ANALYSIS OF BASEBALL BAT WITH DYNAMIC MOMENT OF INERTIA DURING SWING

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INTRODUCTION

Previous studies found that there is a negative relationship between swing velocity and bat weight. Swing velocity is a critical factor for batting performance, it could be transfer more swing momentum to batted ball. However, it is also reduce swing momentum due to lighter bat swung. Dynamic Moment of Inertia bat, DMOI bat, is characterized in that the bat was swung more easily through reducing the moment of inertia at the initial stage of swing without decreasing the bat weight. The sliding mass could be shift along with the bat body to the barrel end of the bat by swing inertia (shown as Figure 1). There is a similar mass distribution as normal bat when bat-ball contact. Therefore, the purpose of this study was to compare swing trajectory, swing movement, and swing velocity between the DMOI bat and normal bat.

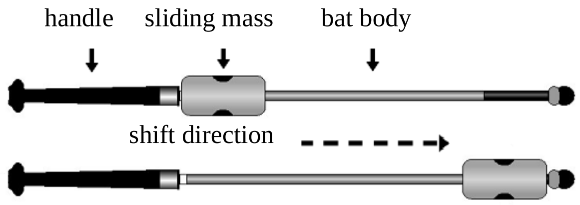

Figure 1: Dynamic Moment of Inertia bat.

METHODS

Eight varsity baseball players were voluntary participated in this study. Each subject randomly swung the DMOI bat and normal bat for three trials, respectively. Both bats are the same weight of 860g and length of 85.5cm. The wooden official bat was used as the normal bat in this study. The body of DMOI bat was made by a piece of metal bar, it was through into the sliding mass. The moment of inertia is lower when the sliding mass was close to the handle before swing. The sliding mass could be shift along with the bat body to the barrel end by swing inertia (Figure 1). Motion Analysis System (Motion Analysis Corporation, Santa Rosa, CA) with ten Eagle digital cameras at a rate of 250 frames per second was used to capture swing movement. Subject, DMOI bat, normal bat, and ball were placed reflective markers, respectively. Swing movement was defined as stride phase (SP), swing phase (including S1, S2 and S3 sub-phases) and follow through phase (including FT1 and FT2 sub-phases) (Shown as Figure 2).

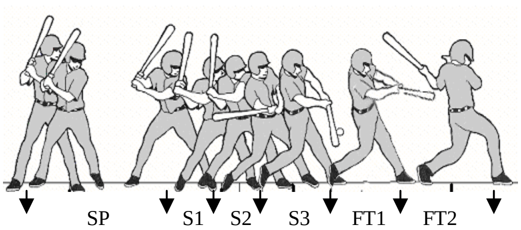

Figure 2: Phases of swing movement.

RESULTS AND DISCUSSION

The results reveal that both bats had similar swing trajectory of the sweet spot before S3. However, the DMOI bat had slightly wide swing trajectory around the moment of the bat-ball contact, because the sliding mass reached the barrel end. After statistic analysis of t-test, there was no significant difference between bats in joint angle of leading arm at all swing phases ($p>.05$). The DMOI bat had significantly faster swing velocity during the swing phase and the moment of the bat-ball contact ($p<.05$).

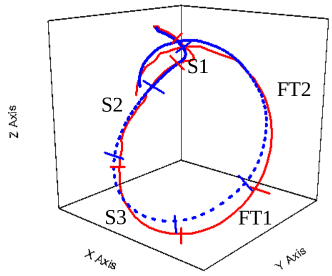

Figure 3: Swing trajectory of DMOI and normal (dot line) bats.

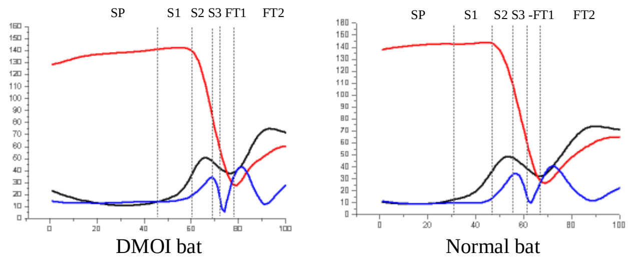

Figure 4: Change of joint angle in leading arm during swung.

Table 1: Swing velocity of the sweet spot. (m/s)

phase	DMOI bat	normal bat	t
SP	0.76±0.29	0.59±0.18	2.318
S1	2.53±0.58	2.27±0.54	2.669*
S2	12.17±1.31	10.48±1.44	3.348*
S3	22.99±1.11	19.58±1.43	3.327*
contact	25.53±1.00	21.57±1.58	4.033*
FT1	23.22±1.39	21.67±1.84	3.337*
FT2	10.49±1.81	10.34±1.35	0.378

CONCLUSIONS

The study concluded that the DMOI bat had faster swing velocity without change swing trajectory and swing movement. The findings suggested that the DMOI bat has the more benefit of swing performance, so it could be adopted for increasing hitting ability during swing practice.

REFERENCES

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