

## Analysis of learning a basketball shot

RAIOLA GAETANO<sup>1</sup>, ALTAVILLA GAETANO<sup>2</sup>, TAFURI DOMENICO<sup>1</sup> LIPOMA MARIO<sup>3</sup>

<sup>1</sup> University Parthenope of Naples, ITALY

<sup>2</sup> University of Basilicata, Potenza, ITALY

<sup>3</sup> University Kore of Enna, ITALY

*Published online: March 25, 2016*

*(Accepted for publication February 05, 2016)*

**DOI:10.7752/jpes.2016.01001**

### Abstract:

This paper tries to clarify from various points of view, physical and athletic, technical, tactical and especially from that biomechanical, those that are the fundamental elements of the shot to basket, in order to optimize the setting and specific preparation. The shot is a fundamental attack in basketball, offers many points to be analyzed from technical point of view that the biomechanical point of view, this article will try to do it on both aspect, trying to provide some elements technical and scientific to whom refer and the description of the biomechanical elements characterizing the execution of the shot at basket, to improve the whole process of teaching and learning.

**Keywords:** biomechanics, performance, technical skill

### Introduction

In the game of basketball the shot is the main action of the attacker; in fact, it is the instrument by which players translate them into points the offensive actions of own team. In this regard, Gamba said: "you become good shooters, are not born. I doubt there has ever been a great shooter that he would not have needed to endless hours of training to develop its effectiveness "(Gamba, 1995).

For this reason, to become a good player one must learn to cure this fundamental technical. Knowing how to pull with high percentage of realization means, essentially, give enormous guarantees of victory to own team, without underestimating the psychological aspect positive on the one hand, esteem and gratification of the team towards the player and on the other the negative impact which infuses on the opponents, of concern and insecurity in respect of a great shooter.

Having one or more players in field that they can realize high percentages of shots, brings a significant advantage at their team and disfavoring therefore, tactically and psychologically, the opponents complicating the them defensive duties. The coaches have the need to build players capable of minimizing the reaction time; therefore, in practice, each player must be able to perceive by intuition what his opponent is going to do and to take advantage; this advantage is then maintained and concretized in a positive result, such as achieve a shot at basket (Raiola, 2015, Raiola, Tafuri, 2015, Raiola 2014ab, Raiola et al, 2014, Raiola, Di Tore 2012ab).

The qualities required of a good shooter are: body balance in static and dynamic situations, concentration and attention of the detail, coordination, sensitivity and the correct execution of a parabola. The knowledge, sometimes superficial, of physical systems, the musculature and related elements, certainly allows to qualify the intervention of the proposition of the field work in a more targeted as well as scientific (Izzo et al, 2015, Raiola, Tafuri, 2015ab, Raiola et al., 2015).

### Aim

Suggest some technical-scientific elements to which to refer and the description of the biomechanical elements that characterize the execution of the shooting at basket, to improve the whole process of teaching and learning.

### Method

Each player will have a shooting mechanics entirely subjective, since it varies in relation to its heritage conditional and coordinative, at the its stature , at the its ability to establish the starting point of the shot, at the type of defender (height and aggression) and at the away from the basket.

A good formulation of the shooting must take into account of the alignment: index, wrist, elbow, tip toes pointing to the basket. The elbow should stay close to your body in a natural way, it is possible that some players tend to "open" the outwards elbow. If it is done in a natural way, it would be best not to correct it this, especially if then the shooting mechanics is fluid and release takes place properly.

The arm and hand are parts of the body directly concerned with the thrust and direction of the ball, and they are also those parts who commit more errors and affect the final quality of the shot. In the carry out the shot the upper limb begins, usually from a position partial homers in abduction and external rotation that, in the final phase of the movement, is in full extension and in anterior-posterior position.

As regards the hand, the intervention of the palm during the pushing can interfere negatively removing the necessary sensitivity on the ball, having as a result little rotation of the ball. Finally, the intervention of the finger middle and of the index on the ball, in fact, are the fingers that leave for last ball, both should be turned outwards and downwards, otherwise the ball will not acquires an optimal rotation and the right direction . Finally, the location and the push of the lower limbs, however, should not be neglected, since the shot begin from the feet; In fact, the indication that you can give is try to have a position of feet wide about the shoulder width, with your foot corresponding at the hand that pulling of about half a foot ahead of the other.

**Discussion**

Over time, the technical act of the shot is fundamental individual that has had more evolutions; There is been, in fact, a gradual introduction of new shooting types (stationary, in elevation and in suspension) and changes to the regulation (24 seconds, introduction of the 3-point first and then from the 6.25 mt to 6.75 mt ) This has produced some significant results:

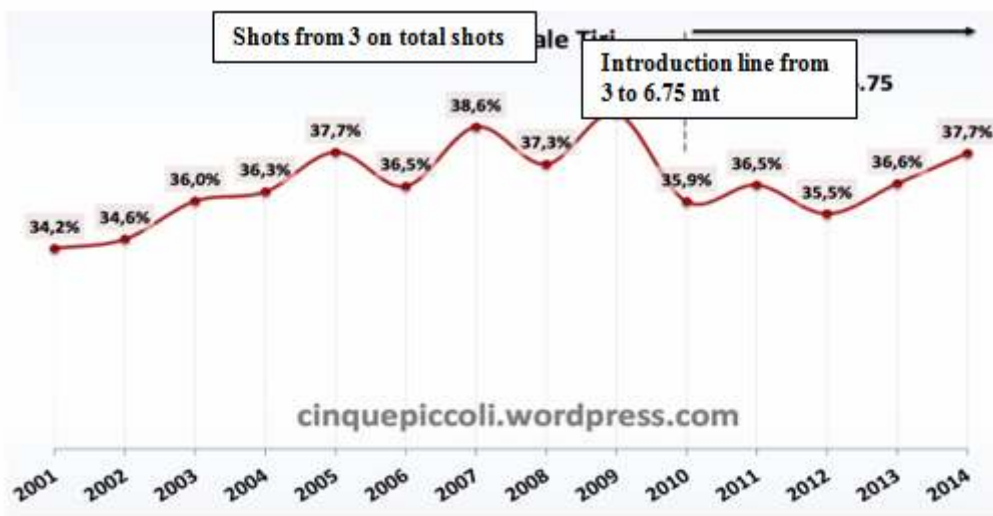


Fig. 1 – Total shots made by 3 points (Italian Championship 2014-15)

- There has been a speeding up of the actions of game
- There was an increase of the spectacle

The ability of shot is related to the objective of performance of the sport, then it can refer to the horizontal distance, at the flight time, at the precision or speed of movement (Scrimaglio, Di Giminiiani, 2013). The shot offers several ideas to be analyzed, both in terms of technical sport that from the standpoint of biomechanics.

Analyzing various shots from different positions and distances, the trajectories realized by the ball, can be assimilated as at the model of parabolic curve, depending on the angle of departure of the ball (Mondoni, 2002). One of the sports where you can notice this parabolic motion is basketball, since the player must try to pull a ball in a basket placed higher than him and therefore the trajectory of the ball you will get from the union of two movement, from that with speed uniform oblique, for picking up the ball, and uniformly accelerated down for force of gravity (Fig. 2).

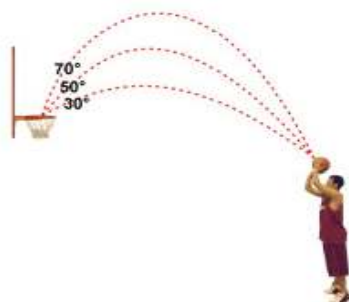


Fig. 2 - Trajectory of the ball with a shot to basket

The biomechanical factors that govern a shot, apart from the force impressed, are:

- 1- The starting height of the ball
- 2- The air resistance
- 3- The release rate of the ball
- 4- The exit angle of the ball

The height of outlet of the ball is determined by the morphology of the player and from the type of shot used in relation to the defender and to the distance from the basket. The air resistance appears to be irrelevant on the trajectory of the ball. Dependence on these influencing factors ( the height of outlet of the ball, the combination of the rate of release and the exit angle of the ball) are related to:

- A. At the distance of the shot
- B. At caliber of the defender

C. At the corner of entry, with which the ball should enter the basket to allow the maximum of the tolerance or space for the error.

A. The rate of release and the exit angle are interdependent, while the distance of the shot directly influences the rate of release, which increases on account of distance, and indirectly the angle of release. The accuracy of the shot varies with distance, as even small deviations become more evident in relation to the residence time of the ball in the air.

B. The physical structure, the ability to jump, the position and the technique of the defender all have a relationship of influence on the speed and angle of exit of the ball that must be such as to allow it to pass over the extent of the intervention of the defender.

C. The role of the angle of entry is rather complex. With an entry angle of 90° the basket it is presented to the ball in all its width equal to 45 cm., therefore with the maximum margin of error as possible.

## Results

An entry angle at 90 °, from a distance of about 5 meters, it is impossible from obtain, as it would require a considerable output speed beyond the capability of an athlete who uses any shot orthodox. Also, there is to consider the effect that produce small errors of the exit angle on the distance of the shot are proportional, and these deviate the ball farther and farther away from the center of the basket; therefore, while a large angle shot is desirable because it leads to a high entrance angle, it is less desirable of smaller angles for what concerns the precision. The best angle of shot produces trajectories with a bow rather low rather than medium or high. And you need to understand what are the variables that affect performance with purpose to improve it (Picasso B., 2012). The equation  $E = \pm (0.2286 \text{ sen } \alpha - r) \text{ cm.}$ , Allows us to calculate the chance that the ball has to go on the vertical axis of the basket (Tab. 1), where:

Table. 1. Angle of entry and the margin of error

$\alpha$ , angle of entry	E, margin for error in cm., respect to the center of the ball
90°	± 10,54
80°	± 10,18
70°	± 9,14
60°	± 7,38
50°	± 5,18
40°	± 2,36
32° e 39'	± 0,00

**E** = error margin

**$\alpha$**  = angle of entry

**r** = radius of the ball

Practical experience and the results obtained also the aiming point should not be overlooked by the coaches;so we should provide as aiming point the far side of the circle than the firer, because if the ball hits the ring of the basket, a ball spin counterclockwise will help the same to enter the basket. In the case, instead, of a short shot you can have a margin of error of about 22 cm., Since this difference that there is between the ball, having a diameter of about 24 cm., And the inner circumference of the ring the basket of 45 cm., there is the possibility that the ball bouncing on the board and enters the basket. Finally, if the ball at the end of the parable hits the backboard or the ring of the basket the factors leading to the entrance at basket (established that the mass of the two bodies and their return coefficient are constant) are represented by:

- Point of contact of the ball
- Its speed at the moment of contact
- From the rotation of the ball.

*Analysis of the shot*

The shot from the biomechanical point of view interests the lower limb (foot, leg and thigh), the trunk (stabilizer musculature of the body in flight) and the upper limb (hand, forearm and arm). The main muscle groups of the upper limb that intervenes during the action of the shot are:

- a. Flexors forearm : brachial
- b. Flexors of the arm: anterior deltoid, grand pectorals (upper fibers), and biceps coracobrachialis
- c. Extensor forearm: triceps
- d. Pronator of the forearm: pronator tires and square
- e. Extensors of the hand: extensor the radial and ulnar, radial extensor short and extensor ulnar
- f. flexors of the hand : radial and ulnar
- g. Flexors of the last four fingers of the hand: lumbrical, interosseous, flexor superficial and deep of the fingers.

Until the player does not bend on the legs, the muscles perform an isometric work and the force used is minimal. The muscular work, during the step of bending, is concentric and the force used increases. After the bending, when the player stretch the lower limbs, the muscles are released slightly, the pressure on the ground is lower and consequently also the force used is reduced. The player locks the movement of folding at the moment of the shot, the muscles perform an eccentric work and the force applied on the ground increases. During the phase release of the ball from the hand, the muscles of the lower limb are concentrically contracts, pushing strong on the ground of play and thereby increasing the force used (Tab. 2).

Tabel. 2. Muscle work during the shot

<b>Phase of the shot</b>	<b>Type of muscular work</b>	<b>Force used</b>
Before the beginning	Isometric	Minimum
Bending of the lower limbs	Concentric	Increases
Extension of the lower limbs	Slight relaxation	Decreases
Release the ball	Concentric	Elevated

**Conclusions**

In light of the above, we believe we have provided some technical-scientific elements, to which doing refer in practice of sport, not only in terms of scientific and theoretical study of the subject, but also as a tool for verification of work programs always more finalized to the qualification and to the specificity of the training proposal , connecting more and more their own system of work with elements more and more specific and directly related at fundamental of the shot, abandoning a training method based on the generic, this aspect not is longer sustainable in the modern competitive sports activities. At last, is a good idea to remember that the highest level of coordination is one in which the player, in addition to successfully perform the gesture, keeps the possibility to modify and adapt to the "real situation" while maintaining the effectiveness (Altavilla, Raiola, 2014,2015). Learning, however, only reached a level cognitive abstract stays away from the real context and direct experience (Raiola et al 2016abc, Altavilla et al, 2014ab, Gaetano et al, 2015).

**Reference**

Altavilla G., Raiola G. (2015) Sports game tactic in basketball, Sport Science vol 8 1  
 Altavilla, G., Raiola, G. (2014) Global vision to understand the game situations in modern basketball Journal of Physical Education and Sport Vol 14 issue 4, pp. 493 – 496  
 Altavilla, G., Tafuri, D., Raiola, G. (2014a) Influence of sports on the control of static balance in physical education at school Journal of Physical Education and Sport Vol 14 3 pp. 351 – 354  
 Altavilla G., Tafuri D., Raiola, G. ( 2014b) Some aspects on teaching and learning by physical activity Sport Science vol 7 1 pp. 7-9  
 Gaetano R., Domenico T., Gaetano A. (2015) Physical activity and its relation to body and ludic expression in childhood Mediterranean Journal of Social Sciences Vol. 6, No 3  
 Gamba S. (1995) Quaderni di Riano, CONI FIP, vol I  
 Izzo R., Sopranzetti S., Altavilla G. (2015) Biomechanical analysis of fundamentals in basketball the rebound, Ovidius university annals series Physical Education and Sport, vol XV 2  
 Mondoni M. (2002) Basket e biomeccanica, Edizioni Libreria dello sport, Milano, Italia  
 Picasso B. (2012) Fondamenti di meccanica e biomeccanica”, Ed. Springer - Milano, Italia  
 Raiola G., Tafuri D, Lipoma M, (2016a) Teaching method indication for education and training of sport skills, Mediterranean Journal of Social Sciences Vol. 7, No 2  
 Raiola G., Tafuri D, Lipoma M (2016b) Some aspects of gait analysis in educational vision, Mediterranean Journal of Social Sciences Vol. 7, No 2  
 Raiola G, Altavilla G, Di Tore P A, (2016c), Analysis on some aspects of the service in volleyball, Sport Science, 9 1  
 Raiola G, Tafuri D., Paloma G. F., Lipoma M., (2015) Bodily Communication in basketball Sport Science, 8 2

- Raiola, G., (2014a), Teaching method in young female team of volleyball Journal of Physical Education and Sport vol 14 1 74-78
- Raiola, G. (2014b) Motor control and learning skills according to cognitive and ecological dynamic approach in a vision on behaviorism, cognitive, Gestalt and phenomenology theories Mediterranean Journal of Social Sciences vol 5 15 504-506
- Raiola, G. (2011) A study on Italian primary school rules: Neurophysiological and didactics aspects on physical education and sport Journal of Physical Education and Sport vol 11 2 153-158
- Raiola G, Tafuri D. (2015a) Pilot work on training for quantitative aspects of performance Sport Science, 8 2
- Raiola G, Tafuri D. (2015b) Teaching method of physical education and sports by prescriptive or heuristic learning. Journal of Human Sport and Exercise vol 10 1 supplement
- Raiola G., Lipoma, M., Tafuri D. (2015) Postural control in young soccer players: differences between the cognitive approach and ecological-dynamic one, Journal of Human Sport and Exercise vol 10 1 supplement
- Raiola G., Tafuri D., Paloma, G. (2014) Physical activity and sport skills and its relation to mind theory on motor control Sport Science vol. 7 1 52-56
- Raiola, G., Di Tore P.A., (2012a) Bodily communication skills and its incidence on female volleyball championship to enhance didactics Journal of Human Sport and Exercise vol 7 1 365-375
- Raiola, G., Di Tore, P.A (2012b) Statistical study on bodily communication skills in volleyball to improve teaching methods Journal of Human Sport and Exercise vol. 7 2 468-488
- Scrimaglio R., Di Giminiani R.(2013) Analisi cinematica e dinamica del movimento, Libreria Benedetti, L'Aquila, Italia
- <https://cinquepiccoli.wordpress.com/2015/01/07/la-linea-del-tiro-da-tre-e-il-momento-di-spostarla/>