



Research Article

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Biomechanical study of different techniques performed by elite athletes in table tennis

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ABSTRACT

Table tennis, as one of the most popular sports in China, has grown considerably since its developed in the 19th century in England. The biomechanics of the research methods in many sports has been widely used, for understanding of sports and technology and improve sports played an important role. Fast break and curving ball technology is this game's core technology. In this study, we based on fast break and curving ball features of kinematic to reveal the table tennis forehand techniques. Eighteen male volunteers were participated in this tests, the speed of the racket during the playing was recorded through Vicon Motion Capture System. The action was divided into three major phases: back swing, attack and follow through. At the end of back swing stage, break and curl technologies, the speed parameter shows some differences. While the peak speed in ball contact frame, the speed of curling ball was significantly higher than the fast break. Further study could be carried out in detailing analysis at sub-stage of the action for integral considering.

Keywords: Table tennis, Sport biomechanics, Motion analysis, Forehand techniques, Curving ball, Fast break

INTRODUCTION

Table tennis, as one of the most popular sports in China, has grown considerably since its developed in the 19th century in England. As modern, scientific and technological level of the movement of life continually improves, the means and methods, the study also constantly updated, the content and quality continuously deepened, system, the biomechanics of the research methods in many sports has been widely used, for understanding of sports and technology and improve sports played an important role [1]. This game has always been concerned of International Table Tennis Federation Forehand to guarantee that Ping-Pong remains a contest of human skills and not that of the technology just advanced in sports equipment [2].

For table tennis technology of motion: the study of living at home and abroad is not much, and shall have enough of research and further, the movement of life, and the study method. Table tennis is a special instrument of movement have very little creature, for many technology has yet to reveal the principle of action, or to expose more comprehensive. For example, the technology process to complete the attack on the stage, and restore upper limb of the main sequence, table tennis world for its understanding of the existing dispute. Table tennis in textbooks and the research that is the forearm and wrist arm in an effort, but in practice often have sports in the opposite. Previous to this problem to know more of the subjective quantitative analysis, but few quantitative analysis to this problem also needs profound knowledge. AS the reason is the lack of suitable instrument for table tennis. New instruments of development and for practical testing, and will help to table tennis footwork teaching and training can provide for table tennis training theory of reference[3].

Due to the competitors should be focused on their individual physical abilities in the biomechanics, this study try to investigate some important techniques in the match. The athletes using the racket to achieve controlling the ball, while the racket becomes the end part of the body with many joints. So the hands techniques definitely consider as the most

important from the generally point view. Forehand loop drive in Ping-Pong like fast break and curving ball technology is this game's core technology. In this research, we based on fast break and curving ball features of kinematic to reveal the table tennis forehand techniques.

EXPERIMENTAL SECTION

Eighteen male volunteers from physical education major were participated in this study. All the subjects have played Ping-Pong for more than 5 years. The information of these volunteers was listed in Table.1.

Table.1 Subjects details

	Mean	SD
Age (years)	22.3	1.8
Height (cm)	172.7	5.1
Weight (kg)	64.6	5.8

A Vicon Motion Capture System (Oxford, UK), consisting of six high-speed cameras (240Hz), collected digital data from the Ping-Pong racket. This 3D Motion Analysis is useful in technique analysis. This system uses small reflective balls that are attached to the skin at set points and 10 infrared video cameras that detect the reflective balls. The cameras pick up the movement of these reflective balls to capture the movement and joint angles of an individual. When this is used in conjunction with the force platforms, joint forces can be determined [5].

Subjects were instructed to complete two different kinds of technologies, those are fast break and curling ball. Each performance was using their maximum force under the their best batting strength controlling. Before the test, each performance has been practiced many times until the technology moves very stable. At least three times high performance tests with good technical quality should be recorded.

One integrity of the action was divided into three major phases: back swing, attack and follow through. In order to find the difference in these two techniques performing in Ping-Pong, paired sample T-test was used in SPSS software (SPSS 14.0, USA). The significant difference level was set as 0.05 to see the change.

RESULTS

Fig.1 reflects the racket speed of fast break and curling ball in different characteristics stage. At the end of back swing stage, break and curl technologies, the speed parameter shows some differences. While the peak speeds in ball contact frame, the speed of curling ball was significantly higher than the fast break. Although the same situation also appeared in follow through stage, those two values not shown any significant phenomenon.

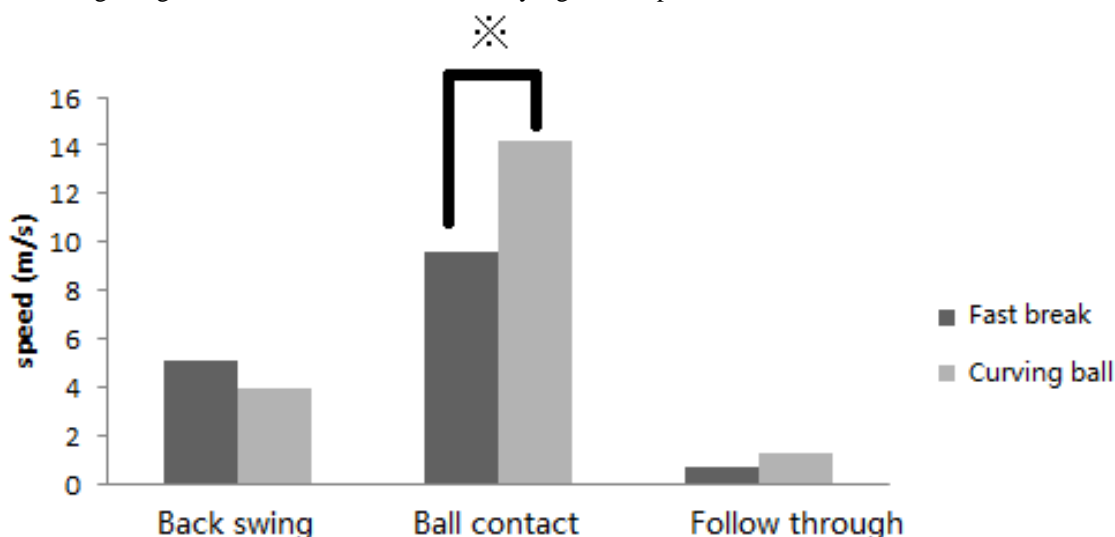


Fig.1 The speed of racket in different character moment (*means P<0.05)

A table tennis bats action is a complex process, in order to facilitate analysis, according to the task and nature, can be a complex integrity of the whole process is divided into different stages. To distinguish between different stages,

facilitate the full on the analysis and study, we set the different phases of the technical features of the picture. One subject to complete a fast break action, total time was $0.80\pm 0.11S$, the back swing, attack, and follow through phase with the average time was 0.51s, 0.18s and 0.21s, respectively. Then the curling ball action, total time was $0.99\pm 0.16S$, the back swing, attack, and follow through phase with the average time was 0.53s, 0.21s and 0.23s, respectively. The percentage of three phases in one action of these two techniques was shown in Fig.2. No significant difference exit about the time used in these two performances.

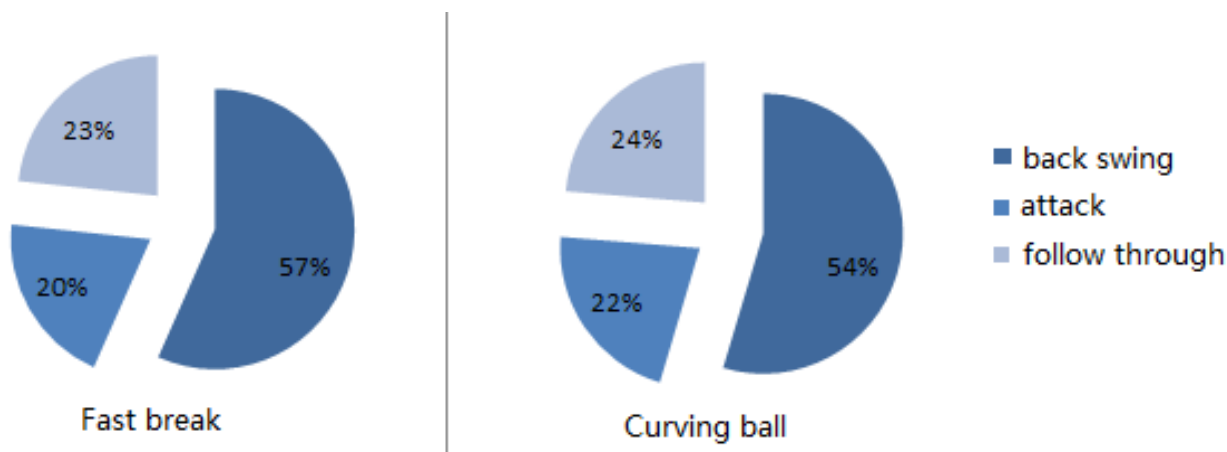


Fig. 2 Different technologies used in various stages in percentage

DISCUSSION

On the table tennis sport, the study of living creatures, and sports science of mechanics development trend of development and table tennis of the practical needs and employ multiple movement biological mechanics of mechanics and experimental method of study the combination of table tennis in a field of analysis and research, the biological mechanics in table tennis competitions of research and development trend [4, 6]. Through the video analysis, you can find the precise moment, but because of successive strokes, the rackets and bodies in motion, no one such a moment, therefore, restore the moment and take over and over time with the wave of the most remote subjective judgment can only go. We choose the speed analysis of racket, because the process was ultimately reflect the movement of change, and take over the bats in the end, and with all speed, in a moment, the bat for the maximum speed or so, so the speed of change can be accurately distinguish to take over and over time with the wave, and restore the moment unable to judge. Previous instructions shows that increasing the racket speed in back swing stage could increase the hitting power and speed for the next ball contact energy [7,8], however, this study can't reflect the importance of back swing stage, which could become the further study to detail analysis the sub-stage for integral considering.

CONCLUSION

Racket speed characteristics: after the back swing stage, fast break and curling ball exists some difference as well as the different playing ways. During the ball contact moment, curling ball speed is significantly higher than the fast break. The time racket features: fast-break technology and curling ball performance characteristics in terms of time was that the total time of curling ball is longer than the fast break techniques. But no significant difference exit about the time used in these two performances.

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