



EFFECTIVENESS OF THERAPUTTY EXERCISES ON GRIP STRENGTH AND MUSCLE FATIGUE IN IT PROFESSIONALS AT THE END OF 3 WEEKS - AN EXPERIMENTAL STUDY

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Abstract:

Background:

IT Professionals, who do a desk job and frequently need to attend virtual meets and do online assessments usually experience pain in neck, shoulder, back, wrist and hand. They maintain a static position for more than 6 hours a day which leads to a higher stress on the upper limb. Repetitive motion and continuous stress are the main causes of decreased upper limb strength. Theraputty provides significant benefits after hand and finger surgery. It's a silicone-based material can be used as part of many hand strengthening programs. These exercises, based on stretching and strengthening, aim to improve muscle strength and reduce muscle fatigue.

Methodology:

Experimental study was performed from May 22 to November 22. A purposive sampling technique was applied to select total 40 subjects according to inclusion and exclusion criteria. Subjects were explained about intervention and written consent was taken. The evaluations of the subjects were done by using Jamar Hand Dynamometer and Fatigue Severity Scale. Subjects were given Theraputty exercises.

Results:

40 participants were included in the study. Paired Test was done. The result obtained for Theraputty exercises on IT professionals on grip strength was measured by Jamar dynamometer suggests significance as P value obtained was (<0.0001) for both the hands and T value was (26.75) for the right hand and (28.48) for the left hand. The result obtained for Theraputty exercises on IT professionals on muscle fatigue measured by fatigue severity scale suggests significance as P value obtained was (<0.0001) T value was (19.58) for both the hands.

Conclusion:

This study shows that the effect of Thera putty exercises is extremely significant to improve grip strength and reduce muscle fatigue among IT individuals.

Keywords: Theraputty Exercises, grip strength, muscle fatigue, IT professionals.

I. INTRODUCTION:

With the advancements in technology, IT sector has gained immense workload over the last few decades, thus increase in upper limb musculoskeletal disorder incidents reported. IT Professionals, who do a desk job and frequently need to attend virtual meets and do online assessments usually experience pain in neck, shoulder, back, wrist and hand.

IT employees maintain a static position for more than 6 hours a day which leads to a higher stress on the upper limb.

Repetitive motion and continuous stress are the main causes of decreased upper limb strength [1].

The gold standard for measuring the strength of forearm muscle is by grip strength.

Asymptomatic individuals fall under the pre-clinical spectrum and thus, don't visit a doctor or therapist for the same. In long term, these pre-clinical symptoms can manifest as serious musculoskeletal hazards and thus are to be handled as a priority.

Various aspects like personal factors, work related factors, psychosocial factors can result in many health hazards like musculoskeletal disorder. From the literature review it is observed that musculoskeletal disorder is very common among IT employee.

Among the various work-related musculoskeletal disorders, tendon related disorders are most common followed by muscle related, nerve entrapment and joint related problems [1]

The power of grip is the result of forceful flexion of all finger joints with a maximal voluntary force that the subject is able to exert under normal bio kinetic conditions.

Nearly 35 muscles are required for hand grip, flexors bringing about the movement whereas extensors stabilizing the wrist.

Grip strength measurements are easy to calculate, which makes them especially useful when tracking the progress of a patient going through physical therapy. [1]

The physiological term fatigue describes reversible condition in which a muscle is no longer able to generate or sustain the expected power output. Fatigue is highly variable. It is influenced by the intensity and duration of contractile activity, by whether the muscle fiber is using aerobic or anaerobic metabolism, by the composition of muscle, and by the fitness level of the individual. [6][7]

The use of computers for a long time without being accompanied by adequate rest periods will cause interference on hard and soft tissues (musculoskeletal) include a headache, arm, stress and stiffness. On the computer operator fatigue will eventually cause health problems such as repetitive strain injury (RSI) and cumulative trauma disorder (CTD) thus causing carpal tunnel syndrome, tendinitis and muscle pain. [8]

People use their hands for almost everything. As such, the results of a hand injury can be devastating. TheraPutty provides significant benefits after hand and finger surgery. Its silicone-based material can be used as part of many hand strengthening programs. After surgery, hand therapists recommend activities such as the three-point and lateral pinch exercises. Doing these exercises over time will gradually increase hand range-of-motion. In addition to post-surgery rehabilitation, TheraPutty exercises can significantly benefit patients with temporary or chronic mobility limitations in their hands such as arthritis. [12]

II. NEED OF STUDY:

The average Hand grip strength of the desk job population is found out to be 21.64Kg which is lower than the normative values suggested by the studies. [2][4]. The posture of wrist probably affects length tension relation of the muscles of forearm mainly the long flexors of forearm as the wrist is kept in extension with elbow flexion to hold the mouse which probably stretches the actin myosin junction in the muscles.

Repetitive motions of wrist and hand muscles causes muscular strain leading in decrease of grip strength and increases muscle fatigue in IT workers. Awkward posture, sustained body position and working in the same position for a long time may put the muscles under stress, reduce blood flow, lead to fatigue and ultimately, elicit pain/tissue damage. With TheraPutty patients can progressively exercise. This exercise putty comes in several color-coded resistance levels. The standardized color-coding system starts with pear which is the softest resistance. The resistance levels move all the way up to plum, which is an extra heavy resistance. This resistance is best for athletes or people with strong hand strength. [12]

III. AIM:

To evaluate effectiveness of Theraputty exercises on grip strength and muscle fatigue in it professionals.

IV. OBJECTIVE:

To study the effectiveness of Thera Putty exercises on grip strength in IT professionals at the end of 3 weeks.

To study the effectiveness of Thera Putty exercises on muscle fatigue in IT professionals at the end of 3 weeks. [3]

V. HYPOTHESIS:

NULL: Theraputty exercises will have no effect on grip strength and muscle fatigue among IT professionals.

ALTERNATIVE: Theraputty exercises will have effect on grip strength among IT professionals. Theraputty exercises will have effect on muscle fatigue among IT professionals.

VI. METHODOLOGY:

Sample Size – 40

Study Design – Experimental Study

Sampling Method – Purposeful

Study Population – IT professionals in age group of 25-40 yrs.[2][8]

Study Setting – Work Site of IT professional.

Study Duration – 6 months

VII. MATERIALS:

Materials used:

- Dynamometer (reliability-99.72) [5]
- Fatigue Severity Scale [9]
- Thera Putty
- Pen
- Paper
- Chair
- Consent form
- Data collection sheet

VIII. INCLUSION CRITERIA:

- Male and Female workers working in the IT sector.
- Grip Strength in dominant and non-dominant hand less than 28kg in female and 45kg in males. [4]
- Mean age is 32years +- 5yrs.
- Working for 6-8 hours a day in front of a computer/laptop. [2]
- Working Experience of 2-3 years. [11]

IX. EXCLUSION CRITERIA:

- IT professionals complaining of pain in upper extremity.
- IT professionals with upper limb pathologies like carpal tunnel syndrome, recent fractures, recent injuries.
- IT professionals with neurological pathologies like nerve entrapment.
- Pregnant women. [10]

X. PROCEDURE:

- The study began with synopsis presentation on in front of the ethical committee in PES Modern College of Physiotherapy.
- Ethical clearance was obtained from the committee.
- Participants were selected according to inclusion and exclusion criteria.
- The study was explained to them and consent was taken from them.
- Pre Exercise measurements were taken. Hand Grip Strength by Dynamometer
- Assessment of Fatigue by Fatigue Severity Scale.
- Thera Putty Exercise Protocol of 3 weeks was followed.
- Post Exercise measurements were taken. Hand Grip Strength by Dynamometer
- Assessment of Fatigue by Fatigue Severity Scale.

Exercise Protocol:

Thera Putty Exercises were taught to the participants at the beginning of the 3 weeks protocol.[3]

These exercise were performed by rolling the putty in between the hand followed by squeezing it in between the fingers and maintaining the tension for 3-5 seconds.[3]

Exercises were done 3days/week.[3]

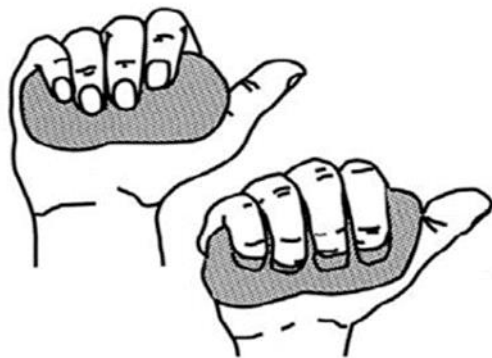
Repetitions: 10-15 times [3]

Frequency: Once a day [3]

Thera Putty was provided to subject by the therapist for 3 weeks.

1) Finger Press (Flexion)

Place TheraPutty into the palm of the hand and press fingers through the putty until the fingertips reaches the palm, resulting in a fully clenched fist. Release fingers and roll putty in hands to reshape, and repeat exercise.



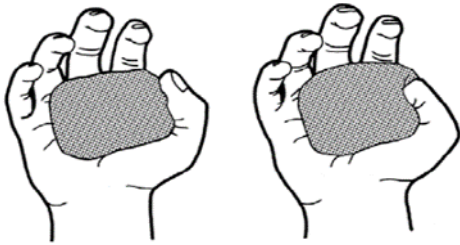
2) Mass Finger Extension

Keep fingers straight while using the palm to roll out a tube of TheraPutty



3) Thumb Dig (Flexion)

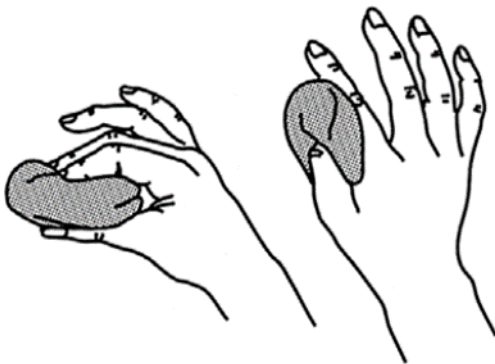
Roll TheraPutty into a cylindrical shape and let it rest in the palm of the hand. Push thumb through putty until it reaches the palm. Reshape putty and repeat



4) Finger Pinch

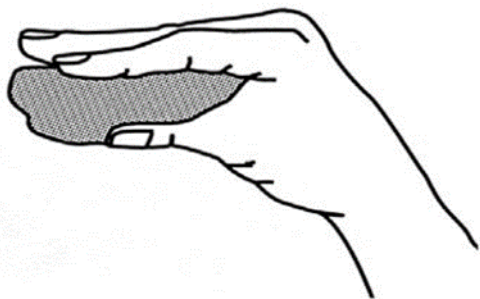
Palmar Pinch: Form TheraPutty into the shape of a ball. Pinch putty between the thumb, index and middle fingertips until the fingers press through the putty.

Key Pinch: Form TheraPutty into the shape of a ball. Pinch putty between the tip of the thumb and side of index finger.



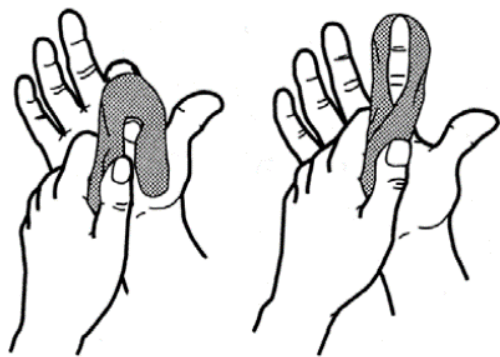
5) “Rooftop” Exercise (Intrinsic)

Form the TheraPutty into a ball. Place ball between fingers and thumb. Form a “rooftop” using straight fingers, leaving the thumb underneath. Press all fingers down toward the thumb, keeping fingers straight and together. Reshape putty and repeat pressing down one straight finger at a time.



6) Individual Finger Extension

Bend one finger or thumb so that the fingertip is close to the palm of the hand. With the other hand, wrap a strip of TheraPutty over the tip of the bent finger and grasp both ends. Straighten the finger. Repeat exercise on each finger.

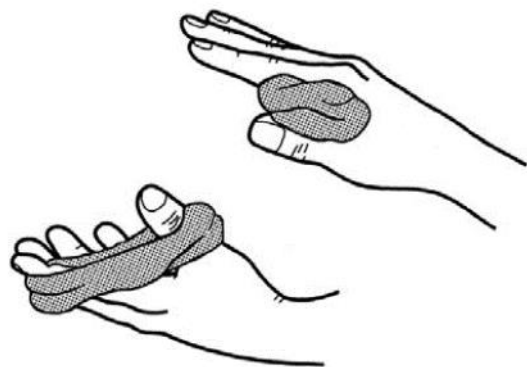


7) Thumb Abduction

Form TheraPutty into a ring. Place ring around the index finger and thumb. Move the thumb away from the index finger. Keep the thumb perpendicular to index finger.

Thumb Adduction

Put a ball of TheraPutty in the thumb web space. Press thumb towards index finger.



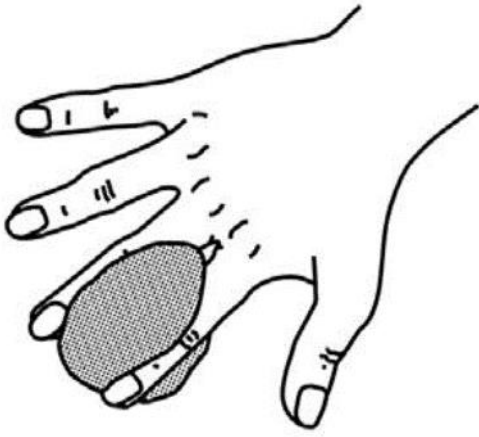
8) Individual Finger Spread (Abduction)

Place two fingers together and wrap TheraPutty around them, near the fingertips. Try spreading the fingers apart. Repeat, using different pairs of fingers until all of the fingers have been exercised



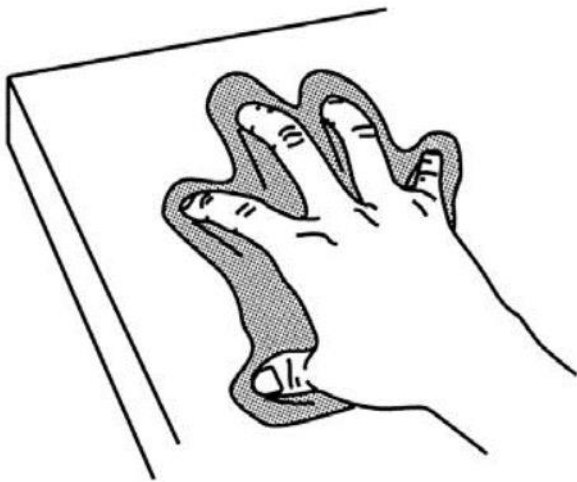
9) Finger Squeeze (Adduction)

Roll TheraPutty into a ball and place between two spread fingers. Using a scissors-like motion, try bringing the two fingers together. Repeat using different pairs of fingers until all fingers have been exercised.



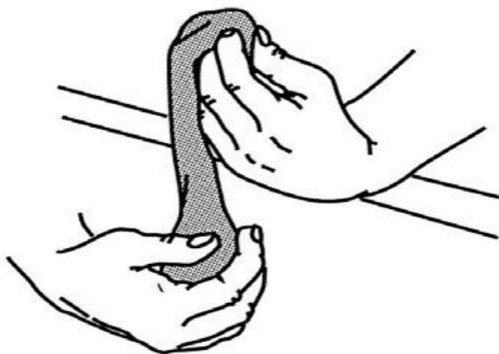
10) Finger Spread (Abduction)

Form the TheraPutty into a thick pancake shape lying on a table. Bunch the fingertips together and place into the putty. Then, spread out all the fingers at once, enlarging the pancake as much as possible.



11) Wrist flexion

Rest the forearm on a table or arm of a chair, palm up, allowing the hand to hang down over the edge. Grip the TheraPutty with the fingertips of the involved hand. Straighten and bend the wrist up while holding the putty steady with the other hand.



12) Wrist Extension

Rest the forearm on a table or arm of a chair, palm down, allowing the hand to hang down over the edge. Grip the TheraPutty with the fingertips of the involved hand. While holding the putty steady below with the other hand, straighten and extend the wrist up while keeping the arm on the table.









XI. STATISTICAL ANALYSIS:

The pre and post analysis was done within groups using paired t test which showed extremely significant results. The study data was statistically analysed using Graph pad instat v 3.1

XII. RESULT:

40 participants were included in the study.

Paired Test was done.

The result obtained for Theraputty exercises on grip strength in IT professionals for both the hands:

- The comparison of grip strength values of right hand, pre and post exercise P value was <0.0001 which is considered extremely significant. The pre-treatment MEAN was 30.29 with SD of 9.85 while post-treatment MEAN was 37.59 with SD of 8.98. The T value was 26.75
- The comparison of grip strength values of left hand, pre and post exercise P value was <0.0001 which is considered extremely significant. The pre-treatment MEAN was 29.59 with SD of 9.88 while post-treatment MEAN was 37.19 with SD of 8.92. The T value was 28.48

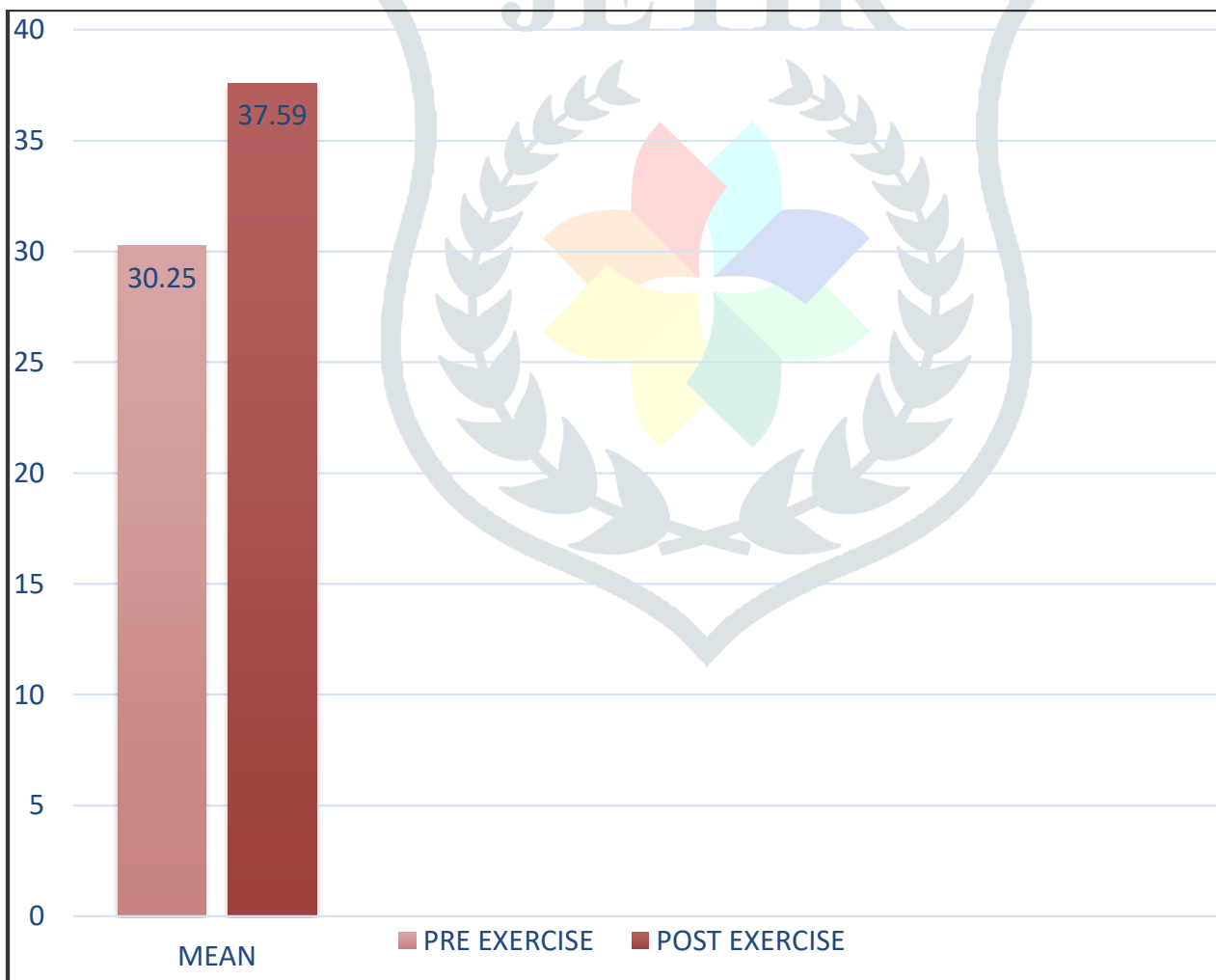
The result obtained for Theraputty exercises on muscle fatigue in IT professionals for both the hands:

- The comparison of muscle fatigue values, pre and post exercise P value was <0.0001 which is considered extremely significant. The pre-treatment MEAN was 31.78 with SD of 3.14 while post-treatment MEAN was 24.88 with SD of 3.38. The T value was 19.58

1) GRIP STRENGTH VALUES – RIGHT HAND:

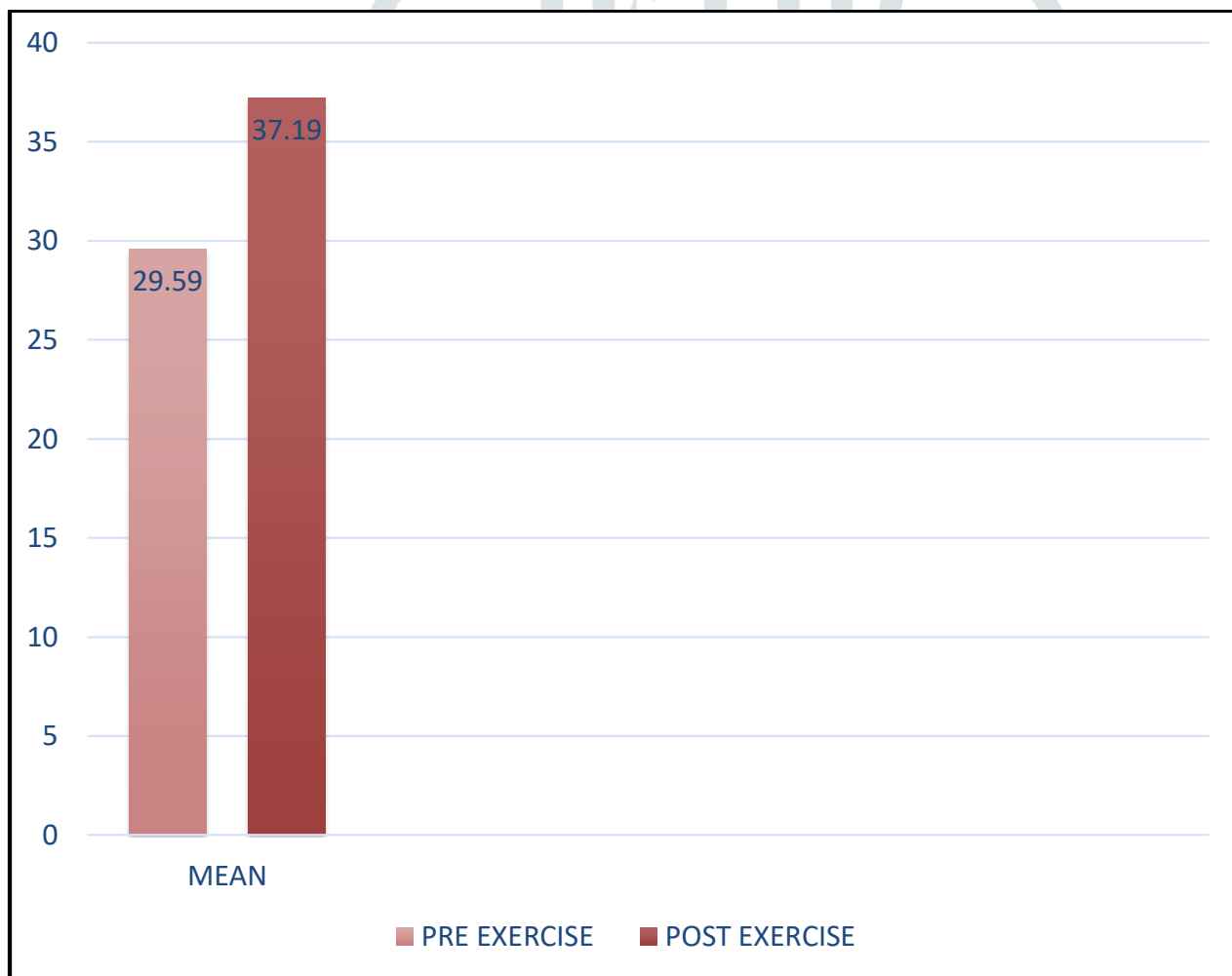
	PRE EXERCISE	POST EXERCISE
MEAN	30.250	37.598
STANDARD DEVIATION	9.858	8.985
T VALUE	26.75	
P VALUE	<0.0001	
SIGNIFICANCE	EXTREMELY SIGNIFICANT	

Graph 1: Mean of grip strength values of right hand



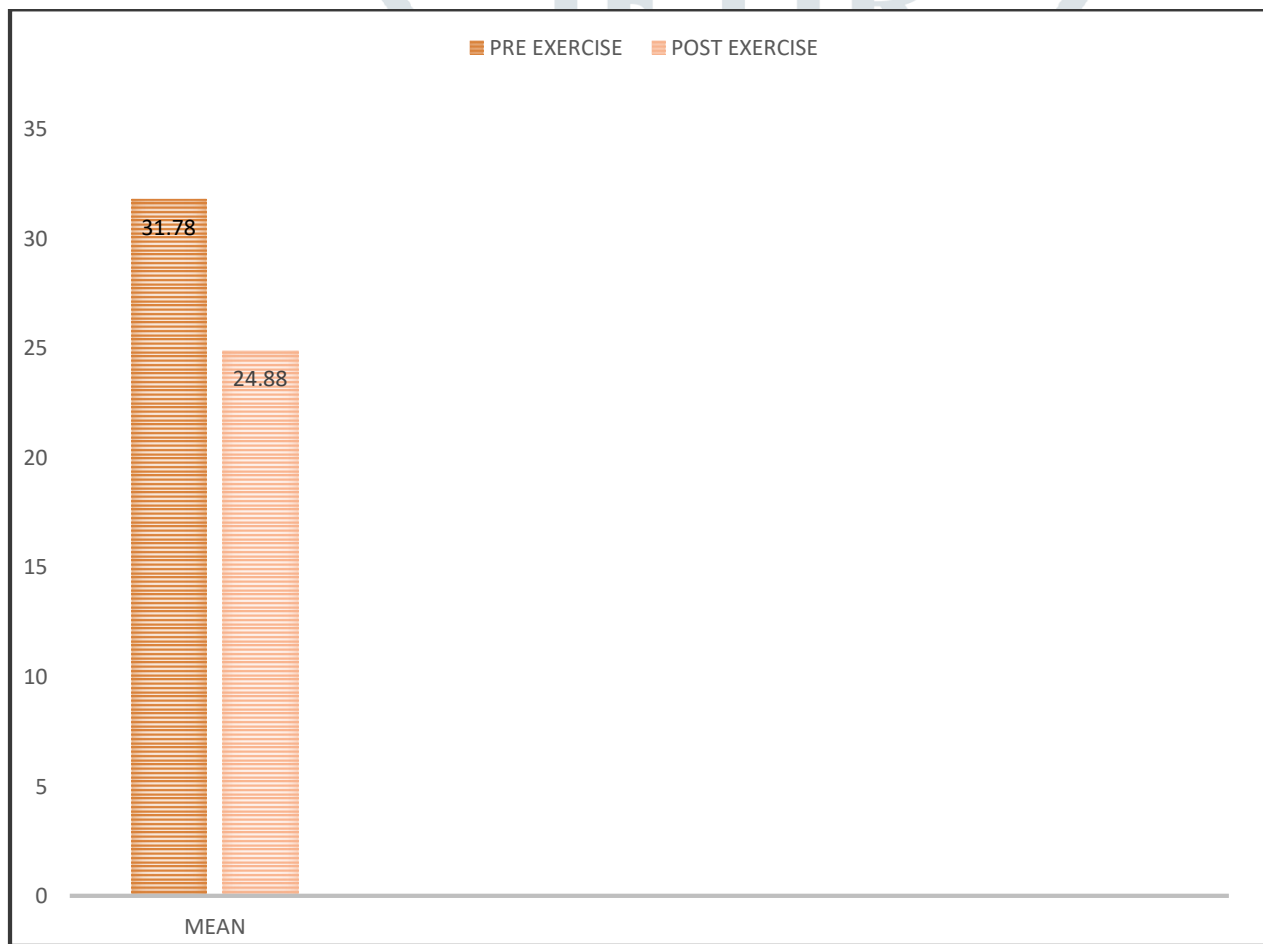
2) GRIP STRENGTH VALUES – LEFT HAND:

	PRE EXERCISE	POST EXERCISE
MEAN	29.593	37.190
STANDARD DEVIATION	9.882	8.925
T VALUE	28.48	
P VALUE	<0.0001	
SIGNIFICANCE	EXTREMELY SIGNIFICANT	

Graph 2: Mean of grip strength values of left hand

3) MUSCLE FATIGUE:

	PRE EXERCISE	POST EXERCISE
MEAN	31.78	24.88
STANDARD DEVIATION	3.14	3.38
T VALUE	19.586	
P VALUE	<0.0001	
SIGNIFICANCE	EXTREMELY SIGNIFICANT	

Graph 3: Mean of muscle fatigue values of both hands**XIII. DISCUSSION:**

The present study was done to see the effectiveness of therapy on grip strength and muscle fatigue in IT workers at the end of 3 weeks.

In this study 40 individuals that were selected according to the inclusion and exclusion criteria underwent the protocol for 3 weeks, 3 days/week. The average age was of the study group was 32yrs. The individuals were selected on the basis of their hand grip strength by using a handheld dynamometer. At the end of the protocol there were statistically and clinically significant improvements in the grip strength and decrease in muscle fatigue of both the hands.

Following resistance there is a transient increase in protein synthesis within muscle. It is proved that performing exercise with increased resistance caused more protein synthesis in the muscles and increased the total volume of muscles.

A study was conducted by Dr. SEVIA CHABUNGBAM-Effects of Resisted Exercises on Grip Strength in Tennis Players(2022)” on 30 tennis players where the objective of the study was to evaluate the effects of resisted exercises (theraputty) in the improvement of grip strength.

The findings of the study revealed that exercises done with the theraputty showed significant increase in grip strength post 3 weeks after performing the given exercises. Exercise with hand theraputty significantly improved all the three types of pinch and grip strength. It was also previously found that the arm of an experienced tennis player was able to exert a greater force than the untrained arm. Theraputty delivered an effective resistance based training which helps to develop a strong grip. The study concluded that, the resisted exercises were effective for improving the hand grip strength in tennis players. [19]

A similar study where EFFECT OF RESISTED EXERCISES VERSUS FREE WEIGHT EXERCISES FOR THE IMPROVEMENT OF GRIP STRENGTH OF CRICKET PLAYERS (2016) was conducted by Dr. P Sathya. In that study a total sample of 40 intercollegiate cricket players were taken. Here the effect of resistance exercises (Theraputty) in the improvement of grip strength in intercollegiate cricket players was evaluated. The findings of the study revealed that exercises done with the theraputty showed significant increase in grip strength post 3 weeks of performing the given exercises. It showed that there was a significant increase in the post grip strength of both the dominant as well as the non- dominant hand in since p value < 0.05. The exercises were beneficial for improving the hand grip strength in cricket players. Therefore, theraputty as they are handy and easy to use they can also be used to improve grip strength in cricket players. [20]

“Effects of a hand training programme in five patients with myotonic dystrophy type 1” was a study conducted by Karolinska University Hospital, Stockholm, Sweden (2005). The aim of this study was to evaluate hand function and self-rated occupational performance before and after specific hand training in five participants with myotonic dystrophy (MD) type 1. Five consecutive participants, were asked to participate from the outpatient clinic of the Karolinska University Hospital. The participants performed hand training three times a week for 12 weeks and were offered one training session guided by an occupational therapist every third week. The participants followed a general exercise programme, which included different exercises with isolated and mass movements with a silicone-based putty, Theraputty, for resistance training. The results suggest that hand function as well as self-rated occupational performance can improve after a three-month training period focused on endurance and low resistance training. [15] [21]

Strength initially increases due to neuromuscular adaptation associated with improved recruitment of motor units in skeletal muscle. Higher threshold motor units are recruited first and thus there is an increase in the maximal force generated in the muscles.

A study was done to see The Effect of hand exercises on grip strength and manual dexterity in children with severe congenital visual impairment (2020) by Sumayya Faiz Shaikh.(*at.al*) The study was targeted to find the effect of hand exercises on grip strength and manual dexterity in children with severe congenital visual impairment. Hand exercises were performed using Theraputty for a period of 6 weeks. The results of this study indicated that there was considerable improvement in grip strength with the hand exercises using theraputty. The study showed that a significant improvement in grip strength was seen. Thus, hand exercises were considered as a useful training method in improving grip strength and manual dexterity in children with severe congenital visual impairment. [17]

The results obtained can be discussed based on a study done by University of Medicine and Dentistry of New Jersey where effect of at-work exercises on computer operators was conducted which showed that that most subjects found the resistance and the stretching exercises easy to do, performed them 1 to 2 times daily, and said they reduced discomfort. At the end of the study the participants showed significant increase in grip strength and reduction in muscle fatigue.[22]The results of our study also emphasized on the effectiveness of hand exercises on decrease in muscle fatigue. Decrease in muscle fatigue could possibly be explained by an improvement in the grip strength scores.

Hence the theraputty can be used to improve the grip strength and reduce muscle fatigue in IT workers.

XIV. CONCLUSION:

The study rejects null hypothesis – Theraputty exercises will have no effect on grip strength among IT professionals, and accepts the experimental hypothesis - Theraputty exercises will have effect on grip strength among IT professionals, Theraputty exercises will have effect on muscle fatigue in IT professionals.

Hence the conclusion of the study is that Thera putty exercises will improve grip strength and reduce muscle fatigue among IT individuals.

XV. LIMITATION:

- Thera putty is expensive.

XVI. FUTURE SCOPE:

- Similar study can be conducted on large scale.
- Comparative study of grip strength between dominant and non-dominant hand can be done.
- Can be done using advanced testing procedures like EMG for precise results.

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