

Analysis of EMG activity in badminton during Hi-Clear Shots

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Summary

Badminton is a racquet sport that utilizes racquets to propel shuttlecocks across a net. The sport is commonly practiced as a recreational and educational activity in various educational institutions, including middle schools, high schools, universities, and community sports programs, as well as in professional competitive settings. The game is conducted on a rectangular indoor court. Electromyographic (EMG) activity in the upper and lower extremities during badminton was distinctly observed in every shot. Coherence was calculated from the EMG of the upper and lower extremity muscles before and after the moment of impact between the racket and shuttle. Although individual techniques may vary, the initiation of the high cleared shuttle is nearly identical across players. The upper and lower extremity EMG tended to exhibit higher values in techniques with mastered coherent values.

Introduction

Badminton is a widely prevalent competitive sport in Japanese school education. Consequently, it attracts numerous enthusiasts across age groups and genders. While match outcomes can be utilized to assess a competitor's progress, there is a lack of established indices for evaluating the motor learning process in racquet sports. Thus, this study aimed to measure EMG from the upper and lower extremities on the racket-holding side during shots and to examine the involvement of muscle activity through coherence values.

Methods

Four university student volunteers, comprising three Division I athletes and one novice participant, all female, with a mean age of 21 years (SD=0.6), mean height of 1.65 m (SD=0.08), and mean weight of 56.5 kg (SD=12.0), without pain symptoms, were recruited for data collection from electromyography (EMG) of the ulnar carpal flexor muscle, deltoid muscle, rectus femoris muscle, and gastrocnemius medialis, respectively. Collection and recording of the myoelectric signals were conducted in accordance with established standards [1]. The myoelectric signals were amplified (PolyMateMini, Miyuki Giken, Japan) and sampled at 500 Hz, with correction of the raw EMG signal for DC offset. The raw data were rectified, and a moving average of 10 points was calculated. The moment of impact of a high clear shot was visually detected by the displacement of an accelerometer on the palm. Using MATLAB software, we computed the coherence before and after the impact, with six

index values for the four muscle sites mutually. This study was approved by the Jissen Women's University ethics committee (H2024-28).



Figure 1: The experimental hi-clear shot for four subjects, one novice and three college athlete.

Results and Discussion

In comparison to novice players, the high clearing shot movement of experienced players was characterized by an elevated point of contact with an extended elbow. There were larger integrated EMG values of the upper extremity and gastrocnemius muscles in beginners (see Fig.1 left).

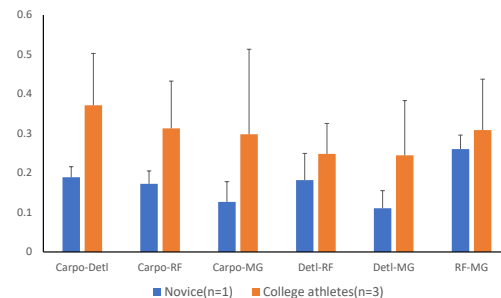


Figure 2: Coherence results among EMG acquisition sites.

Conclusions

It was considered EMG coherence was suggested the motor skill of badminton (see Fig.2).

Acknowledgments

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References

- [1] Merletti R. (1999). Standards for reporting EMG data. *Journal of Electromyography and Kinesiology* (9)III-IV