

THE TRUNK TWIST ANGLE DURING BASEBALL BATting AT THE DIFFERENT HITTING POINTS

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INTRODUCTION

Most of investigations on the baseball batting have focused on the batting motion for hitting a ball at the center of strike zone. However, since a pitcher in real baseball game tries not to throw the ball toward the center of strike zone, it is useful to identify how batters change the batting motion to hit the ball at various points in the strike zone. Although we can easily observe how the arms and legs are changed to carry the bat toward various hitting points, we have no information enough to teach an appropriate trunk motion to batters, which has been advocated to be important.

The purpose of this study was to investigate the change in twist angle between the shoulders and hips during baseball batting at the different hitting points.

METHODS

Subjects were ten right-handed male skilled batters of a varsity baseball club. Informed consent was collected after the explanation of the experiment procedure. Nine hitting points were set in the strike zone according to the baseball rules: three heights (high, middle, low) based on the subject's height and three courses (inside, center, outside) based on the width of a home plate. The subjects were randomly assigned nine hitting points and hit at least five times at each hitting point. The ball was set on a batting-tee stand at the hitting points assigned. The trial in which fastest ball velocity and good feeling of subjects were obtained was chosen at each hitting point for analysis.

Kinematic data were collected by using Vicon 612 system with nine cameras operating at 120Hz. Batting motion was divided into six phases by seven instants of motion event: Take-back start (TBS), Toe-off (TOF), Knee high (KH), Toe-on (TON), Swing start (SS), Left upper arm parallel (LUP), and Impact (IMP).

A trunk twist angle was defined as the angle between a line connecting the hips and a line connecting the shoulders, which were projected on a horizontal plane. A positive angle of the trunk twist means that the shoulder rotation to the hitting direction, i.e. forward rotation, is larger than that of the hips.

A repeated two-way ANOVA was used to test differences in the angular kinematics among hitting points at a significant level of 0.05.

RESULTS AND DISCUSSION

The upper figure of Figure 1 shows changes in trunk twist angle for hitting the ball at three heights (high, middle, low). The shoulder rotation to the opposite hitting direction, i.e. backward rotation, was significantly larger in the low ball hitting from SS to LUP than that of the high ball hitting, and the shoulder forward rotation significantly

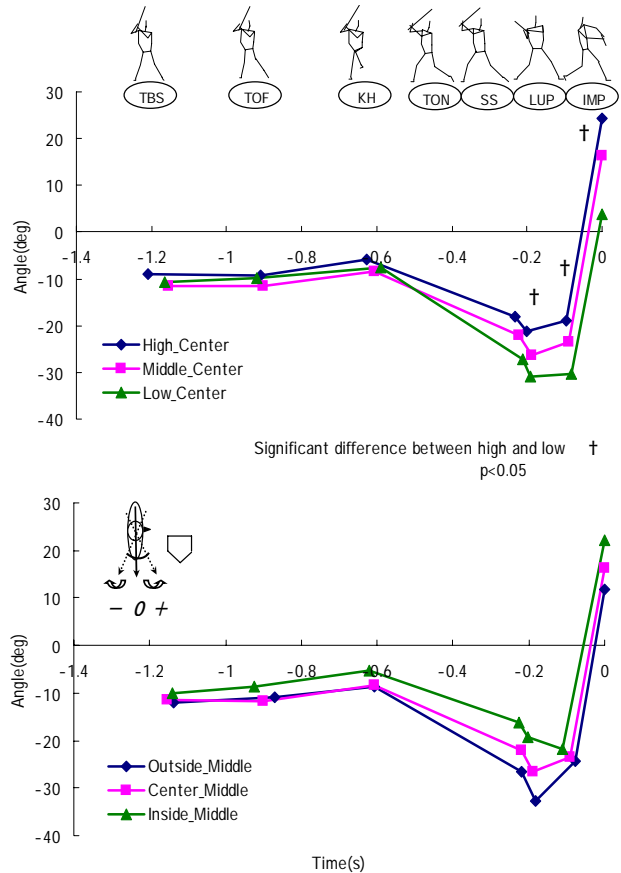


Figure 1. The trunk twist angle in the High—Low and Outside—Inside ball hitting.

smaller in the low ball hitting at IMP than that of the high ball hitting. These differences in the shoulder rotation between the high and low ball hitting indicated that the different trunk motion and timing were used in swinging the bat for high and low ball hitting.

The lower figure shows changes in trunk twist angle for hitting the ball at three courses (outside, center, inside). The shoulder backward rotation was larger in the outside ball hitting from TON to LUP than that of the inside ball hitting, and the shoulder forward rotation tended to be smaller in the outside ball hitting at IMP than that of the inside ball hitting. However these differences were not significant.

These results suggest that when hitting a high ball a batter should rotate the shoulders backward in small range from SS to LUP and use the large forward rotation from LUP to IMP, and that in hitting a low ball a batter should use large backward rotation of the shoulders from TON to LUP and use the small forward rotation from LUP to IMP.