Interrater and Intra-rater Reliability of the Ball Speed Radar Gun Application to Measure Balling Speed in Cricket Ballers

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Abstract

Background: Balling in cricket is an action of propelling the ball towards the wickets defended by a batter and has always been given a special attention. The tools that measure balling speed are not easily accessible and are expensive and the accessible ones are not reliable. The aim of our study is to establish the Interrater and Intrarater reliability of one such application available on google play, the ball speed Radar gun.

Method: In our study we approached various cricket clubs and cricket set up in and around Pune out of which 30 players were selected based on inclusion and exclusion criteria. The balling speed was recorded by the Ball speed radar gun Application and Data was Collected whose Baseline data values in terms of Age in years (22.66±2.70), BMI in kg/m^2(23.12±2.98), Hours of practice in hours(4.12±1.31) and Years of Experience (2.93±0.91) are comparable at P=0.05 and analysed for Interrater and Intrarater reliability.

Result: In our study we established good Intrarater (k=0.988) and Interrater (k= 0.980) reliability at P=0.05 for the application.

Conculsion: From our study we conclude that Ball speed radar gun application is reliable to measure bowling speed.

Keywords: *Ball Speed Radar Gun, Balling Speed, Cricket.*

Introduction

Cricket is widely played throughout this country, yet there is little research done on the varied aspects of the sport. Cricket as a sport received considerable research attention which seems to have coincided with an increase in the worldwide audience for cricket. It consists of two team of 11 players, played by hitting the ball across the boundary and running between two sets called wicket. (1)

Balling in cricket is an action of propelling the ball towards the wickets defended by a batter and it is distinguished as throwing the ball by an angle in terms of action. Ballers are always given a special attention compare to their peers and according to speed of balling they deliver ballers are classified into Fast Bowlers are described as balling at a speed of 142+ kmph and medium fast bowlers are described as balling at a speed of above 96 kmph. The relationship between speed and techniques has received some attention with studies analysing techniques of balling unit but to evaluate and asses the players on the regular basis balling has to be assessed as an outcome measure. (2) (3)

For regular assessment and evaluation of the athlete's performance the balling speed needs to be assessed. Some of the techniques used includes, **The HAWKEYE** which is considered to be a gold standard in cricket. The basic idea is to monitor the trajectory of the cricket ball during the entire duration of play using 6 cameras to get the speed of the ball, It then calculates the data to track the ball path after the ball leaves the hand of the bowler until the ball stops, but due to its expensive setup and accessibility limited to elite players playing at level of National and International level and also decreased accuracy with factor as Wind, Bright

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sunlight, shadow, artificial floodlights, etc. possess a drawback. [4] **Snick-o-meter** consists of a sensitive microphone located in one of the stumps, which can pick up the sound when the ball hits the bat. It was invented by the scientist Allan Plaskett but the drawback is its reduced accuracy as it may record other sounds such as the ball hitting to batsman's pads or the bat hitting the pitch. [5] **Spider cam** is a film camera which move both vertically and horizontally over a pitch. These operates with 4 monitor winches, positioned at each corner at the base of cover area it requires expensive set up to record the balling speed. [6] **Ball spin RPM/ Rev Counter** is able to show a revolution per minutes (RPM) counter, showing how fast the ball is spinning after release. [7] **Speed Gun** is used to measure the speed of the ball from one end of the pitch to other. This technology allows calculating the speed gun gets mounted on a pole positioned next to the sight screen. The device relays a beam from the radar head to detect movement of across the entire length of the pitch, but as suggested most of these methods are expensive and there is always a time to time requirement of assessing the balling speed to evaluate the improvement in a performance of the athlete at a lower level, for the same there should always be a handy tool available which is inexpensive, easily accessible and reliable at the same time and one such tool is Ball speed radar gun application. [8] It is available for free at google play store. Measuring the velocity of the ball through Radar gun technology was developed in 1947 by John Baker, It works on the principle of Doppler Effect. It catches the echo of radio waves as ball travels through the air and uses a principle called doppler shift and classifies the ball between others object on the pitch and displays the speed of the ball. The radar gun reported ball speed to the nearest mph and the error in ball speed arising from misalignment of the radar gun was calculated to be less than 0.1 m/s. [9] [10] [11]But with an easily accessible method its reliability is also equally important leading to the aim of our study which is to establish the interrater and intrarater reliability of ball speed radar gun application.

Method

Study setting was sports clubs in and around Pune. Total number of 30 cricket players were selected between age group 18-30 years of both genders with more than 1 year of experience randomly. Permission was taken from the institutional ethical committee of Tilak Maharashtra Vidyapeeth department of physiotherapy and different centres were approached. Subjects were approached for data collection from cricket sport clubs in & around Pune city, India. The aims and methods of the study were explained and their written consent was taken, out of which 30 participants were selected randomly following the exclusion and inclusion criteria. The therapists used Tripod for stationary video recording of baller balling and distance from the pitch was kept at 50m. For intrarater reliability 30 players were assessed for balling speed on day 1 and were assessed again after a week by the same therapist, for interrarter reliability 15 players were assessed by therapist no.1, and assessed again by therapist no. 2 at a span of 1 week. A pilot study was conducted and errors were resolved.

Data management and Statistical Analysis:

The data was statistically analyzed using Excel sheet and medcalc and Tables and graphs were made using Microsoft word. The central tendencies were calculated for baseline demographic data for of Age (22.66±2.70), BMI (23.12±2.98), Hours of practice (4.12±1.31) and Years of Experience (2.93±0.91) which was found to be comparable at P=0.05.

To establish Interrater and Intrarater Reliability Cohen's kappa index for reliability was used within confidence interval of 95%.

Results

TABLE NO.1 shows the Average value of Age (22.66±2.70), BMI (23.12±2.98), and Hours of practice (4.12±1.31) and Years of Experience (2.93±0.91) comparable at 0. 05.

Table 1. BASELINE DATA OF THE SUBJECTS COMPARABLE AT P=0.05

VARIABLES	MEAN±SD
AGE	22.66±2.70
BMI	23.12±2.98
HOURS OF PRACTICE	4.12±1.31
YEARS OF EXPERIENCE	2.93±0.91

In our study, this application showed good inter-rater reliability (K=0.980) and intra-rater reliability (K=0.988) at P=0.05. (TABLE NO. 2, GRAPH 1 AND 2)

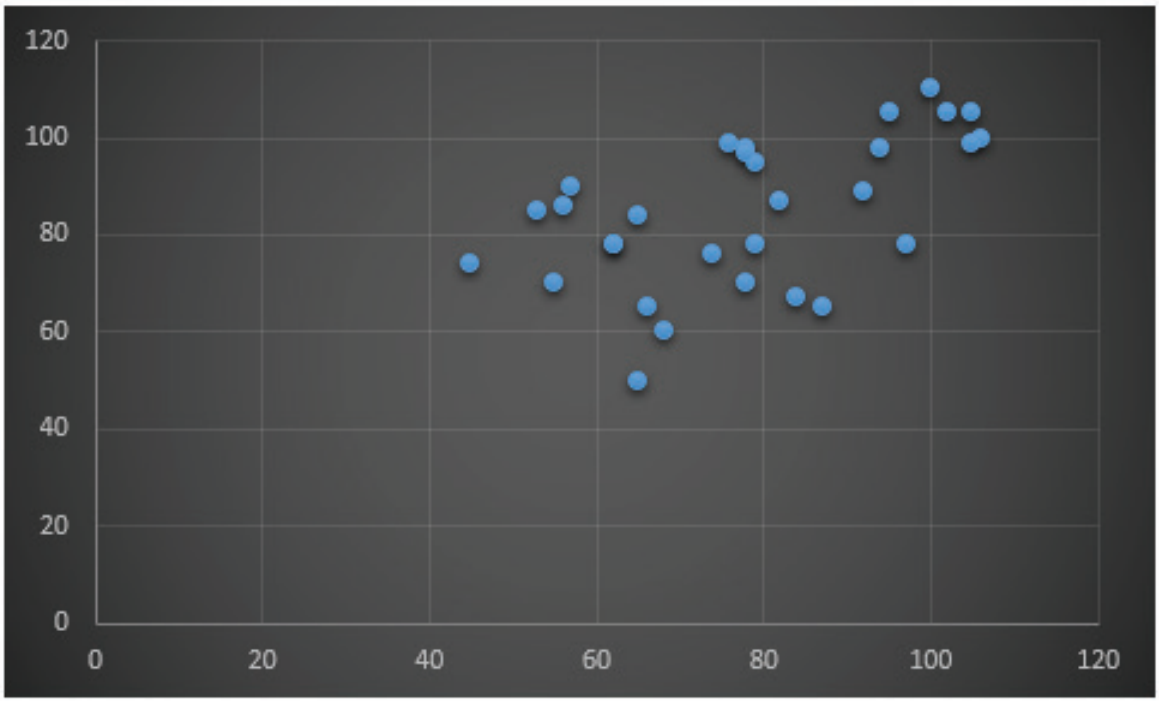

Figure 1: INTRARATER RELIABILITY OF BALL SPEED RADAR GUN AT A SPAN OF 7 DAYS FOR P=0.05, K=0.988

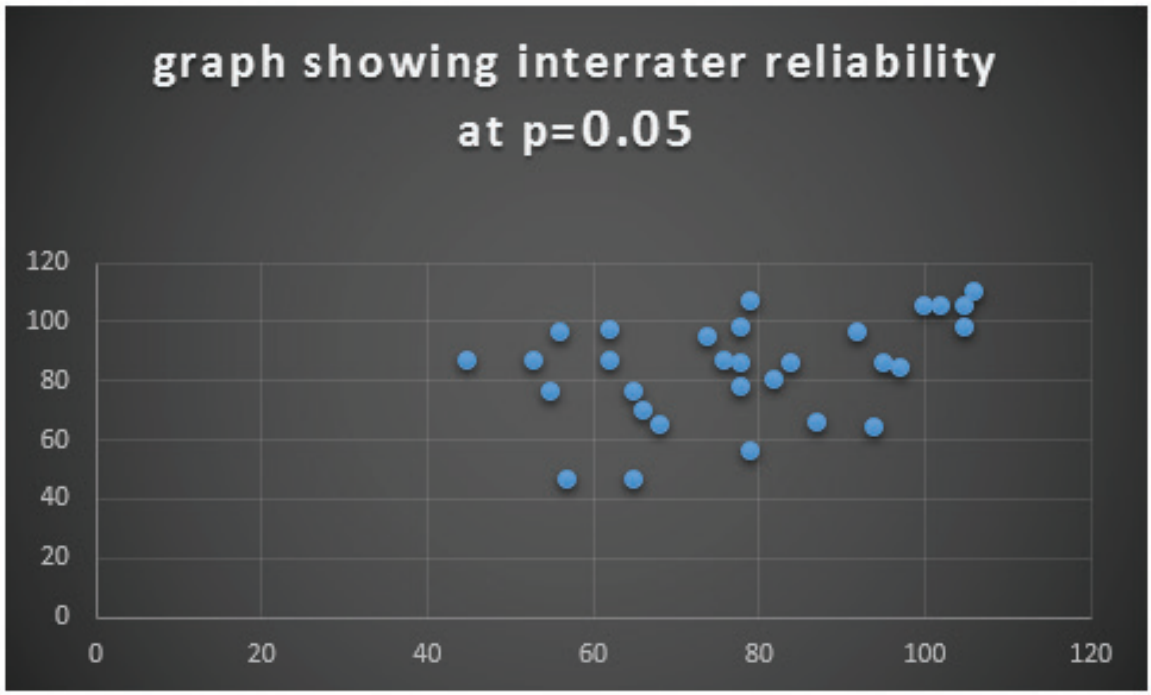

Figure 2 INTERRATER RELIABILITY OF BALL SPEED RADAR GUN AT A SPAN OF 7 DAYS FOR P=0.05, K=0.98

Table 2: TABLE SHOWING INTERATER AND INTRARATER RELIABILITY OF BALL SPEED RADAR GUN AT A SPAN OF 7 DAYS FOR P=0.05

INTERRATER RELIABLITY	K=0.980
INTRARATER RELIABILTY	K=0.988

Discussion

Reliability in psychometrics is the overall consistency of a measurement [12] [13]repeated over span of time. Various kinds of reliability coefficients, with values ranging between 0.00 (much error) and 1.00 (no error), are usually used to indicate the amount of error in the scores. [14] Reliability does not imply validity, that is measure is said to be reliable if it shows consistency used over a period of time. [15] Test-retest reliability is a measure of reliability obtained by administering the same test twice over a period of time to a group of individuals. The scores from time 1 and time 2 can then be correlated in order to evaluate the test for stability over time. [16] The time span in our study was kept at one week as, if the time interval is kept too long the therapist may forget how to perform a test or if the time span is kept too low, a carryover effect may occur, which would lead to a study bias. [17]

The Ball Speed radar gun Application detects the colour of the cricket ball to analyse the ball speed. The working of the APPLICATION is as follows:

Make sure camera is steady and not shaking/ moving while recording:

1. Play the video using open video button

2. Pause when ball is just released out of hand (in the air)

3. Click the "find speed" button and see the values detected

4. The camera is calibrated properly before measuring the speed for every baller.

5. The appropriate ball color is selected, else the app will not be able to track.

To Measure the bowling speed a phone is sufficient with the APP installed unlike the intricate machinery's also it can be assessed at the therapist's own comfort. This APP is can also measure the speed of a moving object and along with speed it also gives a complete analysis of bowling/pitching/serving/smashing action.

Camera calibration method

Point the camera at a player standing at the pitch or base where you want to measure the speed. Freeze the previous frame pause align / drag the two-red line to head and feet of the player standing at the pitch and enter the player's correct height. This way the application understands the pixel distance on phone screen vs the real players height. Then the application calculates you're the instantaneous speed (not average).

As explained earlier this application works on the principle of Doppler Effect that catches the echo. [9]This application can measure the instantaneous speed of a ball object using your phone camera and then the application calculates the instantaneous speed. [4]The possible bias that can be created in our text are the Researcher's lack of knowledge about the application use, Camera not being stationary , poor camera Quality, change in the Distance of the camera from rater to rater, within the rater or amongst the raters. To resolve these sources of error we did a pilot study. We found out that this application shows good inter-rater reliability (K=0.980) and Intra-rater reliability (K=0.988) at P=0.05.

The relationship between speed and techniques have received some attention with studies analysing techniques of balling unit but to evaluate and asses the players on the regular basis balling speed has to be assessed as an outcome measure. [2]There are many factors that affect bowling speed such as aerodynamics and techniques of swing used. [3; 18] [19]For regular assessment and evaluation of the athlete's performance of balling speed needs to be assessed. A timely evaluation of performance is not only helpful in understanding the athlete's game but also keeps the interest of the player in the game, hence this APP can be helpful in the lower levels to provide with a good performance review.

Conclusion

From our study we conclude that the Ball speed radar gun application which is available at the google play app store for free to assess balling speed is a reliable tool.

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Ethical Clearance: A synopsis was submitted and permission was taken from Institutional Ethical Committee of Tilak Maharashtra Vidyapeeth,

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