Comparison of Hitting Impact Variability between Baseball Players of Different Skill Levels

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Summary

Prolonged exposure of the hand to impact vibration from baseball hitting may lead to hand pains, injuries, and fracture. This study compared the differences in hand impact and variability during toss batting between novice batters and trained batters. All batters performed ten toss-batting trials. The peak resultant accelerations on both hands were extracted as hand impact. The results indicated that the impact on both hands of novice batters were not significantly different from those of trained batters ($p > .05$), but the coefficient of variation (CV) in top hand impact was significantly higher in novice batters ($p < .05$). In conclusion, during toss batting training, batters with lower skill levels exhibit higher variability in batting load, which may increase their risk of hand injury.

Introduction

Baseball hitting is a high-intensity and high-risk specialized technical movement. Poor hitting positions often occur during both training and actual games, especially among batters with lower skill levels. When the ball and the bat collide in an unfavorable position, it generates intense impacts that lead to accumulated hand load. Prolonged exposure of the hand to high-intensity impact can result in damage to the hand's bones, muscles, and nerves [1,2]. Additionally, high variability in load may increase the risk of injury [3]. This study aimed to compare the differences in hand impact and variability during toss batting among hitters of different skill levels.

Methods

Ten trained collegiate baseball players (age: 22.2 ± 2.9 years, height: 172.9 ± 4.8 cm, weight: 76.8 ± 13.7 kg, years of playing: 6.5 ± 3.7 years) and ten novice batters with less than one month of baseball practice experience (age: 22.5 ± 2.6 years, height: 179.3 ± 6.0 cm, weight: 70.8 ± 10.0 kg) participated in this study. All participants had not experienced significant bone or muscle injuries in the year before experiment. All participants performed ten toss-batting trials. A maple wood baseball bat was used in this study. Prior to the experiment, two inertial measurement units (IMUs) (Vicon Blue Trident, UK) were attached to the both hands. The IMU 's measurement ranges are ± 200g for accelerometers. Data collection was conducted at a sampling rate of 1600Hz. The peak absolute accelerations of each axis were extracted and calculated the square root of the sum of squares ($\sqrt{\mathrm{Xpeak}^2 + \mathrm{Ypeak}^2 + \mathrm{Zpeak}^2}$), as the hand impact. The CV in hand impact among ten trials on both hands were analyzed. An independent samples t-test was used to compare the differences between the two groups. Statistical significance was set at $\alpha = 0.05$.

Results and Discussion

No significant differences in hand impact between novice batters and trained batters were observed for both hands ($p > .05$). However, the CV in top hand impact of novice batters was significantly higher in novice batters ($p < .05$). These findings suggest that while the average hand impact of novice batters is comparable to that of trained batters, the variability in impact during each hit is greater among novice batters. Excessive load variability has been associated with an increased risk of injury [3]; therefore, novice batters should exercise greater caution during batting practice to minimize potential injury risks.

Conclusions

Novice batters may exhibit greater variability in hand impact during toss batting practice compared to trained batters. This heightened variability could increase the risk of injury, though further research is necessary to confirm this relationship. This study suggests that future research should investigate differences in hand load across various batting conditions and explore the potential of wearable monitoring technologies to better assess and manage hand load in batters.

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References

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Table 1: Interesting data from well-executed experiments.

	Trained batters (n=10)	Novice batters (n=10)	*t*-value	*p*-value
Knob hand impact (m/s^2)	890.54 ± 155.24	749.67 ± 161.13	1.383	.184
CV in knob hand impact (%)	41.46 ± 13.11	41.83 ± 18.46	-0.051	.960
Top hand impact (m/s^2)	1240.40 ± 142.28	1084.64 ± 519.57	0.759	.457
CV in top hand impact (%)	33.04 ± 6.73	45.84 ± 12.54	-2.845	.011*

*$p < 0.05$