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KINETIC ANALYSIS OF EACH HAND IN BASEBALL BATTING MOTION AT DIFFERENT HITTING POINT HEIGHTS

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The purpose of this study was to clarify the kinetic features of each hand under conditions of different hitting-point heights in the baseball tee-batting by using a bat with instrumented grip-handle. Twenty-three collegiate male baseball players' motion were captured with a VICON MX system (12-cameras, 250Hz), and kinetic data at each hand were measured by using the instrumented bat equipped with 28 strain gauges (1000Hz). The vertical displacement of the hitting-point on the bat was mostly dominated by translational movement of the bat. The work of the force of vertical component showed that the positive work of knob-side hand was significantly larger at down swing and level swing phases. These results indicate that the knob-side hand is a great contributor to adjust the bat into the different hitting-point height in each phase.

KEY WORDS: closed loop, instrumented bat, tee-batting.

INTRODUCTION: Baseball players manipulate a bat with both hands by exerting forces and moments on the grip handle of the bat to hit balls thrown into various courses. Due to the kinetic redundancy of the system consisting of the bat and upper limbs, it is essentially impossible to know how each hand exerts forces and moments on the bat. This is known as the 'closed loop problem'. Koike et al. (2004) have proposed a solution to the problem using a bat instrumented with strain gauges. The purpose of this study was to clarify the kinetic features of each hand under conditions of different hitting-point heights in the baseball tee-batting by using a bat with an instrumented grip-handle.

METHODS: Twenty-three collegiate baseball players (age; 19.8±1.3yrs, height; 1.74±0.04m, weight; 74.1±6.2kg, athletic career; 12.0±2.1yrs) participated in this study as subjects. They performed baseball tee-batting with three ball heights (low, middle, high) according to the baseball rules and body height of each player. Three-dimensional coordinate data (body: 47-points, bat: 6-points) were captured with a VICON MX system (12-cameras, 250Hz). Kinetic data at each hand were measured by using a bat with an instrumented grip-handle with 28 strain gauges (1000Hz). The period of forward swing motion was divided into a down-swing phase and level-swing phase identified from the components of bat head velocity.

RESULTS and DISCUSSION: Figure 1 shows the mean value and standard deviation of the vertical displacements of the hitting-points on the bat caused by translational and rotational movements of the bat during forward swing motion. This result indicates that the height of the hitting point is modified mainly with translational movement of the bat. Figure 2 shows the work done by the vertical component of the force exerted by each hand. The work done by the knob-side hand, which was positive, showed significant difference between the height conditions at each swing phase. These results indicate that the knob-side hand is a great contributor to adjust the bat into the different hitting-point height in each phase.

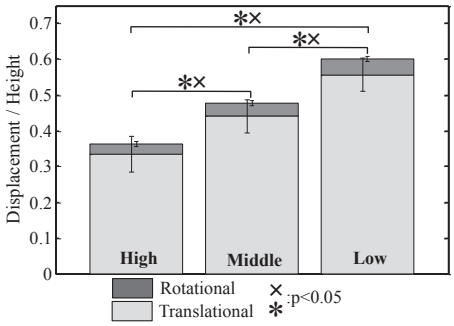

Figure 1: Vertical displacement of the bat.

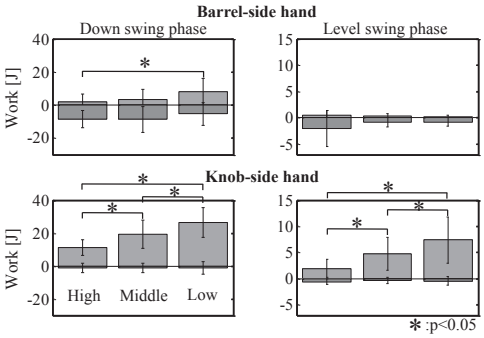

Figure 2: Works of the forces of vertical components.

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