THE INFLUENCES OF THE BUNT IMAGE UPON BALL MEETING BAT

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In today's baseball, a bunt is considered as an important tactic. Therefore the aim of this study was to define the kinematic characteristics of bunt comparing between experts and beginners. Five expert players and five healthy male students participated in this study. Subjects bunted 10 times. 3-D coordinate was determined by DLT METHOD. Using these variables, the variance of distance between the bat-head and forehead, and the variance of bat-angle were researched and analyzed by z-test ($p < 0.05$). In the variables of the bat-angle no significant deference was recognized. In the variable of the distance between the bat-head and the forehead, a significant deference was recognized. Reliability of this data will increase by having an amateur baseball player and a professional baseball player perform the experiment that they performed this time.

KEY WORDS: baseball, bunt, kinematics, characteristics.

INTRODUCTION: In today's baseball, it is said that the bunt is the basic tactic to increase the possibility of scoring runs. Because the bunt is carried out to get a run, success or failure of only one bunt controls winning or losing. But the kinematic characteristics of bunt are not clarified though the training methods of bunt technique are researched. Therefore, it is thought that clarifying the kinematic characteristics of bunt by comparing experts and beginners will help for coaching the technique of bunt. Then the aim of this study was to define the kinematic characteristics of bunt comparing between experts and beginners.

METHODS: Five expert players (Kanazawa Univ. Baseball Club, age: 20.0±1.5 years, height: 173.5±2.7 cm, weight: 69.4±6.5 kg, playing years: 11.2±0.7 years) and five healthy male students (age: 22.2±0.4 years, height: 173.5±5.3 cm, weight: 66.9±8.1 kg) participated in this study. Five healthy male students have not played baseball game and only played catch. The research took place at the pilotis in the gym in Kanazawa Univ. on 7 December 2005. Markers were attached to the thumb of the subjects' right hand, the back of the left hand and forehead to measure three dimensional coordinates. The head and grip of the bat were marked by tape for measurement. Three video cameras (SONY DCR-TRV70K) were put in front of, in the right diagonal front of and an the right side of subjects. Subjects bunted 10 times and analyzed 5 balls after the flash, the start sign. All of the balls were pitched by pitching machine and ball speed was 110km/h, moreover, the course of balls was the same. Subjects bunted 10 times for warm up before camera shooting. Bunted balls were rolled toward third base direction. Three dimensional coordinate was determined by DLT (Direct Linear Transformation) Method (X-axis: front and back, Y-axis: right and left, Z-axis: top and bottom). The standard errors for each X-axis, Y-axis, and Z-axis of three dimensional coordinate and physical measurement points were 0.010m, 0.006m and 0.004m. Using these three dimensional coordinate value, the variance of distance between the bat-head and the forehead of each subject and the variance of bat-angle (top and bottom, front and back) were calculated. The comparison of each variable at the time of bunt for experts and beginners demanded significant difference with z-test without correspondence ($p < 0.05$).

RESULTS: The degree of bat on XY-plane means the movement of bat to front and back. The mean of maximum, minimum, mean and SD for the degree of bat on XY-plane are shown on Table1. The maximum degree of bat for experts was 104.9°, and the minimum degree was 69.6°. The maximum degree of bat for beginners was 112.1°, and the minimum degree was 71.1°

Table1: Degree of the bat on ball meeting bat (XY-plane)

		Max	Min	Mean	SD
Experts	Mean	97,8	87,3	92,7	4,3
	SD	10,5	13,8	10,5	4,9
Beginners	mean	107,8	89,3	97,5	6,7
	SD	4,7	10,6	4,8	4,2

The degree of bat on YZ-plane means the movement of bat to top and bottom. The mean of maximum, minimum, mean and SD for the degree of bat on YZ-plane are shown on Table2. The maximum degree of bat for experts was 93.6°, and the minimum degree was 74.1°. The maximum degree of bat for beginners was 112.0°, and the minimum degree was 65.2°

Table2: The degrees of the bat on ball meeting bat (YZ-plane)

		Max	Min	Mean	SD
Experts	Mean	91,2	79,1	84,6	4,4
	SD	1,4	3,7	2,9	0,6
Beginners	mean	87,7	74,9	81,7	4,5
	SD	12,7	13,8	13,3	1,2

The mean of maximum, minimum, mean and SD of the distance between the bat-head and the forehead of each subject are shown in Table3. The maximum distance for experts was 0.89m, and the minimum distance was 0.60m. The maximum distance for beginners was 1.09m, and the minimum distance was 0.74m.

Table3: Distance between the bat-head and the forehead of each subject for experts and beginners

		Max	Min	Mean	SD
Experts	Mean	0,82	0,67	0,74	0,05
	SD	0,05	0,05	0,05	0,01
Beginners	mean	0,99	0,87	0,93	0,04
	SD	0,07	0,1	0,09	0,02

RESULTS: In the variables of the bat-angle on XY-plane no significant deference was recognized among the experts and the beginners. Making graphs for the variable of bat-angle, these drew a rhythmical wave pattern. It is said that subjects move the bat to the front and back in order to take timing before machine pitches ball. The degree of the bat after ball contact became smaller. This means that subjects moved the bat to back direction. It is thought to be caused by absorbing the power of the ball and rolling weakly. At the time of ball-bat-meeting the degree of bat was different for each subject though they were going to roll the ball to the same place.

In the variables of the bat-angle on YZ-plane, no significant difference was recognized between the experts and beginners. Making graphs from the variable of bat-angle, these also drew a rhythmical wave pattern, but the change was smaller than that on XY-plane. Therefore it is suggested that subjects hardly move the bat to top and bottom to take timing. Before ball meeting bat, the degree of bat became gradually smaller, and after ball meeting bat, the degree of bat became bigger. From this, it is said that the bat-head at ball meeting bat goes to a lower position than in the start position.

In the variable of the distance between the bat-head and the forehead of each subject, the beginners' distance was longer than experts', and a significant deference was recognized in maximum, minimum, and mean. It can be said that an improvement of the bunt technique shortens the distance between bat-head and forehead of each subject. Making graphs of the variable of distance between bat-head and forehead of each subject, it is clarified that

subjects' bunt is much better when changing the distance though keeping distance between bat-head and eyes of each subject.

CONCLUSION: The following things became clear as being the kinematic characteristics of bunt.
1.   Moving bat to front and back in order to take timing.
2.   Moving bat to back direction after ball meeting bat in order to let it lose the speed of ball.
3.   Even if the point to aim at is the same, the front and back angles of bat are different in each subject.
4.   Bat-head at the bunt becomes lower than that in posing.
5.   Improving the bunt technique shortens the distance between bat-head and forehead of each subject.
6.   Bunt a ball while changing the distance between bat and eyes of each subject.
From these conclusions, we suggest that it is necessary to do a similar experiment marking points on the whole body in order to research the movement of lower body and the kinetic chain of the upper and lower body. Furthermore, reliability of this data will increase by having an amateur baseball player and a professional baseball player perform the experiment described in this paper.

REFERENCES:

Tzatzis. G. (2000). Different multimedia means for class presentation in higher education. Journal of Human Movement Studies, vol. 39, 73-84.