Characterization of grip force during badminton strokes

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Badminton is one of the most popular racket sports for which the grip remains crucial for performance. For ergonomic purposes, the hand–handle interface of tennis racket has been studied quite extensively. However, the literature shows a very limited knowledge on badminton grip force intensity. Particularly, the relationship between grip force and different badminton strokes is still poorly understood. Therefore, the purpose of this study was to measure the differences of grip force intensity between four basic badminton strokes, forehand (FH), backhand (BH), smash (SH) and net roll (NR). Ten asymptomatic adult badminton players took part in this study. Grip force was recorded using an embedded capacitive pressure-sensing mat (TekScan 9811) wrapped around a badminton racket handle, from which total grip force could be determined. The sensor was loaded using a force rating of 0-1000N (R²=0.93) and the sampling rate was 500 Hz. The subjects were instructed to hit 20 shuttlecocks, for each stroke, into a target on the court. Only successful trials were analyzed. A one-way repeated measure ANOVA (stroke) was used to compare the effect of grip force. Tukey post-hoc test was used when significant level (p<.05) was reached. Average peak force magnitude was 117.0 N±45.7 N, 166.1 N±58.3 N, 209.0 N±56.1 N and 83.8 N±59.2 N for FH, BH, SH and NR conditions respectively. The statistical analysis revealed that grip force applied on the handle was strongly depending upon the stroke, NR grip force was significantly greater than BH (p<.01) and SH (p<.01) grip force. Moreover, the grip force applied in the SH condition was higher than BH condition (p<.01). Data analysis showed that each player had an individual grip force pattern repeatable, but it was observed a strong intersubject variability. The strokes in badminton are a mix of power, precision and manoeuvrability. These characteristics appear to be contradictory: e.g. the literature shows that an increase grip force (power) led to a decrease in wrist motion (manoeuvrability). The main result of the present study is that the subjects took into account these constraints and the type of the strokes by adapting their grip force. Particularly, the precision (NR) and power stroke (SH) were inversely related: a lower grip force led to a greater precision probably allowed by a greater wrist range of motion.

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Keywords: grip force; pressure sensor; badminton

1877-7058 © 2010 Published by Elsevier Ltd. Open access under CC BY-NC-ND license. doi:10.1016/j.proeng.2010.04.185