
- Your muscles contract more and more as you count 1, 2, 3, 4, and 5.
- You begin to relax the muscles of your arm. Your elbow are no longer pointing up, andyou can feel the biceps tendon against your hand less and less.
- Relax

Both physical and mental practice group -
Mental practice group were imagined and performed the maximal isometric contractionfor
3 sets of 10 repetitions under the same schedule as the physical practicegroup.

VALIDITY AND RELIABILITY:
Instrumental Reliability:
STRAIN GAUGE
Jennifer et al 2002 siated strain gauge is commercially available instrument that canprovide a rapid and reproducible method to measuring biceps brachi strength (45).

Allen et al 1995 stated that strain gauge is acceptable instrument for quantitativemeasurement of biceps brachi strength (46).

Tester Reliability:

The assessment and training procedure were done under the supervision of my guide andco-guide.

Procedural Reliability:

The procedure used for the study was reliable and was used previously by
Researchers for studies with reference to study done by **Jarroldpetrofsky and Michaellaymon.**

CHAPTER- 4

DATA ANALYSIS AND INTERPRETATION

Statistics were performed by using SPSS 11 SOFTWARE.

Using statistical formula for the mean, for a given number of subjects, mean of differentvariables were calculated by :

X= Where,

N = Number of subjects X = each subjects value

STANDARD DEVIATION (o) S

= 2x2

x = deviation of score from meanN = Number of subjects

T-TEST OF INDEPENDENT MEANS

t= S=

df = N+N2-2WHERE:

M= mean, SDM = standard error of the difference between meansN= number of subjects in group, 5 = standard deviation of group DF = degrees of freedom

PAIRED T-TEST

In the t- test, the two samples are independent of each other.The sample sizes are equal, i.e., n1=n2=n
The sample observations X1,2, x2.., xn) and (v1,2..... ,yn) are not completely independent
but they are dependent in pairs, The formula used for the analysis is,t = d'
S/vn
Where d' is the difference in the observations for the ith unitS is the standard deviation

GROUP A → MENTAL GROUP GROUP B → PHYSICAL GROUP
GROUP C → PHYSICAL AND MENTAL

Table 1 Mean and SD of Age, Weight, Height and BMI for Group A, Group B and Group C

Groups	Age Mean +SD	Weight Mean ‡ SD	Height Mean ‡ SD	BMI Mean ‡ SD
Group	22.65 ‡1.89	59.95 ‡7.52	165.25 ‡8.02	21.87 ‡1.25
Group	22.95 +2.32	61.4 + 6.39	166.25 ‡9.08	22.19 +1.34

Group	21.2 +2.14	60.65 ‡7.47	165.75 +8.77	21.99 ‡0.087

Table 2 Mean and SD of the Variables for Group A, Group B and Group C

Groups	Group A		Group B		Group C Post	
	Pre	Post	Pre	Post	Pre	16.61 +
Mean + SD	12.72 + 5.15	14.12 + 5.31	14.07 ÷ 4.66	15.83 + 4.80	14.32 ‡ 6.78	6.86

It describes the mean and SD of the variable for Group A, B and C. The values for Group A were **12.72 ‡ 5.15 (pre) and 14.12 ‡ 5.31 (post) , for Group B the values were 14.07 ‡ 4.66 (pre) and 15.83 + 4.80 (post) and for Group C were 14.32 ‡ 6.78 (pre) and 16.61 ‡ 6.86 (post)** respectively. Above data shows that elbow strength in mental practice (Group A) before the training was 12.72 and increased to 14.12. Elbow strength in mental practice (Group B) before the training was 14.07 and increased to 15.81. Elbow strength in mental practice (Group C) before the training was 14.32 and increased to 16.61

Table 3 Paired test between Pre and Post within Group A

GROUP A		
WEEKS	†- VALUE	p- VALUE
0-2	- 8.345	0.000
0-4	- 13.338	0.000
2-4 WEEKS	- 8.257	0.000

	GROUP B	
WEEKS	†- VALUE	P- VALUE
0-2	- 14.138	0.000
0-4	- 17.219	0.000
2-4 WEEKS	-6.37	0.000

Paired test was applied and mean values of Pre training and Post training sessions within Group A. The t

value for Group A for Zero to 2 weeks were - **8.345** (P < 0.000), for Zero to 4 weeks were **-13.338**(P <0.000) and for two to val four weeks were **-8.257** (P <0.000) respectively, Above data show that the valve for Zero to 4 week was more significant thanZero to 2 week and 2 to 4 week.

Paired t test was applied and mean values of Pre training and Post training sessions within Group B. The t value for Group B for Zero to 2 weeks were **--14.138** (P < 0.000), for Zero to 4 weeks were **-17.219**(P <0.000) and for two to four weeks were **-6.37** (P <0.000) respectively. Above data shows that the valve for Group B for Zero to 4 weeks was more significant than Zero to 2 and 2 to 4 weeks.

Paired t test between Pre and Post sessions within Group C

GROUP C		
WEEKS	t- VALUE	p- VALUE
0-2	- 12.142	0.000
0-4	- 19.200	0.000
2-4 WEEKS	- 6.952	0.000

Paired t test was applied and mean values of Pre training and Post training sessions within Group C. The t value for Group C for Zero to 2 weeks were **12.142** (P < 0.000), for Zero to 4 weeks were **-19.200**(P <0.000) and for two to four weeks were **-6.952** (P <0.000) respectively. Above data shows that valve for Group C for Zero to 4 weeks was more significant than Zero to 2 and 2 to 4 weeks.

Table 4 Independent t test between Group A and Group B

BETWEEN GROUP A & B		
WEEKS	†- VALUE	p- VALUE
ZERO	-0.869	0.391
2ND WEEK	-0.977	0.335
4TH WEEK	-0.95	0.348

Independent t test was applied between Group A and Group B. The t value for Group A and Group B at Zero weeks were **-0.869** (P >**0.391**). The t-value at 2nd week were **-0.977**(P >**0.335**) and for 4" week were **-0.95** (P >**0.348**). Above data shows that valve between Group A& B for Week 0, 2, 4, were a insignificant.

Table 5 Independent t test between Group B and Group C

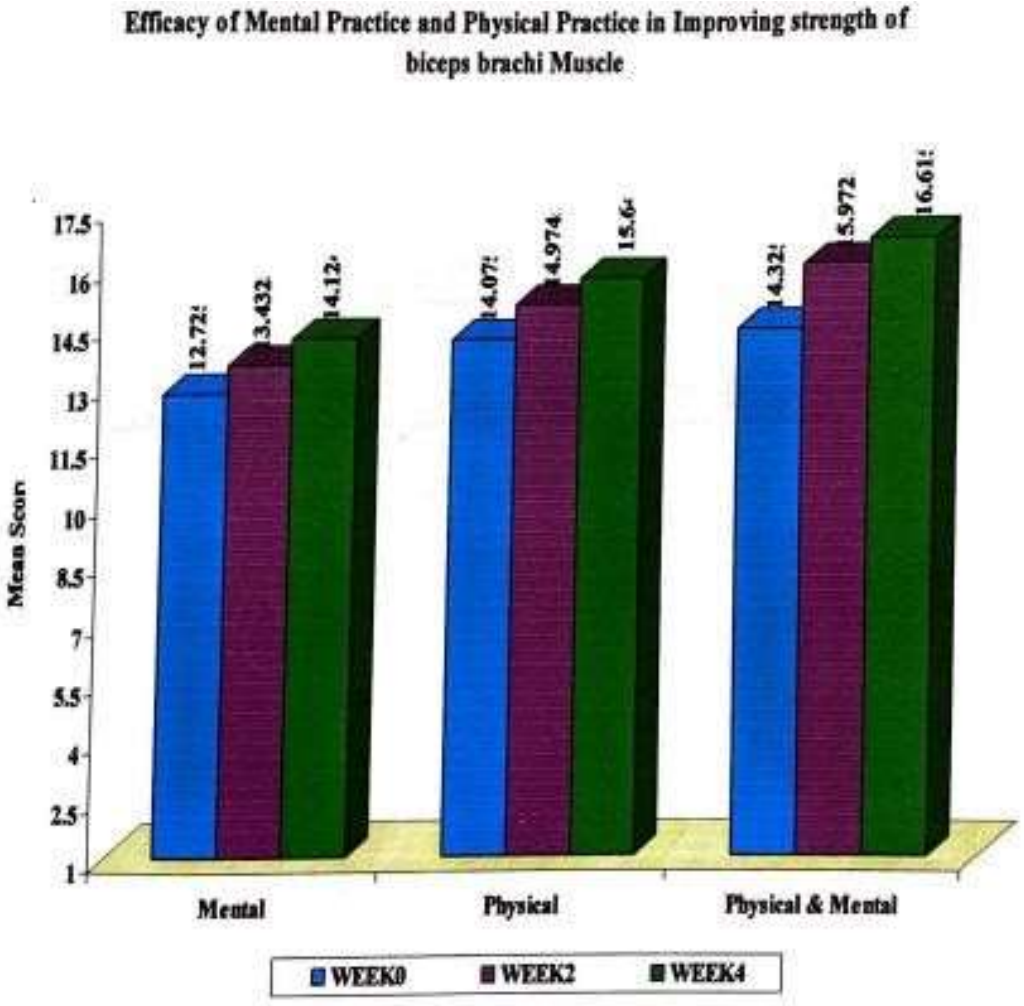
BETWEEN GROUP B & C		
WEEKS	†- VALUE	p- VALUE
ZERO	-0.136	0.893
2ND WEEK	-0.537	0.595
4TH WEEK	-0.522	0.605

Independent t test was applied between Group B and Group C. The t value for Group B and Group C at Zero weeks were **-0.136** (P >**0.893**). The t-value at 2nd week were **-0.537**(P >**0.595**) and for 4" week were **-0.522** (P >**0.605**)Above data shows that valve between Group B & C for Week 0, 2, 4, were insignificant.

Table 6 Independent t test between Group A and Group C

BETWEEN GROUP A & C		
WEEKS	t- VALUE	p- VALUE
ZERO	-0.839	0.406
2ND WEEK	1.321	0.194
4TH WEEK	-1.283	0.207

Independent t test was applied between Group A and Group C. The t value for Group A and Group C at Zero weeks were **-0.839** (P >**0.406**). The t-value at 2nd week were **-1.321**(P >**0.194**) and for 4" week were **-1.283** (P >**0.207**). Above data shows that valve between Group A& C for Week 0, 2, 4, were insignificant



CHAPTER 5 RESULTS AND DISCUSSION

RESULTS:

On the basis of description of the tables given above showing results of the Paired t-test with in different groups, when comparing the pre and post session values of elbow strength, the values are maximised in case of group C thus proving that when physical and mental training is given together it gives best results.

DISCUSSION:

Aim of this study was to evaluate the change on biceps brachi strength when physical practice is combined with mental practice and also to determine effectiveness of biceps brachi strength when physical practice is combined with mental practice.

This study was designed to explore an intervention strategy that physical therapists might consider when the inability to produce biceps brachi strength is a limiting factor in patient's functional capability. This result show that mental practice when combined with physical practice can increase elbow strength more than either physical or mental practice when worked alone.

Biceps brachi strength has been used as an objective clinical measure in a variety of situations. For example, Biceps brachi strength has been used to assess general strength in order to determine work capacity for extent of injury and disease processes and the potential for and progress in rehabilitation.

Indeed it has even been suggested that subjects who practice sets of imagined maximal voluntary contractions experience a significant increase in the strength of a abductor digit minimi muscle. (Yue and Cole, 1992)[1.]

In a more cognitive interpretation, researchers have proposed that mental practice increases performance by improving the preparation and anticipation of movements rather than movement execution. This study was not designed to produce data that could contribute to this theoretical debate. Despite our inability to determine the underlying mechanism, Combination of physical and mental practice used by the subjects in our study resulted in significant gains in the ability to produce maximum biceps brachi strength. This finding perhaps should not be surprising considering that the majority of initial strength gains from resistive exercise are not due to changes in the physiological capacity of the muscle fibers themselves. Muscle hypertrophy resulting from the addition of contractile proteins is a gradual process that takes many weeks to occur. [49,50] The ability to increase force production during the initial weeks of training, therefore, is thought to be the result of neural adaptations.[49,51] Possible mechanisms of these neural adaptations include the extent of motor unit activation [52] improved coordination 53and decreased co- contraction of antagonist muscles.[54] In this study, subjects were trained for only 4 weeks(one month protocol) as was done in previous research,[1,2] and, therefore, we would expect changes in biceps brachi strength to be primarily a function of these neural adaptations. Therefore, given the length of training in this study, it appears that whatever neurological changes in muscle recruitment were taking place in the physical practice and mental practice group also were being stimulated by the physical practice intervention.

Extrapolating the findings to clinical populations, therefore, might be questionable. In many orthopedic injuries (eg., bony, ligamentous, and muscular lesions), however, the patients nervous system remains relatively unaffected. and combination of physical and mental practice may be an appropriate technique to use with these diagnoses. It also should be noted that mental practice has been round to be an effective technique for motor il acquisition in an elderly population. [55]

Finally, in this study, subjects were trained on their ability to produce maximum biceps brachi strength under isometric contraction and then were physically and mentally trained under these conditions. Although concentric and eccentric activations were not trained, the mental practice literature does not suggest that the effectiveness of mental practice would interact with the type of contraction being imagined. Therefore, we believe that combination of mental practice and physical practice would be equally effective for other types of muscle activation that were not trained in this study.

LIMITATIONS OF STUDY

1. Small sample size.
2. Only 1 month protocol was given. If the training period continued for another month, strength differences between the 2 practice groups would be expected to emerge as physiological hypertrophy became evident in the physical practice group.
3. Position of shoulder, elbow and wrist were controlled manually.
4. A portaonyatudnt our duty areefon the fe that our sample consisted of only students who were healthy.

RECOMMENDATIONS:

- Future research is also needed to see the effect in any neuromuscular or musculoskeletal condition patient.
- More number of subjects can be included for better results.
- More time for invention.
- This study can be done in elderly population.

CHAPTER-6 SUMMARY AND CONCLUSION

The current study said that the combination of mental practice and physical practice is effective in increasing the biceps brachi strength in subjects without impairments. The elbow muscles were chosen because they are a clinically significant muscle group in activities of daily living. The next step then is to examine the role of mental practice in strength improvements in patients with neuromuscular or musculoskeletal pathological involvement. The strong effect found for combination of mental practice and physical practice does hold the hope that this intervention may have a role in the rehabilitation of these patients either as a stand-alone intervention for patients with acute injuries or as a useful adjunct to traditional therapeutic exercise later in the rehabilitation process.

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