

RELIABILITY ANALYSIS OF THE 94 FIFTY SMART SENSOR BASKETBALL

Tomislav Rupčić, Ljubomir Antekolović, Damir Knjaz, Bojan Matković, Vjekoslav Cigrovski

Faculty of Kinesiology, University of Zagreb, Croatia

Abstract

The 94Fifty Smart Sensor Basketball, manufactured by InfoMotion Sports Technologies, Inc., allows measurement of certain kinematic parameters in the process of shooting the ball (the speed of performing the shot; the angle at which the ball enters into the basket; and the rotation of the ball during the shot), as well as in the process of dribbling the ball (the number of dribbles and control of the ball). This Smart Sensor Basketball is equipped with a number of sensors inside the ball which allows the user direct monitoring of the results on a computer in an appropriate programming interface connected via a Bluetooth connection. To be more precise, the aim of this study was to compare the results obtained from a 94Fifty Smart Sensor Basketball with the results obtained by video analysis (a DMC-FZ200 Panasonic camera operating at 100Hz; Kinovea software 0.8.15) while examining the following two parameters: the speed of performing the shot and the angle at which the ball enters into the basket. For the purpose of this study, a total of 80 shots were taken; 40 three point shots and 40 two point shots. The results (ANOVA) indicate that there are no significant differences (angle: $p=0,10$; speed: $p=0,08$) in the obtained values for the examined parameters in relation to the manner the results were produced - by video analysis or by using the Smart Sensor Basketball. In addition, there is a statistically significant correlation between the two methods of determining the above parameters (angle: 0,98; $p<0,05$; speed: 0,96; $p<0,05$). Based on the results of this study, the conclusion can be made that the 94Fifty Smart Sensor Basketball has a practical value as it allows obtaining the results in real time, which ultimately provides coaches with an objective confirmation of their subjective assessment. Likewise, the 94Fifty Smart Sensor Basketball can be used for certain scientific research which can ultimately improve basketball practice as such.

Keywords: *basketball, jump shot, angle, speed*

Introduction

The jump shot can be defined as one of the more complex elements of basketball technique (Okazaki and Rodacki, 2005).

A quality technique of performing a jump shot requires that a player has an excellent coordination of movements - the coordination between the lower and upper extremities; a good preparatory phase which will enable him a less difficult transformation of positional (horizontal) movement into vertical movement (a low position of the body's gravity centre); a good position of balance; a correct grip on the ball; with eyes on the basket (Ripoll et al., 1986), a proper and aligned semicircular lifting of the ball to the central position for the jump shot; directing the elbow of the shooting hand towards the basket while it is in central position, shooting the ball at a proper angle (Fontanella, 2006; Satti, 2004), releasing the ball using the wrist of the shooting hand (Palubinskas, 2004), the last contact with the ball being with the middle finger and the index finger, etc.

Nowadays, modern technology allows us to conduct training processes for more complex motor movements, such as after all is the jump shot in basketball, which are more reliable and accurate in order to avoid that any individual mistake during the training process is adopted on such a level that it is hard to ever correct afterwards. Basketball coaches very often use various forms of modern technology for the purpose of adopting and improving certain technical and tactical skills or for the purpose of correcting them.

It is precisely this type of modern technology that the InfoMotion Sports Technologies, Inc., invented and patented as the 94Fifty Smart Sensor Basketball (Crowley, 2011).

This measuring instrument is actually a regular basketball of standard basketball dimensions, in other words, of circumference between 749-780 mm and weighing between 567-650 grams (Official Basketball Rules, 2014), which allows measuring certain essential parameters which determine a player's situational efficiency during a game from the shooting aspect. The mentioned parameters are the following: the angle at which the ball enters into the basket, the speed of performing the shot and the number of the ball's rotations around the horizontal axis. In addition to the mentioned parameters, the 94Fifty Smart Sensor Basketball also has the option of measuring certain parameters from the aspect of ball dribbling, such as control of the ball and the number of iterations.

The Smart Sensor Basketball has previously been used for certain scientific research. In 2015, Dobovičnik and ass., attempted to measure if players perform the three point jump shot within the values which are suggested by the manufacturer as ideal for a correct shooting technique (the angle at which the ball enters into the basket = 42-48 degrees; the speed of performing the shot = < 0.7 seconds; the number of rotations around the horizontal axis = 130-150 rotations per minute). This study was performed on a sample of 52 basketball players, aged between 18 and 19, and the obtained results were lower than the values suggested by the manufacturer. This

led the authors to the conclusion that either the manufacturer suggested the incorrect criteria or that the examined sample of basketball players demonstrated a poorer shooting technique.

This was precisely the objective of our study - to establish the accuracy of the obtained results for the two kinematic parameters measured by the 94Fifty Smart Sensor Basketball: the angle at which the ball enters into the basket and the speed of performing the shot, by comparing the obtained values with the results which were received by means of video analysis.

Methods

For the purpose of this study the 94Fifty Smart Sensor Basketball was used, manufactured by InfoMotion Sports Technologies, Inc., (Figure 1.), as well as a DMC-FZ200 Panasonic camera operating at 100Hz. In order to conduct the video analysis later on and to compare the obtained results, the Kinovea software, version 0.8.15, was also used for this study.

The research was conducted in the following manner - one examinee performed a series of 40 jump shots from a distance of 6 m (two point shot) after which he performed a series of 40 jump shots from the distance of 6.75 m (three point shot).

After recording the results received from using the 94Fifty Smart Sensor Basketball, video analysis of the identical jump shots was conducted (Kinovea, 0.8.15) with the common objective of determining the values of the previously mentioned kinematic parameters.

By applying the statistical programme package STATISTICA, ver. 12, the attempt was made to establish correlative connections, as well as the possibility of certain statistically significant differences (ANOVA) between the two different methods of determining the obtained values between the two kinematic parameters which were analysed.



Fig. 1 The 94Fifty Smart Sensor Basketball (www.94fifty.com)

Results and Discussion

Upon analysing the obtained results it was clear that there are no statistically significant differences between the results received after using 94Fifty Smart Sensor Basketball and the video analysis of the jump shots (Table 1.). On the contrary, correlative connections were found between the two methods of determining the mentioned kinematic parameters (Table 2. and Table 3.).

Tab. 1 Univariate analysis of variance – determining statistical differences between the two methods of measuring the speed of performing the shot and the angle at which the ball enters into the basket (94Fifty Smart Sensor Basketball/video analysis)

Var.	Multiple R	Multiple R ²	Adjusted R ²	SS Model	df Model	MS Model	SS Residual	df Residual	MS Residual	F	p
SPEED	0.13	0.01	0.01	0.04	1	0.04	2.43	158	0.01	3.02	0.08
ANGLE	0.12	0.01	0.01	24.80	1	24.80	1443.93	158	9.13	2.71	0.10

Tab. 2 The correlation between the 94Fifty Smart Sensor Basketball and video analysis - variable „SPEED“

Variable	<i>Marked correlations are significant at $p < ,05000$; SPEED</i>			
	Means	Std.Dev.	94Fifty	Video analysis
94Fifty	0.82	0.11	1.00	0.96
Video analysis	0.78	0.13	0.96	1.00

Tab. 3 The correlation between the 94Fifty Smart Sensor Basketball and video analysis for the variable „ANGLE“

Variable	<i>Marked correlations are significant at $p < ,05000$; ANGLE</i>			
	Means	Std.Dev.	94Fifty	Video analysis
94Fifty	42.28	3.09	1.00	0.98
Video analysis	43.07	2.94	0.98	1.00

Many authors consider that the mentioned kinematic parameters - the angle at which the ball enters into the basket and the speed of performing the shot, are extremely important for the situational efficiency of a player (Okazaki and Rodacki, 2012).

The speed of performing the shot (the time between catching the ball until releasing it towards the basket) is very often described as an important factor of

a player's shooting efficiency, which makes sense, as the shorter the time interval is between the moment of receiving the ball until the moment of releasing it towards the basket, the harder it is for the defensive player to defend the jump shot (Fontanella, 2006; Rojas, 2000). The speed of performing the shot, besides a proper technique of shooting the ball, strongly depends on the preparatory phase for the jump shot. In other words, it is generally considered that if a player does not utilize well the ground reaction force, he will have more difficulties with transforming the horizontal movement into a vertical one, which will in the end reflect on the speed of performing the shot due to the consequential relationship of lowering the ball in the moment of receiving it. In order to perform a jump shot quickly and well enough, a player should be positioned in a lower position of the body's gravity centre with slightly bent lower extremities just before receiving the ball (Krause, Meyer, Meyer, 2008).

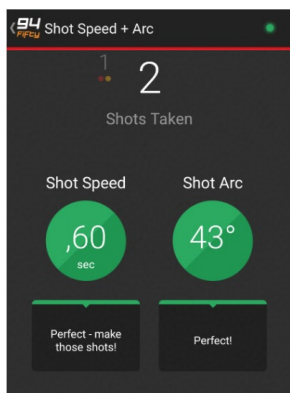


Fig. 2 An illustration of kinematic parameter results for the speed of performing the shot and the angle at which the ball enters into the basket obtained by using the 94Fifty Smart Sensor Basketball (software 94 fifty)

The angle at which the ball enters into the basket is closely related with the angle at which the ball is released (Okazaki, 2015) and it is also defined as an important factor for a player's situational efficiency during the game (Okazaki and Rodacki, 2012). A higher angle at which the ball enters into the basket enables the player to be more precise as in that case the ball has more space for passing through the basket (Fontanella, 2006). Especially among younger players, attention should be paid to this parameter as it is very often that the ball demonstrates a lower parabolic trajectory due to certain mistakes in the motor execution of the shot such as: a poor use of the ground reaction force, not directing the elbow of the shooting hand in the direction of

the basket when in the central position for the jump shot, a disrupted coordination - alignment of movements, etc.

It is very important to state that this “device” has a wide range of use in practice, that is, in training of young players as it enables feedback in real time which makes it possible to immediately apply certain corrections in performing the shot. However, it is also essential to emphasize that it can primarily be used as an objective confirmation of a coach’s subjective evaluation as it is precisely the coach’s knowledge and experience which are most important in the process of interpreting the results, all for the purpose of producing a high quality player (Erčulj, Marković, Broder, 2014).

Conclusion

The results obtained during this study indicate that it is possible to use the 94Fifty Smart Sensor Basketball for practical purposes, but also for scientific reasons in view of the accuracy of the obtained results.

Scientific applicability of this measuring instrument is manifested in the possibility of receiving feedback which are important for the improvement of the overall basketball training process, all with the purpose of “producing” top quality players or results.

Practical applicability comes into the picture in the process of adopting and perfecting the shooting technique in young players, as it is precisely at a younger age that it is essential to acquire the correct motor movements which will later on become automatic.

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