Customising moment of inertia of a badminton racket: Effects on performance and impact location

Hypothesis

1. \( \text{MoI} \) will affect racket head speed
2. \( \text{MoI} \) will affect where the racket head lands relative to the node location

Methods: racket preparation

- Rackets were grouped into国际and national categories,
- Elite senior males > National senior males > Junior males > Females
- A total of 20 badminton players (n=20)

Methods: Dynamic Trials

- Racket and shuttlecock speeds
- Centre of mass measured using a balance
- Elongations using Vicon (500 Hz)
- Number of racket deflections = 3 maxima

Results

- Linear trend not evident for all individuals
- Elite senior males > National senior males > Junior males

Discussion

- Greater shuttlecock speed and feeling allowed MOI calculation
- Racket head speed at the racket head centre
- COR location coincide
- Violin plots of racket head speed and shuttlecock speed, representing the

Conclusions

- Recommendations for racket designers to produce a racket where node and maximum impact deflections (p<0.05)
- The nodal ‘sweet spot’ has been identified as a

Design of experiment

- Randomised order
- Each player performed 3 sets of competition smashes
- 5 rackets of incremental \( \text{MoI} \)

Data analysis

- ANOVA
- Post-hoc tests significantly different to Rackets 1, 2, 3, respectively (p<0.05)

Additional information

- Mean of the fastest three racket head speeds and shuttlecock speeds for each individual were used for analyses.
- Effect of \( \text{MoI} \) on performance metrics assessed using repeated measures ANOVA.