

## Comparative Study of Grip Strength Assessment in Tennis Player with and without Shoulder Pain

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### Abstract

**Background:** Tennis deals with chronic shoulder injuries and also grip strength is important for muscle function, injury prevention and performance. There is positive correlation between grip strength and shoulder musculature. Hence this study finds and compares grip strength in tennis players with shoulder pain and without shoulder pain.

**Methodology:** Ethical committee approval was taken. The subjects selected were in age group of 20-30yrs with experience of 2-5 years having chronic shoulder pain. 30 subjects were selected - 15 with shoulder pain and 15 without shoulder pain with mean age of was 23yrs with S.D.±3.6. With the help of Visual Analogue Scale the pain score was recorded. The testing position for grip strength assessment was taken using Jamar Hand Dynamometer according to American society of hand therapist. The participants seated with straight back with both feet flat on floor with the shoulder adducted and neutrally rotated. The elbow flexed at 90 degrees of flexion, the forearm in neutral, and the wrist between 0- and 30-degrees extension and 15 degrees ulnar deviation. The average of grip strength with pain and without pain was taken. The analysis of results was done and tabulated.

**Results:** The study found that mean VAS was 3.8 and mean grip strength in shoulder pain was 29.88 and without shoulder pain was 37.4.

**Conclusion:** This study found that there was decrease in grip strength in players with shoulder pain than players without pain.

**Keywords:** Grip Strength; Jamar Hand Dynamometer; Shoulder Pain

### Introduction

Functions of daily living require high activity levels of flexor musculature of the forearms and hands. The flexor muscles are primarily involved for strength of one's grip. Some degree of grip strength is necessary for successful sports like wrestling, tennis, football, basketball, and baseball to daily activities like carrying laundry, turning a doorknob, and vacuuming. Tennis players may require adequate grip and forearm strength, to avoid the risk of

developing tennis elbow [1]. In tennis, upper extremity injury is also common due to repetitive overhead shoulder activities [2]. For tennis players, shoulder is one of the most used joints in the body. Fatigue, overuse and faulty biomechanics leads to repetitive micro trauma and leads to PAIN. The reason of shoulder pain is majorly due to impingement and instability during repetitive lifting and overhead arm movements [3]. Typically, this makes it one of the most injured areas in competitive players. Shoulder

redistributes muscle activity to distal joints. Due to the fact that tennis demands playing with racket and long hours of matches, a tennis player must develop strong grip, forearm strength as well as muscular endurance. Hence for injury prevention and overall strength development one's grip plays crucial role [4]. The grip strength is correlated to various factors like fatigue, rotator cuff weakness and overall physical function [1]. Chronic shoulder pain may affect the ability of the muscle to function related to joint stability and control. Hence proximal muscle activity is important for distal joint function. Therefore gripping activity is important to evaluate while assessing shoulder load in manual work and clinical evaluation of patients with shoulder pain. In tennis, during forward swing, it places more load on the upper extremity when serving and therefore increases risk of injury. As a player has more grip and forearm strength, the lesser stress will place on the joints. Hence the shoulder-related injuries can be prevented by sufficient grip and forearm strength. A weak grip or forearm is overcompensated by the shoulder muscles and increases injury risk. Many Studies have proven connection between rotator cuff muscles and hand [5]. Hence this study finds and compares grip strength in tennis players with shoulder pain and without shoulder pain.

### Aim

To find out and compare grip strength in tennis player with and without shoulder pain.

### Objectives

- To find out grip strength in tennis player without shoulder pain.
- To find out grip strength in tennis player with shoulder pain
- To compare the grip strength in tennis player with and without shoulder pain.

## Materials and Methods

### Study design

Experimental Study taken for tennis players in Pune.

### Study population

Tennis players.

### Sample size

30.

### Sampling method

Purposive sampling.

### Inclusion criteria

- Age group 20-30yrs
- Experience of 2-5 yrs.
- Subjects with shoulder pain more than 6 months
- Subjects without shoulder pain.

### Exclusion criteria

- Traumatic cases of upper limb injury
- Polyarthritis
- Elbow injury
- Wrist and hand injury
- Neuromusculoskeletal disorders.

### Materials used

- Pen
- Paper
- Jamar hand dynamometer.

### Outcome measure

- VAS Scale
- Grip strength reading

### Procedure

Ethical committee approval was taken. Permission from head of tennis academy was taken. Subjects were selected according to inclusion criteria. The written consent from the subjects was taken. The study procedure was explained in detail. Assessment of shoulder pain was done by giving the subject Visual Analogue Scale for pain they experienced. They were asked to rate their intensity of pain and mark the point on 10cm scale. VAS was taken by straight line having end points defining extremes as "no pain at all" and "worst possible pain". The mark was noted and recorded with help of scale. American society of hand therapist suggested a standardized testing position for handgrip strength in which subject seated with the shoulder neutral and adducted, the elbow flexed at 90 degree and forearm in neutral and wrist in 0-30 degrees extension and 0-15 degrees ulnar deviation (Fess and Moran,

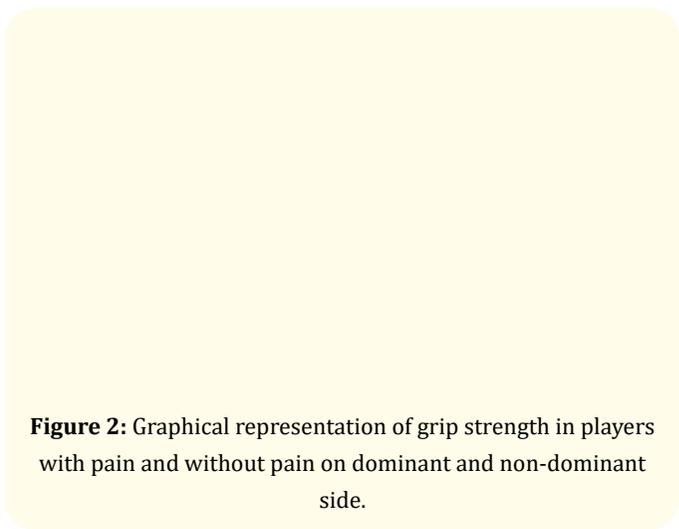
1981) [7]. For grip strength assessment the dynamometer was held comfortably without support with constant position of the hand. The subjects were asked for maximum force on the dynamometer and “squeeze” hand piece and hold the position for 5 seconds with maximum force. The readings were taken on both sides. The test was performed without any verbal encouragement. 3 values were recorded and it was reset to 0 position prior to each reading. The subjects were given a minute of rest to reduce effects of fatigue. The maximum value was recorded in kilograms on dominant hand in subjects with shoulder pain and without shoulder pain.

**Statistical analysis**

Unpaired T test was used for analysis.

**Results and Discussion**

In this study the p value was 0.000 which was significant for grip strength in tennis players with shoulder pain and without shoulder pain.



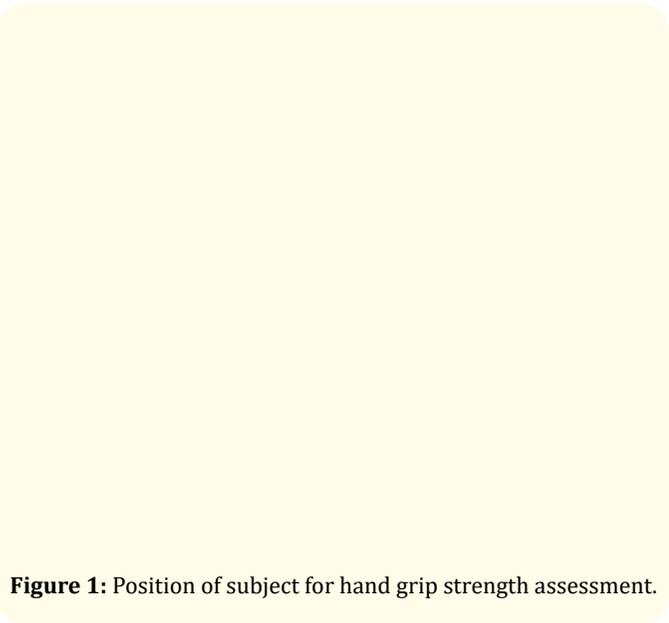
**Figure 2:** Graphical representation of grip strength in players with pain and without pain on dominant and non-dominant side.

In this study the mean age was 23yrs with S.D. ± 3.6. Patients having shoulder pain with mean VAS score of 3.8, the grip strength was 29.88 with SD ± 5.37 and for patients without shoulder pain, the grip strength was 37.4 with SD ± 5.01.

On statistical analysis the p value was 0.000 i.e., statistically significant using paired t- test. Thus, grip strength was affected in tennis players shoulder pain.

**Discussion**

The purpose of the study was to evaluate grip strength in shoulder pain. The mean VAS was 3.8 and grip strength in shoulder pain was 29.88 and without shoulder pain was 37.4. In this study, we found decrease in grip strength in players with shoulder pain than players without pain. Fatigue, overuse and faulty biomechanics leads to repetitive micro trauma leads to chronic pain. In tennis players common condition that can result in chronic shoulder pain include rotator cuff disorder, shoulder bursitis and shoulder instabilities. Due to this vicious cycle there is adaptation to pain which affects the ability of muscle to function related to joint stability and control. It is found that these changes tend to persist into period of chronicity. ROBERT LV STINEAR CM in 2008 EMG studies showed positive correlation between rotator cuff muscle activity and handgrip strength. He also suggested that propriospinal pathways may connect the hand to the rotator cuff of the shoulder [5]. Also Mandalidis and O’Brien justified this relationship by overflow principle. According to this principle, the neural circuits mediated the co-activation of the agonists and synergists muscles



**Figure 1:** Position of subject for hand grip strength assessment.

GRIP Strength	MEAN	S.D.	T value	P value
With shoulder pain	29.88	5.37	4.285	0.000
Without shoulder pain	37.4	5.01		

**Table 1:** Comparison of grip strength in players with and without shoulder pain.

of a specific task [8]. As the kinetic chain comprises of GH joint, upper arm, forearm and hand. The ultimate velocity of distal segments depends on velocity generated by proximal segment and their interaction. A weak grip may be the reason for proximal compensatory mechanisms in the cervical spine, shoulder and elbow. In one segment the lack of stability may be compensated by another segment. In case of shoulder soft tissue injury, there is tendency to compensate in order to protect the injury. Therefore in order to prevent further injury, there is weakening of grip strength of hand. As it is known, the proximal joints must be stabilized well by surrounding muscles for effective muscle action on distal joints.<sup>11</sup> Hence, the stability of proximal joint has relationship with mobility in distal joint. And this justifies the link between rotator cuff strength and hand grip strength. Many experimental studies also concluded that increase in shoulder stability has improved grip strength. As it is easy to perform, less time consuming and strongly associated with the rotator cuff strength, isometric grip strength testing can be used as an outcome measure to assess shoulder rehabilitation programs. The other sophisticated tools can be replaced by this simple hand grip strength method. There is further scope to investigate different causes of shoulder pain and their relationship with grip strength.

## Conclusion

Based on the study findings, it was concluded that there was significant effect of shoulder pain on grip strength. Also that chronic shoulder pain has an effect on grip strength. The limitations of this study are small sample size. Also other factors like shoulder pain cause, height and weight can be considered for future studies. In future, same study can be conducted to find out effect on grip strength in acute shoulder pain, correlation between grip strength and performance of tennis player and grip strength in different pathological condition of shoulder.

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