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Abstract

Elite tennis is characterised by repeated bouts of up to five-set matchplay, yet little is known about the technical requirements of shots played. This study therefore investigated technical performance changes over consecutive days of prolonged, simulated tennis matchplay. Seven well-trained men tennis players performed four consecutive days of competitive four-hour matchplay. Matches were notated to determine between-day changes in groundstroke and serve performance, as well as point and match durations. Changes ≥75% likely to exceed the smallest important effect size (0.2) were considered meaningful and represented as effect size ± 90% confidence interval. Effective playing time reduced on days three and four, alongside likely increases in ‘stretch’ groundstrokes over the four days (mean effect size ± 90% confidence interval; 0.57±0.38) and ‘stretch’ backhand returns on days two and three (0.39±0.54 and 0.67±0.55). Relative unforced errors increased on day four (versus day two; 0.36±0.22) and second-serve winning percentage reduced after day one (-0.47±0.50). Further, a likely increase in emotional outbursts characterised day three (versus day two; 0.73±0.57). Consecutive-day matchplay impairs hitting accuracy, stroke positioning and emotional responses; an understanding of which prepares players for elite-standard tennis tournament play.

Keywords: tennis, fatigue, technical performance, consecutive days

Introduction

Tennis is widely considered to be a ‘skill-based’ sport, with shots performed at varying speeds on both sides of the body, above the head, and from a wide range of incoming ball trajectories (Bahamonde & Knudson, 2003; Kawasaki et al., 2005; Reid, Elliott, & Alderson, 2007). A player’s skill or technical engagement in individual tennis bouts (training or matchplay) has been described through stroke rates (shots hit per minute of play), rally lengths, stroke frequency and stroke location (Johnson & McHugh, 2006; Murphy, Duffield, Kellett, & Reid, 2014; O'Donoghue & Ingram, 2001). However, more detailed descriptions of the technical demands of tennis matchplay that consider important contextual features, such as the comfort with which strokes are played and their effectiveness, are sparse (Reid, Morgan, & Whiteside, 2016). Furthermore, variations in technical demand across repeated bouts of matchplay, which typifies tournament tennis, is unclear.

Basic technical descriptions of individual tennis training or matchplay sessions have been reported (Fernandez et al., 2006; Johnson & McHugh, 2006; Murphy et al., 2014). For Grand Slam tournaments, most comparisons have been of technical characteristics between sexes. In turn, men tennis players play shorter rallies than women but with greater stroke rates (O'Donoghue & Ingram, 2001; Reid et al., 2016) and tend to hit more aces and unreturnable serves with greater mean serve speeds (O'Donoghue & Ingram, 2001; Reid et al., 2016). The prominence of the serve, especially in the men’s game, was demonstrated by Johnson and McHugh (2006) who reported that Grand Slam games had stroke ranges of 16-21; of which the serve, followed by the forehand, were the most common. Mean rally lengths have approximated 2.5-3 strokes per player, with 80% of all strokes played within 2.5 m of a player’s ready position (Girard & Millet, 2004). Although these findings provide a general overview of the sport's technical demands, they are based on individual matches and tend not to consider contexts in which shots are played (ie. in relation to point outcomes and stroke positioning). With this limitation in mind, the recent contributions of Ojala and Häkkinen (2013) and Gescheit et al. (2015) are informative as both quantified effects of repeated matchplay efforts (i.e. simulated tournaments) on physiological demands and movement patterns of competitors. Gescheit et al. (2015) reported reductions in unforced and forced errors on the final two days of four days of matchplay, but without change in absolute winner rates or serve speeds. However, neither study investigated detailed technical changes that arose from repeated bouts of tennis matchplay.

The relationship between technical or point outcomes and subsequent emotional outbursts during matchplay has attracted little research attention. To our knowledge, the work of Hanegby and Tenenbaum (2001) represents the only research to have identified a link between the timing of aggressive outbursts and point score/outcome. This study demonstrated that outbursts were more likely when players made errors and after negative outcomes of important points. However, the occurrence in these outbursts over the course of consecutive matchplay bouts remains unknown.

While researchers have examined physical and physiological responses to tennis matchplay, few studies have investigated associated technical characteristics, particularly over consecutive days of matchplay. Accordingly, the aim of this study was to extend the work of Gescheit et al. (2015) through detailed analysis of effects of four consecutive days of matchplay on technical characteristics. These include types, outcomes and rates of stroke play, as well as behavioural responses in the form of obvious physical and verbal frustration outburst (“tap outs”).

Methods

Participants

Seven sub-elite men tennis players, age (mean ± standard deviation (SD)) 21.4±2.2 years, stature 181.8±7.1 cm and body mass 79.9±4.8 kg were recruited and completed the study. Eight participants commenced but one participant withdrew after the day one and was replaced by a participant of similar playing ability; neither was included in the analyses. The participants were all nationally ranked (Australian ranking of 74±17) and had played professional tennis for 3.4±2.2 years. The study was approved by the Charles Sturt University Human Ethics Committee.

Experimental Set Up

Participants undertook 4 h competitive matchplay on four consecutive days simulating tournament settings. Testing was conducted on indoor Plexicushion® hard courts in a controlled environment (ambient temperature: 12±2°C and relative humidity: 65±5%) using new Wilson Tour tennis balls (Wilson, Illinois, USA), which were replaced 120 min into matchplay each day. All players competed in a singles match against the same matched opponent each day complying with the International Tennis Federation scoring and rest durations (International Tennis Federation). Pairs were determined based on similar national rankings and coach observations playing standard. Opponents were the same each day to standardise skill and to minimise influences of different playing styles on matchplay outcomes. While this is recognised as a potential limitation and not representative of ‘live’ tournament contexts, it was the most appropriate method to determine effects of four days of matchplay, rather than different opponents, on technical changes.

Upon waking at a set time each day (06:45), participants were provided with a breakfast containing a carbohydrate (CHO) content of $2g \cdot kg^{-1}$ body mass. Starting times were consistent each day, with participants completing a 15 min tennis-specific warm-up involving the general movement and specific hitting of the strokes involved in a tennis match. The 4 h of set-play tennis followed. If five sets were completed inside 240 min, players continued set play until the 4 h mark. Standardised water (~2-3L dependent on player) and carbohydrate ($2.5g \cdot kg^{-1}$ body mass) were provided each day to be consumed throughout the match. All recovery procedures, exercise, food and fluid intake were regulated across consecutive days of play, and standardised across all participants to minimise influence on subsequent matchplay outcomes. Participants stayed in the same accommodation and completed food diaries each day, with the supervision of the research team, to help ensure further consistency. Players were also provided with a daily stipend to cover costs and motivate them to compete throughout testing (Adcroft, Teckman, Mondello, & Maxcy, 2009).

Match-play recording and coding

One video camera (DSR-PDX10P, Sony, Japan) was mounted 8 m behind the baseline and 8 m above the ground at the same end of each court to film each match. The recorded footage was then analysed using customised software (SportsCode Elite 9.0.0, Sportstec, Australia) that identified player and ball on a tennis court depicted as a 42x36 grid. Player and ball position were notated for each shot by a trained analyst, with additional annotation of context in the form of winner, error and comfort of making the shot (as detailed in Table 1). Shot comfort was considered as follows: (i) comfortable shots were defined as shots where the player was able to swing their racquet freely, without obstruction; (ii) stretch shots were defined as shots where the player stretched to reach a ball; and (iii) body shots were considered shots where the player was cramped and made contact with the ball close to their body. Intra-class Correlations (ICC) and Coefficients of Variation (CV%) of coding were determined for four matches, three times each, before coding the entire matchplay footage for all participants on all days. The ICC and CV ranged from 0.89–1.00 and 1–12% respectively, which is within acceptable ranges of measurement error (Hopkins, 2000; Shrout & Fleiss, 1979). Raw data were transferred from the Sportscode software to a customised spreadsheet (Microsoft Excel 2010, USA) for subsequent preparation and analysis.

*** Insert Table 1 here***

Statistical analysis

The study is a within-participant design to determine individual technical changes between respective days of tennis matchplay. Intra-Class correlation and CV were used to evaluate test-retest reliability of the coding of each outcome measure in matchplay. Data are presented as mean ± SD for total and percentage of stroke counts and respective stroke types. Effect sizes ± 90% confidence intervals were used to determine magnitude-based inferences about the value of outcomes. A difference was considered 'likely' if there was a ≥75% chance of exceeding the smallest practically important effect set at a standardised effect threshold of 0.2. Each dependant variable was analysed using a specialised, published spreadsheet (Hopkins, 2012) to determine the effect of consecutive days of matchplay on technical performance.

Results

Measures of external matchplay load

As presented in Table 2, simulated matchplay on consecutive days resulted in variations in external load on subsequent days. Effective playing time on days three and four was less than on day one (-0.33±0.72, 76% likely and -0.41±0.29, 93% likely respectively). On day three, there were fewer games played and total strokes hit than on the preceding two days (Table 2).

*** Insert Table 2 here ***

Point outcomes

The manner in which players won/lost points is summarised in Table 3. Small to moderate effects indicate changes in the relative proportion of unforced errors (reduced; -0.46±0.51, 83% likely) and winners (increased; 0.68±0.90, 83% likely) on day two compared with day one. Also compared with day one, matchplay on day three had likely decreases with small effects, in total (-0.45±0.44, 85% likely) and relative (-0.31±0.31, 76% likely) unforced errors but with a probable increase in the relative number of winners (0.49±0.73, 77% likely). Additionally, there was an increase in the number of 'tap outs' on day three compared with matchplay on day two (0.73±0.57, 94% likely). The way in which players won points on day four, was notably different to all preceding days. Specifically, medium and large effects reveal that total forced errors were fewer than on the previous three days (-0.98±1.11, 90% likely; -0.94±0.56, 98% likely; -0.73±0.53 95% likely respectively), yet this was accompanied by a likely increase in total unforced errors on day four over day three (0.40±0.49, 79% likely).

*** Insert Table 3 here ***

Rally characteristics

Days 2-4 saw a likely increase both in backhand (0.33±0.24, 94% likely; 0.94±0.47, 99% likely; 0.49±0.34, 96% likely) and forehand (0.51±0.13, 100% likely; 0.74±0.61, 92% likely; 0.42±0.49, 79% likely) stretch shots compared with day one (Table 4). Yet both backhand (-0.42±0.39, 85% likely) and forehand (-0.54±0.29, 98% likely) stretch shots reduced on day four compared with day three, with small to moderate effects. The inverse pattern also occurred across the number of backhand and forehand comfortable shots. This comfortable backhand trend reversed on day four with a likely increase over day three (1.25±0.72, 99% likely).

*** Insert Table 4 here***

Serve characteristics

Table 5 highlights that there was no change in the percentage of first-serves won across all four days. However, the percentage of points won on second-serve likely reduced on days two (-0.31±0.23, 86% likely), three (-0.54±0.36, 95% likely) and four (-0.57±0.91, 80% likely) compared with day one. No clear pattern of results occurred in aces or double faults.

*** Insert Table 5 here ***

Return characteristics

The percentage of stretch backhand returns likely increased on days two (0.39±0.54, 77% likely) and three (0.67±0.55, 94% likely) compared with day one, as well as on day three (0.28±0.28, 76% likely) compared with day two (Table 6). Yet, the percentage of stretch backhand returns reduced on day four versus day three with a large effect (-1.54±0.63, 100% likely). The same pattern did not occur on players' forehands returns.

*** Insert Table 6 here ***

Discussion

The aim of the present study was to investigate technical performance during prolonged, simulated bouts of matchplay over four consecutive days. As anticipated, there was a reduction in technical performance, particularly during day three. Specifically, a reduction in total strokes, the percentage of second-serves won and 'comfortable' shots played; as well as increases in relative forced errors. Furthermore, an increase in “tap outs” on day three over day two, highlighted the growing frustration and negative emotional responses exhibited by players. Accordingly, prolonged tennis matchplay on consecutive days resulted in technical performance decrements through decreased involvement, poorer positioning to perform stroke play and increased frustration.

The reduction in technical performance on days three and four of simulated matchplay manifests in a decline in effective playing time and an increased exercise-to-rest ratio (ie. more rest; Table 2). The exercise-to-rest ratios in the current study (1:4.0-4.9) are consistent with previously reported values on individual and repeated bouts of tennis (Kovacs, 2006; Ojala & Häkkinen, 2013). Despite the experimental protocol regulating the upper limit of rest between points and games, between-day reductions in effective playing time occurred. This aligns with the findings of Mendez-Villanueva et al. (2007) who reported that rest periods increased with an increase in rally length. While this is intuitive, researchers and practitioners could gain improved understanding of this relationship by considering the psychology of winning/losing points and the subsequent role of the server/returner in determining rest times.

Total strokes and games played were also fewer on day three than day two (Table 2). This infers a degradation in matchplay engagement or modified pacing strategies that arise from altered motivation by players (de Morree & Marcora, 2013). Notably, there were fewer mean strokes per game (deduced from Table 2) than reported for Grand Slam tournaments (12-14 vs 16-21; Johnson & McHugh, 2006), which might relate to reduced match involvement and/or be symptomatic of the lower standard of player in the current study.

Similarly, there was a marked increase in frustration, in the form of “tap outs” (Table 3), over the course of the study. Matchplay on day three was particularly challenging for the players, resulting in a 58% spike in “tap outs” compared with day two. These types of ‘norm-breaking behaviours’ are not uncommon in competitive matchplay, with Hanegby and Tenenbaum (2001) reporting a match mean of seven incidents of self, equipment and opponent/umpire abuse in junior tennis. The increase in outbursts in the current study could be because of players’ growing familiarity with testing surrounds (Traclet, Moret, Ohl, and Clémence (2015), fatigue and/or monotony in the testing protocol. These findings indicate that training or simulated matches can be structured to tax player emotions that is not always considered possible in practice (Lazarus, 2000).

The type and prevalence of errors suggests the quality of matchplay decreased over the consecutive days. Although total errors remained unchanged over the four days, there was a redistribution of error type, with a decrease in forced errors on the final day, accompanied by an increase in unforced errors (Table 3). Comparatively, Davey, Thorpe, and Williams (2003) showed a decrease in hitting accuracy of up to 80% as time elapsed in a single 90 min bout of simulated matchplay. Furthermore, Gescheit et al. (2015) highlighted no change in the absolute number of winners over the four days. However, the more detailed analysis here highlights an increase in the relative percentage of winners on days 2-4 over day one. While speculated by Gescheit et al. (2015), we assert that players adopt a pacing strategy in an attempt to hit more winners and subsequently reduce point durations. It is also likely that opponents made less of an effort to reach more difficult shots, because of fatigue or lack of motivation, resulting in more winners. This is supported by the reduction in movement on the same day as reported by Gescheit et al. (2015) that could also have contributed to the reduction in unforced errors on days two and three. These contentions are bolstered by the reduced stroke count, games and effective playing time on days three and four (effective playing time only; Table 2). Alternatively, the increase in relative unforced errors on day four could indicate the inherent interplay between risk and reward (Girgenrath, Bock, & Jüngling, 2004), wherein relative increases in offence (winners) heighten the likelihood of increased unforced error counts (Ferrauti, Bergeron, Pluim, & Weber, 2001). It is worth noting that the attempt to play 'riskier' tennis as a pacing strategy (to shorten point durations) could be because of the non-competitive nature of the matches (no prize-money or points offered) (Butt & Cox, 1992) or limitations in players' physical capacities (Johnston, Gabbett, & Jenkins, 2015) . Nevertheless, tennis players and coaches could optimise the pacing approach through appropriate training and recovery or use it strategically according to the importance of points (Klaassen & Magnus, 2001).

More forehands and fewer backhands were played over the four days, which is consistent with stroke frequencies in Grand Slam tennis (Johnson & McHugh, 2006). However, on day four there was a relative reduction in forehands and increase in backhands compared with days two and three. This change in the relative distribution of shots hit suggests that players were either directing more balls to their opponents' backhands or making fewer attempts to 'run around their backhands' to play forehands. The use of the former strategy could be deliberate, as backhands are slower and less accurate than forehands in men's tennis (Landlinger, Stöggl, Lindinger, Wagner, & Müller, 2012). Although stroke distributions (Johnson & McHugh, 2006), running distances and stroke rate (Pieper, Exler, & Weber, 2007) have been studied, the current study is the first attempt to consider stroke performance in the context of "comfort". There are anecdotal reports of compromised stroke positioning or impairments to movement (Ferrauti, Pluim, & Weber, 2001), and shot comfort presents a proxy for this. Hence, more 'stretch' shots were played on days two to four than on day one (Table 4). In light of reduced rapid forward-backward and lateral movements (Gescheit et al., 2015), this reduced court movement might have alter stroke positioning. Nevertheless, even without direct evidence of this link, cumulative effects of repeated bouts of matchplay adversely affect on-ball positioning of players to perform 'optimal' stroke play.

As the serve is technically complex and the most physically demanding stroke in tennis (Kibler, Chandler, Shapiro, & Conuel, 2007), its performance could be expected to suffer with each subsequent match. However, first-serve performance did not change meaningfully over the four days of matchplay with percentages (67±4%) remaining higher than those reported among professional players (61±5%) (Johnson & McHugh, 2006). The number of double faults was also stable across all four days, indicating that second-serve accuracy did not suffer. However, points won on the second-serve likely reduced after day one, suggesting that second-serve effectiveness was altered. Consistent with the findings of Maquirriain, Baglione, and Cardey (2016) over 5-set matches at the Wimbledon Grand Slam, there was no change in serve speed or accuracy. Davey, Thorpe, and Williams (2002) also reported no change in serve accuracy during their simulated matchplay study. Collectively, these findings suggest stability of serve speed and accuracy in matchplay. Alternatively, they could indicate insensitivity of these outcome measures to fatigue.

Return-of-serve performance during matchplay has attracted little research attention (Hizan, Whipp, Reid, & Wheat, 2014) therefore consideration of this performance represents an important addition to the literature. Over the course of the four days, and consistent with what occurred during rallies, more backhands than forehands were hit on return. This finding agrees with the return-of-serve behaviour (as inferred through service landing locations) of men players as reported by Hizan et al. (2014). It was highlighted that serves directed to the backhand side were more common on the advantage court and, with second-serves, on the deuce court. In our opinion, it is improbable that men players selectively run around their forehand return to hit a backhand return. Consequently, these findings suggest that men players favour serves directed to the backhands of opponents. Additionally, the increase in 'stretch' returns on days two (backhand) and three (forehand and backhand) partly infers impaired court movement, which leads to compromises in stroke production (Girard & Millet, 2009). This impairment is reinforced by the reduction in lateral movement loads reported by Gescheit et al. (2015). Notably, the proportion of stretch returns declined on day four, which could have related to more centrally directed serves by servers (as they prioritised serve accuracy) and/or greater engagement by the returners (as they neared the 'end'). With the return-of-serve commonly described as an under-practised skill in tennis (Reid et al., 2016), these observations related to 'comfort' suggest that return practice should be better prioritised.

The small sample size is a limitation of the study. Additionally, as players were sub-elite, they are unlikely to have experienced such high tennis volumes as elite-standard players, so limiting the generalisabilty of the results. However, it still represents a 'worst case scenario'. Lastly, the trade-off of having competitive matches by pairing players of similar ranking every day, was that players could have formulated strategy and/or implemented tactics that might also influence the interpretation of the findings.

In conclusion, simulated tennis tournament matchplay produces decrements in stroke accuracy and positioning, and adverse emotional responses. Conversely, first-serve performance is maintained. Whether the observed technical changes result from altered tactical approaches, physiological/physical fatigue or a reduction in motivation is unclear. Regardless, an improved understanding of the altered technical demands of matchplay in intensive tournament schedules should assist coaches to improve players' preparations to withstand the physical and mental rigors of competition.

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Table 1: Descriptors of technical performance

Measure	Description
Total Strokes	Total number of strokes hit by each player
Stroke Rate	Number of total strokes divided by time in play and reported per minute.
Serve Returns	Total number of return-of-serves divided into forehands and backhands. Returns are further divided into comfortable, stretch and close for each stroke type. Expressed as absolute (total) and relative (% of total returns) values.
Rally strokes	Total strokes hit during the rally of a match, divided into forehand and backhand, and further divided into comfortable, stretch and close. Expressed as absolute (total) and relative (% of total rally strokes) values.
Forced and Unforced Errors	A forced error occurred if a player was unable to make a reasonable attempt at playing a shot and the ball did not land in the opposition court. An unforced error occurred when a participant had adequate time and space to play a shot but missed the court (either outside the lines or into the net). Expressed as absolute (total) and relative (% of point outcomes) values.
Winners	A winner was determined as any ball that landed in the opposition court and was not reached by the opponent before a second bounce or hitting the surrounding netting. Expressed in absolute and relative (% of point outcomes) terms.
Number of net approaches and volleys	Total number of volleys, divided into forehand and backhand and number of times a player strikes the ball and transitions into the front half of the court or cover the net during play.
First and Second-serve	Total number of first and second-serves, respectively, within a match.
First-serve percentage	Number of successful first-serves expressed as a percentage of total first serves.
Serve rate	Mean number of serves per game.
Serve outcomes	Total number of aces, faults and double faults, respectively.
"Tap outs"	Obvious outbursts in the form of physical and verbal frustration (e.g. racquet throws, yelling, swearing).
Effective Playing Time	Total duration (min) of time the ball is in play.
Dead Time	Total time between points/games/sets.
Exercise-to-rest ratio	Ratio of effective playing time to dead time.

Table 2: External Matchplay Load Descriptors - Mean ± SD of total strokes, stroke rate, total games, point durations, exercise-to-rest ratio and effective playing times of four days of 4 h simulated tennis matchplay.

	Day 1	Day 2	Day 3	Day 4
Total Strokes (#)	727 ± 125	692 ± 155	662 ± 55†	690 ± 42
Stroke Rate (per minute)	13.1 ± 2.3	13.1 ± 3.1	13.4 ± 0.8	13.1 ± 1.1
Total Games (#)	52 ± 7	56 ± 7	49 ± 8#	50 ± 8
Point Duration (s)	10.1 ± 0.1	9.3 ± 1.0†	9.9 ± 0.3	9.9 ± 1.6
Exercise-to-rest ratio	1:4.0 ± 0.3	1:4.7 ± 1.0	1:4.9 ± 0.5†	1:4.6 ± 0.4†#
Effective Playing Time (min)	55.3 ± 8.5	52.7 ± 10.4	49.5 ± 5.0†	52.5 ± 4.9†#

* - ≥ 75% likely positive difference compared with Day 1, † - ≥ 75% likely negative difference compared with Day 1, ‡ - ≥ 75% likely positive difference compared with Day 2, # - ≥ 75% likely negative difference compared with Day 2, ^ - ≥ 75% likely positive difference compared with Day 3, ˜ - ≥ 75% likely negative difference compared with Day 3

Table 3: Point Outcomes - Mean ± SD of total and percentage of errors, winners and "tap outs" across four consecutive days of 4 h simulated tennis matchplay.

	Day 1	Day 2	Day 3	Day 4
Forced Errors (total)	47 ± 10	50 ± 7	49 ± 12	42 ± 10[†#~]
Forced Error (%)	29 ± 4	29 ± 4	30 ± 6 [*]	26 ± 7 [#~]
Unforced Errors (total)	67 ± 15	65 ± 24	57 ± 14 [†]	66 ± 26 [^]
Unforced Error (%)	21 ± 4	19 ± 7 [†]	19 ± 4 [†]	21 ± 6 [‡]
Winners (total)	48 ± 21	51 ± 12	44 ± 13 [#]	49 ± 16
Winners (%)	12 ± 3	14 ± 3 [*]	14 ± 4 [*]	15 ± 4 [*]
Tap Outs (#)	13 ± 7	10 ± 11	17 ± 10 [‡]	13 ± 13

[*] - ≥ 75% likely positive difference compared with Day 1, [†] - ≥ 75% likely negative difference compared with Day 1, [‡] - ≥ 75% likely positive difference compared with Day 2, [#] - ≥ 75% likely negative difference compared with Day 2, [^] - ≥ 75% likely positive difference compared with Day 3, [~] - ≥ 75% likely negative difference compared with Day 3

Table 4: Rally Characteristics - Mean ± SD of total and percentage of forehand and backhand strokes, stroke comfort and net play characteristics across four consecutive days of 4 h simulated tennis matchplay.

	Day 1		Day 2		Day 3		Day 4	
	Raw	%	Raw	%	Raw	%	Raw	%
Backhand Rally Total	274 ± 84	45 ± 7	240 ± 89†	44 ± 8	253 ± 54	47 ± 7*‡	256 ± 52	48 ± 7*‡
Comfortable	134 ± 46	48 ± 3	94 ± 36†	39 ± 5†	69 ± 20$^{\dagger\#}$	27 ± 4$^{\dagger\#}$	105 ± 32$^{\dagger\wedge}$	41 ± 7$^{\dagger\wedge}$
Body	13 ± 10	5 ± 3	6 ± 5†	2 ± 1†	9 ± 2†‡	4 ± 1†‡	7 ± 2$^{\dagger\ddagger\sim}$	3 ± 1$^{\dagger\sim}$
Stretch	127 ± 34	47 ± 5	140 ± 54	59 ± 5*	175 ± 38*‡	69 ± 4*‡	144 ± 30$^{*\sim}$	56 ± 7$^{*\sim}$
Forehand Rally Total	327 ± 63	55 ± 7	291 ± 80	56 ± 8	281 ± 45†	53 ± 7$^{\dagger\#}$	278 ± 36†	52 ± 7$^{\dagger\#}$
Comfortable	169 ± 51	51 ± 10	129 ± 50†	44 ± 8†	108 ± 29$^{\dagger\#}$	38 ± 7$^{\dagger\#}$	123 ± 44†	43 ± 10$^{\dagger\wedge}$
Body	20 ± 12	6 ± 4	7 ± 2†	3 ± 1†	9 ± 5†	3 ± 2†	9 ± 6†	3 ± 2†
Stretch	138 ± 30	43 ± 7	155 ± 43*	53 ± 8*	164 ± 25*	59 ± 7*‡	146 ± 21$^{*\sim}$	53 ± 10$^{*\sim}$
Total Volleys	21 ± 21	3 ± 2	22 ± 15*	3 ± 2*	25 ± 15*‡	4 ± 2*‡	22 ± 13	3 ± 2
Net Approaches	38 ± 21		36 ± 15		38 ± 15		39 ± 10	

* - ≥ 75% likely positive difference compared with Day 1, † - ≥ 75% likely negative difference compared with Day 1, ‡ - ≥ 75% likely positive difference compared with Day 2, $^{\#}$ - ≥ 75% likely negative difference compared with Day 2, $^{\wedge}$ - ≥ 75% likely positive difference compared with Day 3, $^{\sim}$ - ≥ 75% likely negative difference compared with Day 3

Table 5: Serve Characteristics - Mean ± SD of serve outcomes (first-serve percentage, aces, double faults, percentage of points won on first and second-serve) across four consecutive days of 4 h simulated tennis matchplay.

	Day 1	Day 2	Day 3	Day 4
First-Serve (%)	65 ± 5	68 ± 3 *	67 ± 3	67 ± 4
Aces (total)	13 ± 9	10 ± 5	6 ± 3 †	6 ± 1 $^{\dagger\#\sim}$
Double Faults (total)	4 ± 5	5 ± 3 *	4 ± 3 $^{\#}$	4 ± 3
First-Serve % won	65 ± 7	65 ± 8	62 ± 5	64 ± 5
Second-Serve % won	59 ± 8	53 ± 9 †	52 ± 7 †	53 ± 7 †

* - ≥ 75% likely positive difference compared with Day 1, † - ≥ 75% likely negative difference compared with Day 1, ‡ - ≥ 75% likely positive difference compared with Day 2, $^{\#}$ - ≥ 75% likely negative difference compared with Day 2, $^{\wedge}$ - ≥ 75% likely positive difference compared with Day 3, $^{\sim}$ - ≥ 75% likely negative difference compared with Day 3

Table 6: Return Characteristics - Mean ± SD percentage of forehand and backhand return-of-serve strokes and stroke comfort across four consecutive days of 4 h simulated tennis matchplay.

	Day 1	Day 2	Day 3	Day 4
Backhand Return Total	63 ± 14	55 ± 8[†]	56 ± 8[†]	58 ± 11[†‡]
Comfortable	31 ± 13	38 ± 9[*]	30 ± 9[#]	47 ± 14[*‡^]
Body	19 ± 13	8 ± 8[†]	10 ± 7[†‡]	9 ± 6[†‡]
Stretch	50 ± 21	54 ± 10[*]	59 ± 11[*‡]	44 ± 16[#~]
Forehand Return Total	37 ± 14	45 ± 8[*]	44 ± 8[*]	42 ± 11[*#]
Comfortable	38 ± 9	48 ± 8[*]	39 ± 6[#]	45 ± 10[*^]
Body	15 ± 15	6 ± 7[†]	9 ± 8	7 ± 7
Stretch	47 ± 12	45 ± 13	53 ± 11[*‡]	48 ± 13[~]

[*] - ≥ 75% likely positive difference compared with Day 1, [†] - ≥ 75% likely negative difference compared with Day 1, [‡] - ≥ 75% likely positive difference compared with Day 2, [#] - ≥ 75% likely negative difference compared with Day 2, [^] - ≥ 75% likely positive difference compared with Day 3, [~] - ≥ 75% likely negative difference compared with Day 3.