

# Effect of Patellar Tendinopathy on Agility in Recreational Fast Bowlers

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**Abstract:-Background:** Musculoskeletal disorders are natural health problems in sports players. Patellar tendinopathy caused by repeated loading of knee extensor mechanism, and pathological region is differentiating from normal tendon, with cellular changes. Cricket is most popular sport. Cricket has both high rate of gradual onset of various injuries and great variations in players workload. Recreational bowlers means players who plays for their amusement, enjoyment, fun hobby and pleasure. The term fast bowlers refers to bowl fast, medium-fast or medium. And this bowling motion involves run-up and straight-arm hurling movement with predominant associated injuries occurring to lumbar spine and limb. Agility is expressed as ability to immediate change in direction and to start and to stop quickly. Good agility needs complete mixture of speed, balance and coordination. So the purpose of this study is to find out the effect of Patellar tendinopathy on Agility.

**Aim:** To find out the effect of patellar tendinopathy on agility in recreational fast bowler.

**Objectives:** To diagnose patellar tendinopathy in recreational fast bowlers using the Royal London Hospital test. And to assess the agility of the recreational fast bowlers by using agility t-test.

**Methodology:** Total 90 subjects were taken of age 19-26 years old recreational fast bowlers according to inclusion and exclusion criteria using Purposive sampling method. Royal London Hospital test performed for diagnosis of patellar tendinopathy. And then agility T-test performed in that same players who has positive patellar tendinopathy.

**Result:** There is maximum recreational fast bowlers who have patellar tendinopathy of age 20 years (24.4%) and 19 years (21.1%). And there is maximum players who has maximum practicing years as 10 years (18.9%) and 6 years (14.4%). As there is all players are of patellar tendinopathy but having different leg affection like most of recreational fast bowlers have left leg affection and the percentage of interpretation of agility T-test of players has maximum percentage in poor (46.7%) and average (30%).

**Conclusion:** The above study concluded that agility is

more affected in recreational fast bowlers who has patellar tendinopathy. Which shows the maximum players (in percentage) who has interpretation of agility T-test as poor(46.7%) and average (30%).

**Keywords:** recreational fast bowlers, patellar tendinopathy, Royal London Hospital test and agility T-test.

## INTRODUCTION

Musculoskeletal disorders are natural health problems in sports players. Patellar tendinopathy is common and significant syndrome in sports medicine and occurs in several sports.<sup>(1)</sup> Patellar tendinopathy is tendinosis typically in deep posterior portion of patellar tendon and adjacent to lower pole of patella.<sup>(2)</sup> Tendinosis is characterized by progressive tissue degeneration and complete absence of inflammatory cells.<sup>(3,4,5)</sup>

Patellar tendon is originates from anterior aspect of distal end of the patella, causing anterior to knee joint and inserted on tibial tuberosity. Patellar tendinopathy caused by repeated loading of knee extensor mechanism, And pathological region is differentiating from normal tendon, with cellular changes.<sup>(5)</sup> In this it includes abnormal patellar laxity and muscular tightness and imbalance.<sup>(6)</sup>

Tendinopathy is associated with relative expansion of tendinous tissue, loss of the longitudinal alignment of collagen fibers. <sup>(7)</sup> For patellar tendinopathy to develop, repeated heavy loading of the tendon is required. This explain its prevalence in sports including some form of jumping, such as basketball, volleyball and cricket.<sup>(8)</sup>

As the characteristics lesion in patellar tendinopathy, it has been hypothesized that loading exposes this region to the most strain. This may cause pain which

is usually of insidious and gradual. And may precipitate by an increase in frequency and intensity of repetitive ballistic movement of the knee. (9) Patellar tendon tenderness is typically located at inferior pole of patella and it influenced by knee position.(1)

Recreational sports means: sports activities that mainly serve physical fitness, the compensation of physical inactivity and enjoyment of sports. Recreation bowlers means players who plays for their amusement, enjoyment, fun hobby and pleasure.

Cricket is most popular sport in India. (10) The major global team of sports, cricket has both high rate of gradual onset of various injuries and great variations in players workload.(11) Whereas most team sports are played over a short and particular duration, cricket is played in a variety of form.(12)

There are three unique aspect of the game that is bowling, batting and fielding which are associated by risk of injury(13). The term “fast bowlers” refers to bowlers who bowl fast, medium-fast or medium (that is bowling with a fast run up, with ball speed generally above the 100kph)(14). Fast bowling motion involves a run-up and straight- arm hurling movement with the predominant associated injuries occurring to lumbar spine and lower limb.(15)

The complete bowling action is divided into five distinct positions or phases (figure 1);

1. Back foot impact
  2. Delivery stride/ front foot impact
  3. Cradle position
  4. Ball release
  5. Follow through Back foot impact (BFI): This is a phase from run-up to landing on the ipsilateral foot before the delivery of the ball. E.g. it is the right foot for a right handed bowler.(16)
- Delivery stride/ front foot impact (FFI):

In delivery stride the bowler being in a side-on position with trunk hyper-extended and away from the batsman.

The front foot lands pointing in the direction of the batsman with an angle of about 30 degree to the leg side of the target, with shorter stride length compared to a fast bowler.

Cradle position:

In this phase, hips begin to rotate forward to reduce shoulder pelvic separation at ball release phase. Thus, the weight transferred from the back foot to the front foot with internal rotation of rear foot, while maintaining the side-on position, as the front foot is in slight internal rotation and adduction.(17)

Ball release:

At the time of the ball delivery, the bowler pivots his body on the metatarsophalangeal joint of the front foot with trunk forward flexion of approximately 55 degrees. This helps the bowler to rotate his rear leg hip joint to increase ball revolution by kinetic chain mechanism, resulting in more deviation of the ball from the pitch.(16)

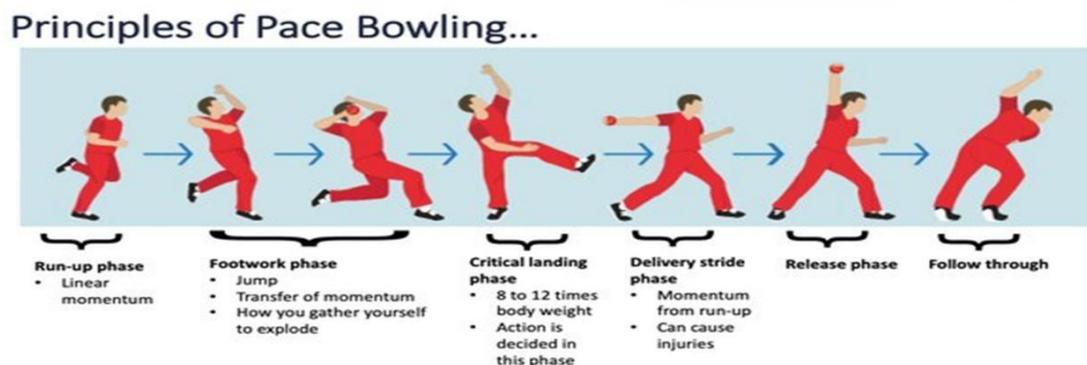


Figure 1- Phases of bowling or principles of pace bowling

These days in cricket the actual physical demand has expanded which needs the players to possess more agility, and strength. In cricket the ability to change direction quickly, running before ball release action need agility.(18)

Agility is one of the critical components of any sports. Agility is generally expressed as the ability to immediate change in directions and to start and to stop quickly. Also it has identified as ability to maintain and control correct body positions while

changing the direction throughout a series of movements.<sup>(19)</sup> Good agility requires complete mixture of speed, balance, coordination and power. It includes the aggregate capacities of player which helps the players to do group of movements good quality and effect.<sup>(20)</sup> These involve their capacity to react, balance, orients themselves and to perceive a rhythm of movement to perform a particular task precisely.<sup>(19)</sup>

For the T-test, 4 cones were arranged in T shape, with cones placed 9.14m from the starting cone and 2 additional cones placed 4.57m from either side of the second cone. All of the times were recorded using an stopwatch, with a height of 0.75m and a width of 3m, in line with marked starting point.<sup>(21)</sup>

Royal London Hospital test is test which has elicited local tenderness by palpating the tendon with the knee in the neutral position. The specificity and sensitivity of the Royal London Hospital test is very high and it mostly used in volleyball, tennis and cricket.

#### NEED OF STUDY

Agility is one of the critical factor of cricket. Cricket is one such sport where agility is important aspect for a players to excel. Good agility requires a complete mixture of speed, balance, power and coordination. The agility of cricket players differs on the basis of their anthropometric measurements, positions, training period and type of innings played. Improved agility in enhance neuromuscular coordination thereby reducing the risk of injuries to the cricket players. Limited literature is available evaluating agility of cricket players.

Study focus on examine workloads in fast bowlers during and prior to cricket matches and to investigate relationships between workload and injury risk for different tissue subtypes (bone, muscle, tendon and joint). Hence, a need arises to conduct this study. The aim of this study is to evaluate and compare the agility of players depending on their position during bowling.

There is no study which check the effect of patellar tendinopathy on agility in recreational fast bowlers. So the need arises to find out the effect of patellar tendinopathy on agility in recreational fast bowlers.

#### METHODOLOGY

Study design- Observational study  
Study setup- District stadium Krida Sankul and

sports club in and around the city.

Sampling method- Purposive sampling.

Duration- 6 months

Sample size- 90

A sample size was calculated using the formula,  
$$n = \frac{Z^2 p(1-p)}{D^2}$$

Where,

n is sample size, Z is statistics correspond level of confidence (95%), p is prevalence (0.0001), d is precision (.1).

#### MATERIALS



Figure 2: Writing pad Figure 3: Cone Figure 4: Mat



Figure 5: Stop watch Figure 6: Measuring tape

#### SELECTION CRITERIA

Inclusion Criteria: I) Male cricket recreational fast bowlers of age 19-26 years.<sup>(24)</sup> II) Playing experience of minimum 3 years.<sup>(24)</sup> III) Patient having patellar tendinopathy.

Exclusion Criteria: I) Knee surgery within previous six months.<sup>(26)</sup> II) Chronic joint disease (OA, RA, any degenerative conditions of bone).<sup>(26)</sup> III) Corticosteroids injections in the patellar tendon within the previous three months.<sup>(26)</sup> IV) Use of drugs 48 hours previously (e.g.: NSAIDs).<sup>(26)</sup>

#### PROCEDURE

The study was started after approved by Institutional ethical committee. Subject were selected based on inclusion and exclusion criteria and all participants

were provided consent prior to enrollment. Demographic details such as name, sex were noted. Outcome measures Agility T-test used to measure a leg speed, leg power and agility of the players. Participants were selected using purposive sampling method.

The procedure was explained to the subject and subject, firstly diagnosed patellar tendinopathy using Royal London Hospital Test (RLHT).

Royal London Hospital Test used for the clinical diagnosis of patellar tendinopathy. The Royal London Hospital test was performed with patient in supine position. This test considered positive when the local tenderness elicited palpating the tendon in relaxed position that is knee extended position, decreases or disappears when the tendon is palpated under tension that is in knee flexion.



Figure 7 (A and B): Royal London Hospital test (Patellar tendinopathy test)

The T-Test is one of the important agility test, Agility T-test commonly used to assess the ability of team sports players to change direction, including acceleration, deceleration and lateral movement during preseason testing protocol.

In this test, a player is asked to run from the start point 10m forward to point one, sidestep to point two before sidestepping to point three, side stepping back to point one and running back to the finish.



Figure 8 A & B : Agility T- test

Data was collected and recorded on master chart and statistical analysis was done. And find out the effect of Patellar Tendinopathy on Agility in recreational fast bowlers and result were calculated.

**OUTCOME MEASURES:**

**AGILITY T-TEST:**

For the T-test, 4 cones were arranged in a T shape, with a cone placed 9.14 m from the starting cone and 2 extra cones placed 4.57m from either side of the second cone. All of the times was recorded using an stopwatch.

A subject starts at cone A. on the command of the timer, the subject sprints to cone B and touches the base of the cone with their right hand. They then turn left and shuffle sideways to cone C, and also touches its base, this time with their left hand. Then shuffling sideways to the right to cone D and touching the base with right hand. They then shuffle back to cone B touching with left hand, and run backwards to cone A. the stopwatch is stopped has they pass cone A.

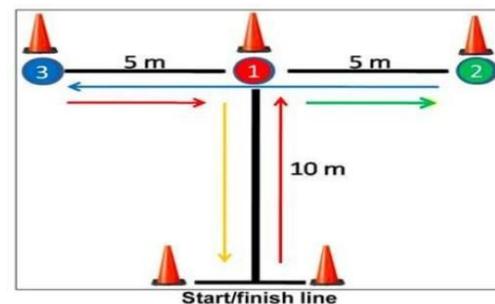


Figure 9: Agility T-Test

Equipment required for test purpose are - cones, stopwatch.

Interpretation of Agility T-test is -

Ranking	Males (seconds)	Females (seconds)
Excellent	<9.50	<10/50
Good	9.51-10.50	10.51-11.50
Average	10.51-11.50	11.51-12.50
Poor	>11.50	>12.50

Table 1- Interpretation of Agility T-test  
Interclass reliability- 0.98

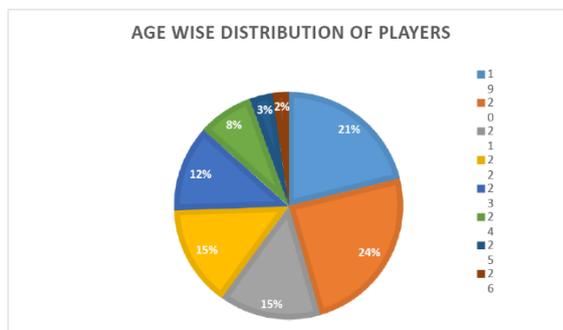
STATISTICAL ANALYSIS:

The data was collected and analyzed using descriptive statistics using percentage in MS Excel sheet and analyzed by using SPSS Version 26 with the level of significance set at  $p < 0.05\%$

RESULTS AND DATA ANALYSIS

Table 2 graph 1 depicts the age wise distribution of players of age 19 to 26 years old recreational fast bowlers.

Age	Frequency	Percent
19	19	21.1
20	22	24.4
21	13	14.4
22	13	14.4
23	11	12.2
24	7	7.8
25	3	3.3
26	2	2.2
Total	90	100



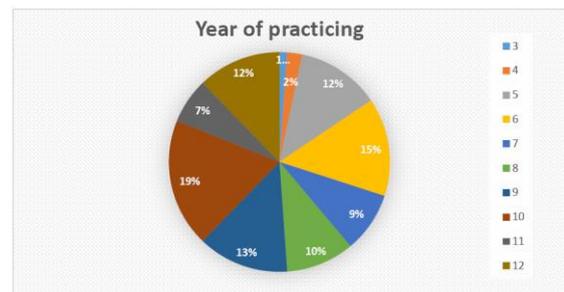
Graph-1 describes the frequency and percentage of age group. And the number of recreational fast bowlers according to their age between 19 to 26.

As 21.1% were in the age group of 19 years, 24.4% were in the age 20 years, 14.4% were in the age group of 21 years and 22 years, 12.2% were in the age group of 23 years, 7.8% were in the age group of 24 years, 3.3% were in the age group of 25 years and 2.2% were in the group of 26 years old recreational fast bowlers.

Table 3 and graph 2 depicts percentage distribution of recreational fast bowlers according to their

practicing years.

Year of practicing	Frequency	Percent
3	1	1.1
4	2	2.2
5	11	12.2
6	13	14.4
7	8	8.9
8	9	10
9	12	13.3
10	17	18.9
11	6	6.7
12	11	12.2
Total	90	100



Graph 2 describes the frequency and percentage distribution of recreational fast bowlers as their practicing years.

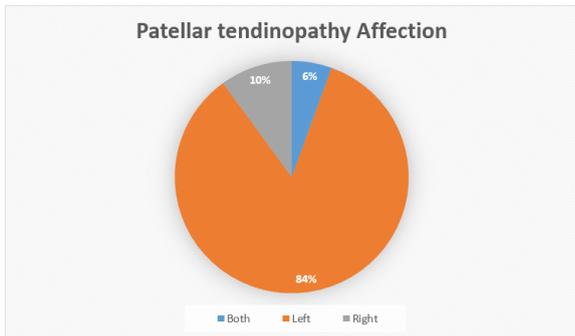
As 1.1% were in years of practicing of 3 years, 2.2% were in the years of practicing of 4 years, 12.2% were in the years of practicing of 5 years, 14.4% were in the years of practicing of 6 years, 8.9% were in the years of practicing of 7 years, 10% were in years of practicing of 8 years, 13.3% were in the years of practicing of 9 years, 18.9% were in the years of practicing of 10 years, 6.7% were in the years of practicing of 11 years and 12.2% were in the years of practicing of 12 years.

Table 4 graph 3 describes percentage of patellar tendinopathy affection.

Patellar tendinopathy affection	Frequency	Percent
both	5	5.6
left	76	84.4
right	9	10

Total	90	100
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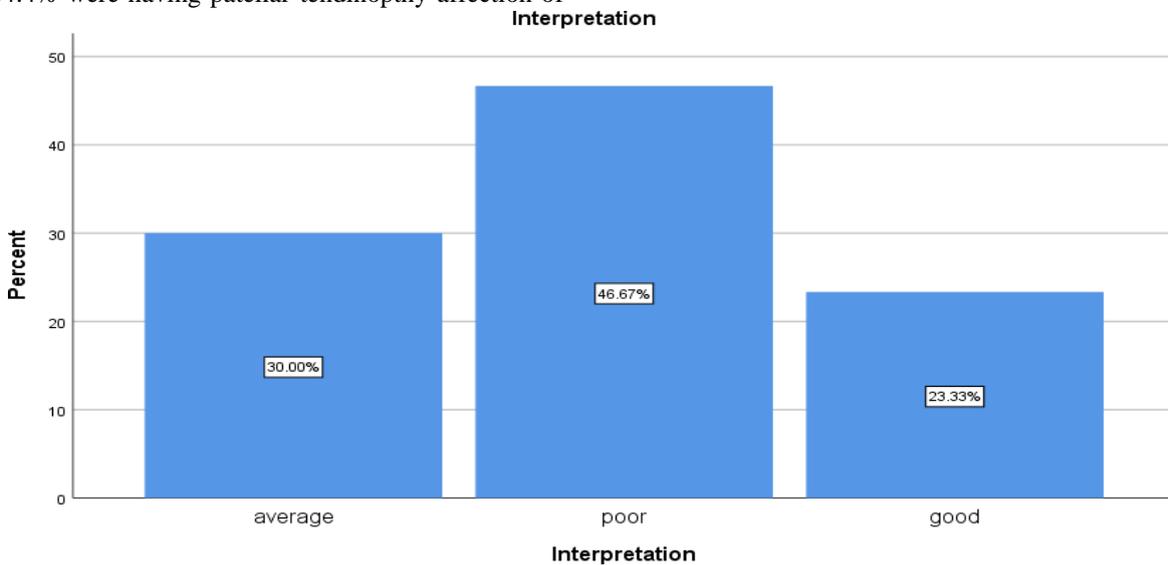
left leg and 10% were having patellar tendinopathy affection of right leg.



Graph 3 shows the frequency and percentage distribution of recreational fast bowlers having patellar tendinopathy. According to data 5.6% were having patellar tendinopathy affection of both leg, 84.4% were having patellar tendinopathy affection of

Table 5 and graph 4 depicts the frequency and percentage of interpretation of agility T-test in recreational fast bowlers.

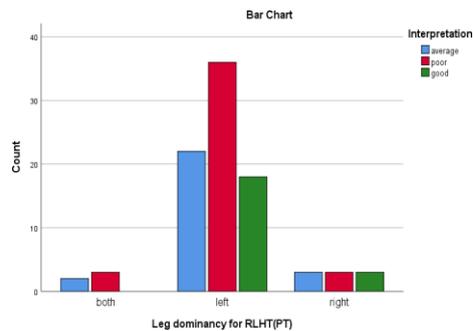
Interpretation	Frequency	Percentage
Poor	42	46.7
average	27	30
good	21	23.3
excellent	0	0
total	90	100



Graph 4 shows interpretation of Agility T-Test recreational fast bowlers. According to data collection 30% of average, 46.7% of poor, 23.3% of good and 0% of excellent interpretation of agility T-test.

Table 6 and graph 5 describes the patellar tendinopathy affection with agility T-test.

			Interpretation			Total	Chi-square value	p-value	
			average	poor	good				
Leg dominancy for RLHT(PT)	both	Count	2	3	0	5	2.326	0.676	
		%	7.4%	7.1%	0.0%				5.6%
	left	Count	22	36	18				76
		%	81.5%	85.7%	85.7%				
	right	Count	3	3	3				9
		%	11.1%	7.1%	14.3%				
Total		Count	27	42	21	90			
		%	100.0%	100.0%	100.0%	100.0%			



Graph 5 shows the patellar tendinopathy affection with Agility T-test.

patellar tendinopathy affection of left leg with agility is poor which is 36 (85.7%) and Average is 22 (81.5%), in patellar tendinopathy affection of right leg with agility is poor which is 3 (7.1%) and average is 3 (11.1%) and patellar tendinopathy affection of both legs with agility is poor which is 3 (7.1%) and average is 2 (7.4%).

## DISCUSSION

The present study aimed to find out the effect of patellar tendinopathy on agility in recreational fast bowlers. These days in cricket actual physical demand has expanded which requires the players to possess high agility, flexibility and strength. The ability to change direction quickly, running for tossing the ball needs agility. Test is defined as primarily a measure of agility, it is not surprising that leg speed contributes substantially to the variability in t-test scores. According to the normative values of agility T-test, batsmen and wicketkeeper showed good agility scores whereas bowlers showed average scores (10.60 secs) for the same.<sup>(22)</sup> The frequency and percentage of interpretation of agility T-test in recreational fast bowlers according to the interpretation shows 46.7% are of poor, 30% are of average, 23.3% are of good and 0% are of excellent. Shloka Jayawant et.al. revealed that the probable reason for bowlers not being that agile as compared to other players may be because he needs to propel the ball from just behind the popping crease towards the stumps that the batsmen is defending. Agility being a collective coordinative ability it also includes the physical demands of the game and the anthropometric measures of each player.

Miller et.al. stated that enhancing balance and control of body positions during complex movements should result in an improvement of agility. This hypothesis seems logical because all agility performances include a stop-and-go movement pattern, where

balance is likely to significantly influence the efficacy of the directional change. In other words, due to inertia, body segments tends to maintain the direction of the movement, whereas balance ability ensures stability for positioning and a subsequent change of direction.<sup>(23)</sup> The present study show the frequency distribution of recreational fast bowlers having patellar tendinopathy according to their leg dominance. Result showed 84.4% participants developed patellar tendinopathy in their left leg respectively.<sup>(Table 3)</sup>

The fast bowling motions involves a run-up and slightly arm hurling movement with associated injuries occurs into the lumbar spine and lower limb.<sup>(15)</sup> High and low overall bowling loads have been found to increase injury risk in fast bowlers. High acute workload, low recent workload, high previous season workload and moderate career workload are risk factors for tendon injuries in cricket fast bowlers.<sup>(12)</sup>

Bowling involves repetitive, twisting, extension and rotation of trunk in a short period, at the same time body tissues and footwear must absorb large ground reaction force of 4.1 to 9 times the bowlers body weight. And lower limb injuries to the knees and ankles are common due to heavy impact and twisting force while running before the bowling action. Because of these there is more prevalence of patellar tendinopathy in recreational fast bowlers.<sup>(24)</sup> The frequency and percentage distribution of recreational fast bowlers as their practicing years. According to result 14.4% of participants in 6 years of practice and 18.9% of participants in 10 years of practice.<sup>(Table 2)</sup>

Josep c et.al, explained the relationship between age and practicing years may indicate changes in mechanical properties of the tendon or its material properties associated with a decreased water content. Adult male basketball players also may have experienced greater stress associated with repeated ballistic movement.<sup>(25)</sup>

Study shows leg affection is associated with age and practicing years in recreational fast bowlers as participants having left leg dominance in patellar tendinopathy has highest percentage distribution of interpretation of agility T-test is poor (85.7%) and average (81.5%). In this study Participants shows more of poor agility in recreational fast bowlers in comparison with leg dominance. So the dominance of leg plays important role for agility in cricketers. The study concludes that agility plays more

important role in patient with patellar tendinopathy in cricket fast bowlers.

#### CONCLUSION

The result is clinically significant ( 52% ) and statistically non significant which conclude that out of total participants 46.7% participants shows poor agility.

There is strong effect of patellar tendinopathy on agility in recreational fast bowlers. Also in patellar tendinopathy left patella seems to have more predominant over right.

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