



Research Paper

“Effects of Resisted Exercises on Grip Strength in Tennis Players”

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Abstract

Background: Hand grip strength is the maximal power of forceful voluntary flexion of all fingers under normal bio kinetic conditions. It is often used as an indicator of overall physical strength, hand and forearm muscle performance, functional index of nutritional status, physical performance, bone mineral content, functional integrity of upper extremity. It is regarded as one of the most reliable clinical method for estimating strength. Hand grip strength is a physiological variable that is affected by a numbers of factors, including, age, gender, height, weight, and various anthropometric traits.

Objectives: The aim of the study was to evaluate the effects of resisted exercises on grip strength in tennis players with the handheld dynamometer.

Method: Total samples of 30 tennis players were taken in the age group of 15 – 25 years (male). Anthropometric variables, that is, height, weight, and BMI were measured at the beginning of the study. The hand grip strength was measured using handheld dynamometer at the beginning of the study as well as at the end of 3 weeks of intervention. The subjects were given resisted exercises for hand using hand gripper and theraputty (green).

Main outcome measure: Handgrip strength was measured by handheld dynamometer.

Result: The result of the study showed there was a significant improvement in hand grip strength after 3 weeks of intervention.

Conclusion: The study concludes that hand gripper and theraputty (green) can also be used for improvement of grip strength in tennis players.

Keywords: Handgrip strength, Anthropometric variables, handheld dynamometer, theraputty, hand gripper.

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I. Introduction

Hand is a very complex structure capable of a multitude of motor tasks ,relaying sensory information about the temperature, the shape , texture of objects to the brain.¹ It is unique in being free of habitual locomotor duty and devoted entirely to the functions of manipulations.,

Handgrip strength is a general term used by strength athletes referring to the muscular strength and force that they can generate with their hands. The strength of the handgrip is the result of forceful flexion of all finger joints, thumb and wrists with the maximum voluntary force that the subject is able to exert under normal biokinetic conditions.³

Many sports are played using a handheld implement such as a bat in cricket, a racquet in racquetball or a stick in field hockey. It is obvious that the ability to manipulate an instrument provided in a particular sport might highly influence and athlete’s success. Grip strength may be an indicator of good performance in such sports.³

Tennis is one of the competitive sports and played by millions of people all over the world. It is played as recreational sports among people to enhance the physical fitness because tennis game improves the fitness quality particularly among children. Tennis game has three and five sets, and played more than three hours and demand more physical fitness such as speed, agility, endurance, and strength to challenge at competitive level.

Handgrip strength is a physiological variable that is affected by a number of factors including, age, gender, and body size among others.³

Grips strength determines the handedness of an individual an important field of population variation study.⁸ It is often used as an indicator of overall physical strength¹³, hand and forearm muscles performances¹⁴ and as a functional index of nutritional status¹⁵ and physical performance¹⁶.

It is well known that muscle strength can be improved with a strength training program ¹¹.

It is reasonable to presume that a person who has a stronger grip should be able to grasp a handheld instrument with greater tightness than one with a weaker grip ¹⁰.

There are different types of exercises to improve hand muscle strength, like, power web, theraputty, hand gripper, table with pulleys, free weights, etc ⁹.

Resistive hand exerciser has the shape that feels great in the hands. It is designed to provide effective resistive therapy in a wide variety of exercises for the fingers, hand, wrist, and forearm. With regular use, there is improvement in grip strength, increased dexterity and mobility ⁹.

Doing putty exercise is a great form of fingers and grip strength training. Using putty to train fingers is very low impact and as a result it can be done more often with lower risk of injury ¹⁸.

Hand putty can be formed into various illustrated shapes, providing a balanced exercise program. Strengthening opposing muscles maintains a delicate muscular balance which improves one's dexterity and coordination ¹⁷.

There are fewer studies done on improvement of hand strength by giving different exercises in tennis players. Hence, the need of the study is to evaluate the effect of different resisted exercises, like, hand gripper and theraputty in improvement of grip strength in tennis players.

II. Methodology

STUDY DESIGN:

Experimental study.

RESEARCH SETTING:

- SAI (Sports Authority of India, Imphal, Manipur)
- Officers' Club (Lamphelpat, Imphal, Manipur)

POPULATION:

Tennis player fulfilling the inclusion criteria.

SAMPLING:

Non- randomized with convenient sampling.

SAMPLE SIZE:

A sample of 30 subjects took part in the study.

SELECTION CRITERIA:

1. INCLUSION CRITERIA –
 - Age between 14 – 25 years
 - Male tennis players
 - Tennis players without any history of upper limb trauma and medical illness.
2. EXCLUSION CRITERIA
 - Female tennis players
 - Subjects with surgical records
 - Subjects with upper limb trauma and medical illness

INSTRUMENTATION:

- Hand gripper.
- Theraputty (Green).
- Standard weighing machine.
- Flexible measuring tape.
- Handheld Dynamometer

OUTCOME MEASURES:

Handgrip strength was measured by handheld Dynamometer



Instrument used – Hand Gripper, Theraputty (Green), Standard Weighing Machine, and Flexible Measuring Tape.



Handheld Dynamometer.

PROCEDURE

Samples of 30 subjects were taken. The subjects’ demographic details, such as, age, dominance, height and weight of each participant were noted and BMI were calculated before proceeding the study.

HEIGHT MEASUREMENT: Subjects were made to stand in erect position and heights were measured using a measuring tape.

WEIGHT MEASUREMENT: Subjects’ weights were measured by using standard weighing machine.

BMI: It was calculated using the formula, weight (kg)/height (m)².

HAND DOMINANCE: This was determined by asking the subjects with which hand they hold pen while writing.

EVALUATION OF HAND GRIP: Each participant was seated on a chair with straight back and forearm resting on the chair in 90°. Procedure was demonstrated to the participant. Grip strength was assessed first on dominant hand and then the non-dominant by using handheld Dynamometer. The calibration of the instrument was tested periodically during the study and also in between the 3 squeezes. The participants were asked to squeeze the dynamometer 3 times with each hand. There was a 1 minute resting period between each squeeze in order to overcome fatigue. The mean value of 3 squeezes was taken in account.

EXERCISE PROGRAM: Resisted exercises using hand gripper and theraputty (green) were given for 20 repetitions of each exercise per day with a rest period of 5 minutes in between the 2 exercises. After 3 weeks, the grip strength of tennis players was again assessed.



Resisted exercises of hand using Theraputty (Green)

III. Findings

Result of analysis of hand grips of Dominant and Non-dominant Hands in the beginning.

Average Hand Grip		Calculated Z	Critical Z (p < 0.005)
DH ₁ (38.33)	NDH ₁ (34.14)	38.982	1.96

Figure 1: Analysis of hand grips of DH and NDH in the beginning.

Graphical analysis of handgrip strength of DH and NDH in the beginning.

Result of analysis of hand grips of Dominant and Non-dominant Hands after 21 days (3 weeks).

Average Hand Grip		Calculated Z	Critical Z (p < 0.005)
DH ₂₁ (44.14)	NDH ₂₁ (38.42)	38.39	1.96

Figure 2-Analysis of hand grips of DH and NDH after 21 days (3 weeks).

Graphical analysis of handgrip strength of DH and NDH after 21 days (3 weeks).

Result of analysis of hand grips of Dominant Hands on 1st day and after 21 days (3 weeks).

Average Hand Grip		Calculated Z	Critical Z (p < 0.005)
DH ₁ (38.33)	DH ₂₁ (44.14)	38.98	1.96

Figure 3-Analysis of hand grips of DH on 1st day and after 21 days (3 weeks).

Conclusion: The analysis of data on hand-grips as recorded on 21st day of investigation i.e. after three weeks , showed that grip of Dominant Hand (DH) is significantly higher or say stronger than that of Dominant Hands strength on 1st day . The grip strength of Dominant hand after 3weeks increased by 15% as compared to Dominant Hand on 1st day.

Result of analysis of hand grips of Non- Dominant Hands on 1st day and after 21 days (3 weeks).

Average Hand Grip		Calculated Z	Critical Z (p < 0.005)
NDH ₁ (34.49)	NDH ₂₁ (38.42)	26.38	1.96

Figure 4 -Analysis of hand grips of NDH on 1st day and after 21 days (3 weeks).

Conclusion: The analysis of data on hand-grips as recorded on 21st day of investigation i.e. after three weeks , showed that grip of Non-Dominant Hand (NDH) found on 21st day is significantly higher or stronger than that of Non-dominant Hand on 1st day. The grip strength of Non- Dominant hand is found increased by 12.2% as compared to Non-dominant Hand on 1st day.

Summary Table

DH ₁ > DH ₂₁ 38.33 44.14	NDH ₁ > NDH ₂₁ 34.49 38.42
Z = 38.39	Z = 26.38
Significant	Significant

Difference in hand grip of DH and NDH on the 1st and after 21 days (3 weeks)

IV. Result

The result of the study showed that there was a significant improvement in post-grip strength of both the dominant as well as the non-dominant hands since p<0.005.

V. Discussion

In this study, a total sample of 30 tennis players was taken. The objectives of the study were:

(1)To measure body height and weight of selected tennis players, (2) To determine the hand preference of selected tennis players, (3) To measure hand grip strength of selected tennis players, (4) To evaluate the effects of resisted exercises (gripper and theraputty) in the improvement of grip strength.

The findings of the study revealed that exercises done with the hand gripper and theraputty (green) showed significant increase in grip strength post 3 weeks after performing the given exercises. The mean of the pre-grip of dominant hand was 38.33, whereas, the mean of the post-grip of dominant hand was 44.14. The mean of the pre-grip of non-dominant hand was 34.94 and the mean of the post grip of non-dominant hand was 38.48. This

shows that, there was a significant increase in post-grip of both the dominant as well as the non-dominant hand since $p < 0.005$.

the racquetball player's grasp on the racquet has direct effect on the rotation of the racquet (that is position of the racquet in the hand) before, during, and after impact with the ball²⁶. A strong grip will influence a racquet sport athlete's ability to maintain adequate control of the racquet before and after striking the ball¹⁰.

Exercise with hand gripper significantly improved all the three types of pinch and grip strength¹⁹. It was also previously found that the arm of an experienced tennis player was able to exert a greater force than the untrained arm²³.

Training included resistance exercises which enhance the strength and the endurance of the muscles. Strength initially increases due to neuromuscular adaptation associated with an improved recruitment of motor unit in skeletal muscle. Higher threshold motor units are recruited first and thus there is an increase in the maximal force generated in the muscle. Although changes in cross sectional area of hypertrophied muscle begins in the initial stage of strength training. It only begins to contribute meaningfully to improve strength as muscle hypertrophy becomes more visible. There is a direct correlation between the increase in muscle circumference and the increase in force generated by the muscle.²⁴

VI. Conclusion

The study concludes that, the resisted exercises were effective for improving the hand grip strength in tennis players. Hence, either of the exercises or a combination of the two mentioned exercises (both gripper and theraputty) can be helpful while training the tennis players for improvement of hand grip strength.

LIMITATION

- Sample size was small.
- Age group was less wide.

Female player was not included.

- **Ethical clearance-**
SAI (Sports Authority of India, Imphal, Manipur)
Officers' Club (Lamphelpat, Imphal, Manipur)

- **Source of funding-**

Self

Conflicts of Study-

NIL

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