

# Analysis of Rotator Cuff Injury in Tennis Players Using Long Racket versus Short Racket

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## ABSTRACT

### Background:

Tennis is a famous recreational sport worldwide; however, it involves numerous abrupt and distinct body movements that may lead to severe musculoskeletal injuries to the player. Most common musculoskeletal injuries in tennis are overuse injuries of wrist and elbow. But certain factors may also put stress on other body parts, for instance, shoulder and calf regions. The aim of the study was to find out association of rotator cuff injury with length of rackets among tennis players.

### Methodology:

This analytical association study was conducted in Shahina Jamil Hospital - Frontier Medical College, Abbottabad and King Abdullah Teaching Hospital, Mansehra. Inclusive criteria were fulfilled by recruiting tennis players from different clubs and universities. Data was collected after taking informed consent through convenient non-probability sampling technique. Hawkins-Kennedy test was used to assess the rotator cuff tendinitis.

### Results:

The results showed that the age and experience have a consistent relationship with the racket lengths, with older and more experienced participants using long racket frequently. However, the probability (p-value) of association of rotator cuff injury and length of rackets used by tennis player was 0.488, indicating that rotator cuff injury is not dependent on the length of the racket used by tennis players.

### Conclusion:

There was no significant association between rotator cuff injury with the length of long and short rackets in tennis players. The probability of injury may depend on the body mechanics of the player.

### Keywords:

Pain, Rotator cuff, Shoulder joint, Sports, Tennis, Overuse injuries, Musculoskeletal, Racket/Racquet length

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## INTRODUCTION

Tennis is amongst the most famous sports worldwide as it involves a remarkable amalgamation of aerobic and anaerobic moves making it an exciting game for the youth.<sup>1</sup> Yet at ground level, tennis exposes its player towards a dynamic series of strokes and rapid movements, leading to a diverse profile of musculoskeletal injuries.<sup>2,3,4</sup> So, to meet the physical demands of this sport, athletes put themselves at the venture of several musculoskeletal injuries.<sup>5,6</sup> Hence, we can conclude that more than 50% of athlete departures from tennis can be attributed to injuries. This highly increased prevalence of injuries has shifted the attention of many researchers towards the mechanics of playing

tennis.<sup>7</sup>

Most common injuries resulting from tennis may be caused by sudden movements and overuse syndromes,<sup>5,8</sup> presenting mostly as pain and inflammation. These overuse injuries can be sustained because of the failure of body to continuously strike back to monotonous and micro-traumatic occasions of over-burden. These injuries are most prevalent in lower extremity, but also affect upper extremity and low back in the same ratio. These injuries include plantar fasciitis, Achilles strain, calf strain, hamstring strain, jumper's knee, tennis elbow, low back pain, etc.<sup>9</sup> According to the available knowledge the leading reasons for injuries among tennis players can be

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summed up as depicted in **Table 1**.<sup>1,5,10</sup>

Serial Number	Cause of injury	Percentages
1	Action error (receiving swing too large)	45%
2	Inadequate preparation	21%
3	Excessive movement	18%
4	Fall	16%

Table-1: Tennis injury causes

Rotator cuff, a multiplex of four muscles for stabilisation of glenohumeral joint, includes subscapularis in front, supraspinatus above and infraspinatus and teres minor on back.<sup>11,12</sup> When the arm is abducted overhead, rotator cuff muscles impinge between the acromion process and greater tuberosity of humerus. Due to this impingement, vascularity of supraspinatus may be compromised. This chronic irritation may ultimately lead to tendinitis.<sup>13</sup> Moreover, inflammation can thicken the rotator cuff, thus hampering the functional activity of rotator cuff muscles.<sup>14</sup> Therefore tennis players frequently encounter exaggerated external rotation at glenohumeral joint due to the weakness of internal rotators in the dominant shoulder. This pathology exhibits the existence of internal impingement following the rotator cuff tears in repetitive overhead motions. If not treated properly, it can lead to shoulder instability or even biceps tendinitis.<sup>15</sup>

This study aims to compare the effects of long handle and short handle rackets on injuries of rotator cuff muscles in tennis players. While ample research literature is available on the injuries of lower extremity as well as elbow and wrist, very few studies are available on shoulder injuries specifically rotator cuff injuries. So, this research investigates the frequency of rotator cuff injuries in tennis players. Additionally, it also compares the injury frequency of rotator cuff in players using long handles versus short handles of tennis rackets.

## OBJECTIVE OF THE STUDY

To find out association of rotator cuff injury with length of rackets among tennis players

## MATERIALS AND METHODS

This study was an analytical (associational) study, conducted in Shahina Jamil Hospital - Frontier Medical College, Abbottabad and King Abdullah Teaching Hospital, Mansehra during the year 2018.

### Inclusion criteria

- Tennis players of different universities and sports clubs
- Players with experience of at least one year
- Players practicing and playing for at least 25 hours a week throughout the year

### Exclusion criteria

- Players having any systemic and musculoskeletal disease or any recent trauma

### Tool of Data Collection

- Hawkins-Kennedy test; used to assess rotator cuff tendinitis<sup>16</sup>

### Data collection procedure

The participants were informed about the objective of this study. Subjects of this study were lawn tennis players from different clubs and universities. The selected sample size was 100 players. The method used to calculate the sample size was online "Java applets for power and sample size" software by Russ Lenth.<sup>17</sup> The sample population was selected based on convenient non-probability sampling technique and the data was collected individually from the players. The questionnaires were filled by the participants themselves except those having any language barrier. The criteria followed for grouping of the short racket and long racket according to their lengths has been depicted in the **Table-2**.<sup>18,19</sup> Since all the players were adults, so the Senior/Adult racket ranges were used for making the aforementioned two groups of participants.

Serial Number	Type of Lawn Tennis Racket	Length Range
1	Junior Racket Range	19 to 26 inches (49-66 cm)
2	Senior/Adult Racket Range	Short Racket
	Long Racket	27-28 inches (<28") (69-71 cm)
		28-29 inches (71-74 cm)

Table-2: Criteria for standard tennis racket lengths<sup>18,19</sup>

### Ethical consideration

The study was approved by the ethical review board. Data was taken after informed consent from the athletes. A written consent was taken from the authorities of registered players from the clubs as well as from the subjects. Privacy of collected data was ensured. The researchers followed all the rules of medical ethics and respected athletes' values and morality according to the Declaration of Helsinki.<sup>20</sup>

### Statistical procedures

For statistical analysis, Microsoft Excel 2016 and IBM SPSS statistics software version 22 were used to record and analyse the data. For categorical variable, frequency or percentage were used and for discrete variables, mean and standard deviation were used. Chi-square test was used to determine the association between rotator cuff tendinitis and lengths of rackets used by tennis players. P-value < 0.05 was considered statistically significant.

## RESULTS

The mean age in years of athletes using long rackets was 35.36 ± 6.26. The mean age in years of the athletes using short rackets was 26.66 ± 4.40. The mean experience in years of the athletes using long rackets was 7.40 ± 2.82. The mean experience in years of the athletes using short rackets was 4.66 ± .34. These results of descriptive statistics are depicted in **Table 3** along with the significance i.e. p-value of each variable. It shows that the age and experience have a significant and consistent relationship with the racket lengths, with older and more experienced participants using long racket frequently (**Table 3**).

Type of Racket Handles	N	Long Racket	Short Racket	p-value <sup>#</sup>
Age	50	35.36±6.26	26.66±4.40	0.00
Mean ± SD*				
Experience	50	7.40 ± 2.82	4.66 ± 2.34	0.00
Mean ± SD*				

\*SD = Standard Deviation; #p-value for chi square = <0.05

Table-3: Descriptive statistics for age and Experience

On the other hand, Chi-square test of independence when applied for inferential statistics, showed no significant association between rotator cuff injury and length of rackets used by tennis players, i.e.  $\chi^2(1, N=100) = 0.488$ , so  $p > 0.05$  here. This p-value of 0.488 is greater than the statistically significant p-value of  $p < 0.05$  (**Table-4**). Hence, the results with a p-value greater than the statistically significant p-value indicate that the rotator cuff injury is independent of the racket length used by the tennis players.

Type of Racket Handle	Test				N = 100
	Positive		Negative		
	n	%	n	%	
Long	14	28	36	72	50
Short	11	22	39	78	50
<b>P-value = 0.488</b>					

"n" = frequency of association; "%" = percentage of association; N = sample size

Table-4: Chi-square test of association between rotator cuff injury and lengths of rackets

## DISCUSSION

Players involved in overhead sports are more susceptible to rotator cuff muscle injury.<sup>21</sup> As already mentioned, this research comprehensively elaborated the rotator cuff damage seen in tennis players. Specifically, this study investigated the extent to which the injury of rotator cuff muscles could occur due to usage of variable lengths available in tennis rackets. Beyond this fact, it was the only study to measure any significant relationship between the occurrences of rotator cuff injury associated with the use of short length and long length of tennis rackets individually in recent few years. Hence, the generalized results derived by chi-square analysis showed that there was no significant relationship between rotator cuff injury and length of rackets used by tennis players. So, consequently the use of short length and long length tennis rackets would not individually produce any difference of strain on player's rotator cuff muscles. Therefore, a tennis player can use his desired racket length while playing without any fear of having shoulder injury.

This study compared equal participants who happened to use long rackets and short rackets (**Table 2**). Eventually, most of the participants using long rackets produced a negative Hawkins-Kennedy test (n=35) similar to the majority of those using shorter rackets also producing a negative status (n=39). So, this result draws our attention towards the fact that overuse injuries of the wrist and elbow are more prevalent in tennis players rather than any other musculoskeletal injury. Furthermore, it identifies that the variable length of rackets does not put any strain on shoulder joint. Instead the altered biomechanics of the player's body can produce strains of shoulder joint<sup>21</sup>, but this is beyond the scope of this research.

On the basis of these results, the current study simulates and validates the work of other relevant studies carried out on tennis players and tennis rackets. A study conducted by Ricardo E. Colberg et al. in 2015 on tennis players in France, showed a positive comparison of asymmetrical injury frequency in dominant axial side and non-dominant axial side. The results were suggestive that players with a history of injury at the upper limb present altered dominant upper limb mechanics, and such asymmetrical proportions would be specific to the injury location.<sup>5</sup> Another study conducted by Thomas Creveaux et al. in 2013, to evaluate the effect of the racket on a tennis player's shoulder, concluded that racket specification is a critical point for coaches who train players suffering from shoulder pain and injuries.<sup>23</sup>

Nevertheless, it has also been observed that insufficient preparation and action errors such as too long swings, mainly contribute to rotator cuff muscle injury (**Table-1**). Other reasons for injury include excessive movements and falls; all these findings being supported by the study conducted during 2010 to 2015 by **Haolin Fang et al.**<sup>10</sup>

## CONCLUSION

There is no significant association between rotator cuff injury and the length of long and short rackets in tennis players. The probability of injury may depend on the body mechanics of the player.

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