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Tennis serve volume, distribution and accelerometer load during training and competition from wearable microtechnology.

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INTRODUCTION:
This study investigated serving volume, frequency and accelerometer loads of elite female tennis players via machine learning algorithms for stroke even detection developed from global positioning systems (GPS) and micro-electro-mechanical systems (MEMS) devices. Specifically, these wearable technology metrics were analysed across session type (practice vs. match-play) and drill type (e.g., serving vs. point-play) during training and tournament blocks to inform coaching decisions and serve training prescription.
METHODS:
Five elite female tennis players (18.8 ±2.9y) wore a commercial GPS and MEMS device (Catapult Vector S7) during a tennis season. Training and tournament blocks were determined from individualised athlete schedules. Monitoring occurred during practice sessions and official singles and doubles matches. Within practice sessions, drills that involved the serve were classified as "serving drills" or "point play drills". Prototype machine learning algorithms were used to detect serve strokes at 98-99% precision alongside measures of intensity from the accelerometer and gyroscope. Three key variables of the serve were analysed and included absolute and relative; 1) serve volume, 2) serve load (arbitrary units [AU]) and 3) rotation magnitude (revolutions per second [rps]). Due to the small sample size, effect size analyses were performed using Cohen's d statistic with 95% confidence intervals across and within block type, session type and drill type.
RESULTS:
Large effects were observed for greater serve load during official matches compared to training and tournament practice sessions (d = 0.97-1.07 [95% CI = 0.69-1.30]). Further analysis of session-level data showed trivial differences in rotation magnitude per serve across all conditions (d = 0.03-0.06 [95% CI = -0.01-0.09]). Within training blocks, large ES existed for higher cumulative serve volume (d = 0.82 [95% CI = 0.54-1.10]) and serve load (d = 0.85-1.10 [95% CI = 0.33-1.34]) during point-play drills. However, serving drills involved greater serve frequency (n.min-1) (d = 1.10-1.87 [95% CI = 0.59-2.19]) and relative serve load (AU.min-1) (d = 1.35 [95% CI = 1.06-1.65]). Serving drills had a small ES for increased rotation magnitude during tournament blocks (d = 0.43 [95% CI = 0.02-0.88]), whilst trivial ES were observed for point play drills (d = 0.19 [95% CI = -0.14-0.53]).
CONCLUSION:
Serve volume remains highest in official match-play compared to individual practice sessions. Further, this study presents initial evidence that serving during official match-play demonstrate greater accelerometer demands compared to practice. This could indicate the usefulness of wearable technology metrics for serving practice in tennis to ensure training outcomes are replicating competition outcomes. An increased focus on serving frequency within tennis monitoring strategies may also have important implications for adolescent athletes that require careful training prescription.

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