7th Asia-Pacific Congress on Sports Technology, APCST 2015

The accuracy of a real time sensor in an instrumented basketball

Emad Abdelrasoul[b] , Islam Mahmoud[c], Pro Stergiou[a], Larry Katz[a],*

[a]Faculty of Kinesiology, University of Calgary, 2500 Universtiy Drive NW, Calgary, Alberta, T2N 1N4, Canada,
[b]Faculty of Physical Education, Benha University, Egypt,
[c]Mansoura University, Egypt

Abstract

Integrating sensing devices into sports equipment such as tennis racquets, basketballs and soccer balls has great potential for measuring performance, training athletes and encouraging participation. These innovative, interactive tools provide real time feedback systems for collecting and analysis sports data and could provide effective support for coaches and athletes. The 94fifty™ is an instrumented basketball that has the same specifications as a standard basketball with the addition of a sensor that provides data on shot arc, shot speed, and number of dribbles in real time through a smartphone or tablet device app. The purpose of this investigation was to determine the sensor accuracy in the 94Fifty on measures of shot arc and dribbling in relation to Dartfish™ video analysis software.

To measure the shot arc, five adult basketball players were recorded performing 28 shots from various positions for a total of 140 trials. For dribbling 260, 4-12 year old children were video recorded dribbling for 10 seconds each. We compared results using Cronbach's alpha. Shot angle reliability coefficients between the 94Fifty software and Dartfish video analysis alpha = 0.998. No differences were found in the dribbling count between the video analysis and the 94Fifty sensing basketball. While Cronbach's alpha was very high for shot arc, a detailed analysis reveals discrepancies in arc angle on individual shots where 78 out of 140 angles were the same, 59 were within +/-1 degree and three were +/-3.5 degrees.

Participants universally enjoyed receiving feedback on their performance. This new technology could redefine the way players are trained and could encourage creative approaches to practice planning and implementation.

* Corresponding author. Tel.: 403-220-3418.
 E-mail address: emadeen2002@yahoo.com

1. Introduction

The world of sport is constantly changing due in large part to the integration of technology. Modern science now allows athletes to go higher, move faster, and importantly, stay safer. Technological innovations have improved not only the products and clothing used by athletics (e.g. bicycles, tennis racquets, and swimsuits), but there have also been significant developments in the ways in which athletes study their own (and opponents') performance, as well as how they receive feedback from coaches [1].

Technology in sports is a scientific means by which athletes attempt to improve their training and competitive surroundings in order to enhance their overall athletic performance. The real time and rapid feedback systems for collecting and analysis sports data provide innovative and effective support for coaches and athletes [3]. The drive for success in athletics has spurred coaches to continually search for new techniques and tools to improve athlete performance. This has led to the increased prevalence and application of technology in sport. However, the concept of "virtual coaching" has only evolved with the increasing demands placed on coaching feedback [4].

The intelligence factor in ball technology just went up with the introduction of the 94Fifty Basketball sensor, the world's first smart basketball made by InfoMotion™ that received an award at the Consumer Electronics Show in 2014 [2]. Other instrumented balls have also joined the market, for example the Adidas smart ball (http://micoach.adidas.com/ca/smartball) and the smart bowling ball [3].

94fifty balls have the same specifications as a standard basketball and contain a sensor that provides data on shot arc (the angle of the shot); shot speed; shot arc and speed compo; shot backspin; and the number of dribbles.

The 94fifty is linked by blue tooth to a smart device, tablet or smartphone, using either Android or IOS. Through the smart device the player can see his/her performance and receives short tips and comments after shooting the ball or dribbling. Feedback includes comments on arc angle and a feedback on dribbling trials.

The current study was conducted to test the validity and reliability of measurement of the 94 Fifty for shot arc and for the accuracy of the dribbling count. Dartfish™ a video analysis system used by many sports associations around the world was used to compare results. The Dartfish Video Analysis system is a video computer software system that allows performers to capture video clips from a digital camera, playback the video frame-by-frame, and analyze the video[1].

2. Materials and Methods

2.1. Participants

A basketball dribbling test was performed by 260 boys and girls aged four through twelve. In total, 569 trials lasting 20 seconds each were captured, totaling 17,000 dribbles. A basketball shooting test (20 shots) was performed by seven adult male basketball players aged 26 - 35, for a total of 140 recorded shots.

2.2. Tools for collecting data:

- Dartfish Teampro software version 6 was used for the video analysis.
- IPad 3 with downloaded 94fifty software app.
- DSLR camera with speed of 20 frames per second.
- 94fifty smart basketball.

2.3. Device description (Design of the Instrumented Basketball):

2.3.1. The 94Fifty basketball

The 94Fifty is a rubberized indoor/outdoor ball that contains nine accelerometers inside, sitting on a circuit board that weighs less than 20 grams (0.7 ounces). The sensors can detect force (a 360-degree view of it) and speed, ball rotation and ball arc. Also, the sensors can measure an angle at which an inflated object (the ball) contacts a surface [5]. The sensors in the 94fifty do not appear to affect the weight of the ball or its rotation. Additionally, the sensors