DESIGN OF SIMULATIVE PITCHING MACHINE AND IT'S EFFECT

Chiang Liu[1], Kuo-Ghi Tseng[1], Chen-Wei Chung[2], Ying-Chieh Kao[1] and Tzyy-Yuang Shiang
[1]Taipei Physical Education College, Taipei, Chinese Taipei
[2]Shih-Hsin University, Taipei, Chinese Taipei

The purpose of this study was to design a simulative device that attached on pitching machine to create the similar pitching motion of real pitcher, and to investigate the subsequent training effect. A photo sensor and automatic switch were used in the design of a simulative device in this study. When light from the photo sensor was cut off by the pitcher's throwing arm, the automatic switch would be turned on immediately and allow a ball to roll down into the pitching machine. Twelve collegiate baseball batters were divided into three groups. A cross-over experimental design was used. Each group involved one of three types of practice after one days rest. The three groups were Type-A: do nothing. Type-B: batting practice by traditional pitching machine. Type-C: batting practice by simulative pitching machine. Each batter hit six balls before and after batting practice for investigating training effect and two baseball experts evaluated batting performance. The results showed that there was significantly increased batting performance after Type-B and Type-C practice ($p < .05$). Type-C achieved significantly higher batting scores than type-A and Type-B ($p < .05$) methods. The results suggest that batting practice using a pitching machine with simulative device was an effective batting training method.

KEY WORDS: pitching machine, simulative device, batting, baseball

INTRODUCTION: Baseball is a very popular sport throughout the world. It is an all-round sport combining the skills of pitching, batting, baserunning, throwing and fielding. It is known that a powerful offense is the best defense. Batting is an active offensive weapon and a critical factor to win as well as also being a very difficult skill. A pitcher delivering a pitch or a pitching machine is widely used during batting practice for improving batting ability. Use of a pitching machine could allow the batter to hit a pitch with very high speed and good accuracy. Loran & MacEwen (1997) stated that the batting skill could be separated into two stages: visually the judging pitch, and swinging the bat. Batter often adopts a certain swing strategy depending upon visual input. Because there is a difference in pitching motion between a real pitcher and a pitching machine, using a pitching machine may confuse the visual judgement of a pitch, therefore disturbing batting timing and batting pattern. This is the reason why baseball players seldom use it in batting practice and prefer to instead use it in bunting practice. The purpose of this study, therefore, was to design a simulative device that attached onto a pitching machine to create the similar pitching motion of a real pitcher, and to investigate its training effect.

METHODS:

Design simulative device: A photo sensor and automatic switch were used in the design of the simulative device in this study. The photo sensor was placed on the back of the pitching machine. An automatic switch was placed on the top of the ball entrance of the pitching machine. When the light from the photo sensor was cut off by the pitcher's throwing arm, the automatic switch would be turned on immediately and would allow a ball to roll down into the pitching machine. The height and distance of the photo sensor were adjusted to match the ball release time as same as the pitcher's wrist arrive exit of pitching machine. Briefly, the simulative pitching machine creates a situation where real pitching may be simulated. The illustration of simulative pitching machine showed in Figure 1.

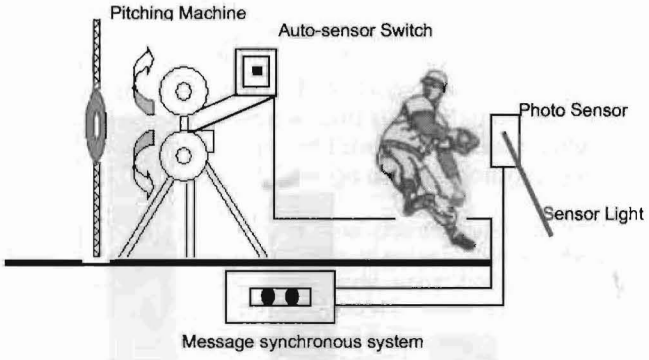

Figure 1 The illustration of simulative pitching machine.

Twelve collegiate baseball batters participated in this study and were divided into three groups. A cross-over experimental design was used. Each group involved three types of practice and altered practice after one days rest. The three experimental conditions were as follows; Type-A: do nothing, Type-B: batting practice, 20 hits by using traditional pitching machine. Type-C: batting practice, 20 hits by using simulative pitching machine. In Type-B and Type-C, the pitching machine was placed 16.7m in front of the home plate and the pitching speed was set at 130 km/hr. Each batter hit six balls before and after batting practice to investigate the training effect. Two pitchers with similar pitching motion and pitching speed (average speed was 130 km/hr) participated in the practice and testing sessions. In the testing session, a speed gun (Combo Pitching Machine, USA) was used to supervise pitching speed. Deviation of 5 km/hr was allowed to be hit. Two baseball experts evaluated batting performance of each batter. The criterion of evaluation was as follows: 5 points (powerful fly), 4 points (powerful ground), 3 points (higher ground), 2 points (fly), 1 point (foul tip), and no points (strike out). There was a significant relationship between evaluative results of two baseball experts ($p < .05$). Therefore, it is indicated that two baseball experts have a criterion of reliability. The same procedures were carried out through different practice sessions and testing sessions. Statistical software (SPSS version 10.0) was used to analyze data. The differences between pre-test and post-test in three types of batting practice were analyzed by a repeated measures t-test. The difference of training effect was analyzed by an independent sample one-way ANOVA. The significant level was set at 0.05.

RESULTS: The results showed that there was significantly increased batting performance after Type-B batting practice ($t = -2.589$, $p = 0.017$) and Type-C batting practice ($t = -4.848$, $p=0.00$) (Shown in Table 1 and Figure 2).

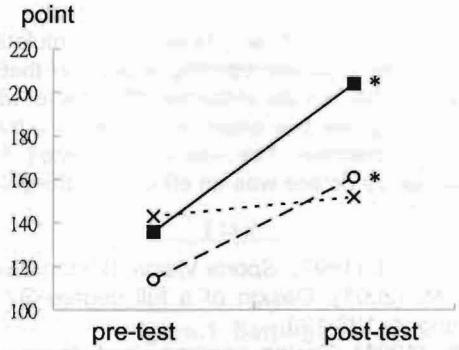

Figure 2 The points vary in the pre-test and post-test. (× is Type-A, ○ is Type-B, ■is Type-C. * $p < .05$)

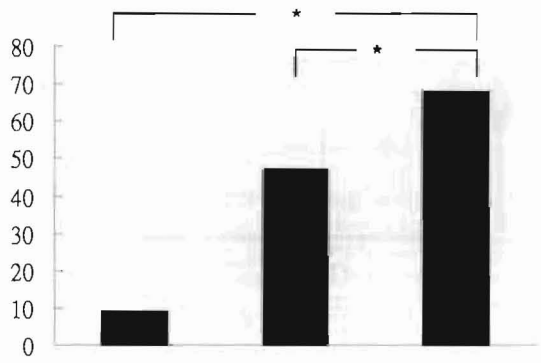

Figure 3 Difference of training effect among practice types (*p < .05).

There was an increase of 9 points after type-A practice, a 47 point increase after type-B practice, and a 68 point increased after the type-C practice. The results showed that Type-C practice resulted in significantly higher batting scores than either type-A or Type-B practice ($p < .05$) (Figure 3).

DISCUSSION: The results revealed that the simulative pitching machine developed in this study could significantly increase batting performance. The results indicated that batting practice using pitching machine with the simulative device was an effective batting training method. In general, pitching machines are widely used during batting practice for improving batting ability, because pitching machines can release a pitch with very high speed and good accuracy. There are several kinds of pitching machine that have been developed. Mish & Hubbard (2001) used a thermodynamic gas flow model to design a new baseball pitching machine. By using separate mechanisms to impart linear and angular velocity vectors of the ball at release, it provides accurate and repeatable full degree-of-freedom control over each. McLeod & Jenkins (1991) found that timing accuracy and decision time was related to performance in high-speed ball games. Batters often take certain swing strategies depending upon visual input. However, batters do not observe any pitcher's motion during batting practice when using a pitching machine. It often confused visually judging pitch and disturbed batting timing and batting pattern. Thus, bad contact between bat and pitch may be caused. In this study, a photo sensor and automatic switch were used in the design of a simulative device which made synchronization between ball release from pitching machine and pitcher's release stages. It creates a situation that batter faces a real pitcher during batting practice by simulative pitching machine.

CONCLUSION: The purpose of this study was to design a simulative device that is attached on a pitching machine to create a similar pitching motion to that of a real pitcher, and to investigate its training effect. The results indicated that there was significantly increased batting performance after batting practice when compared to a traditional pitching machine and using simulative pitching machine. The results suggested that batting practice using pitching machine with a simulative device was an effective batting training method.

REFERENCES:

Loran, D. F. C. & MacEwen, C. J. (1997). *Sports Vision*. Boston: Butterworth.
Mish, S. P. & Hurbbard, M. (2001). Design of a full degree-of-freedom baseball pitching machine. *Sports Engineering*, 4, 123-133.
McLeod, P. & Jenkins, S. (1991). Timing accuracy and decision time in high-speed ball games. *International Journal of Sport Psychology,* 22, 279-295.