Full Title: The effect of pre-departure training loads on post-tour physical capacities in high-performance junior tennis players.

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Abstract

Purpose: Difficulties in preserving physical capacities whilst on tennis tours necessitate targeted training prescription. This study analysed training and match loads performed prior to and on tour for their relationship with post-tour physical capacity changes. A secondary aim was to determine the effect of strength and conditioning (S&C) coach presence on type and volume of on-tour training load.

Methods: The training and match loads of 30 high-performance junior tennis players were recorded over 8 weeks: 4-weeks prior and 4-weeks during an international tour. Fitness tests were conducted pre- and post-tour, including; double and single-leg counter-movement jump (CMJ-DL;DOM;NON), speed (5-, 10-, 20-m), modified 5-0-5 agility, 10x20-m repeat-sprint ability (RSA), and multistage fitness tests. Tour training and match loads were also categorised and in accordance with the presence or absence of S&C support.

Results: Total and tennis training loads were significantly greater on-tour than pre-tour ($p<0.05$;$d>0.8$). Moderate, positive correlations were observed between increases in on-tour, on-court training loads and decrements to speed and aerobic capacities ($r=0.31$-0.52). Finally, S&C presence on-tour significantly increased total, on-court and off-court training load completed ($p<0.05$;$d>0.8$).

Conclusions: Training loads should be carefully prescribed to ensure sufficient total and tennis TL's are completed pre-tour. Specifically, speed and aerobic capacities may regress with increased training on-tour. Finally, a practical observation was that on-tour S&C support resulted in increased S&C training load (around match-loads), potentially countering the observed regression of physical capacities. Such a finding has the capacity to alter current physical preparation structures in high-performance tennis environments with finite resources.

Key Words – Travel, Physical capacities, Testing, Training load, Tour preparation

Introduction

Due to the physicality of modern day tennis, technical and skill attributes alone are unlikely to compensate for poor physical preparation, therein reducing the likelihood of performance goals being achieved.[1,2] For high-performance tennis players, the progressive improvement of physical capacities (i.e., strength, power, speed, agility and aerobic capacities) helps to ensure that players cope with the increased physical stress of matches as they transition from junior to senior competitions.[3] It is therefore crucial that physical capacities are maintained throughout intensive touring schedules. Previously, we have identified that speed capacities (5-m, 10-m, and 20-m sprints) are susceptible to decline over the duration of a 4-week high-performance junior international tour.[4] Accordingly, specific training programs designed to counter physical capacity regression are imperative. However, whilst on tour, matches and on-court training take precedence and encompass the majority of training load.[2,4] Prioritization of match and on-court preparation means off-court training time is often reduced, whether through necessity or circumstance. Notwithstanding the potential acute increase in fatigue throughout periods of a tour, it is also possible reductions in off-court training may result in the observed decrements in certain physical capacities whilst on prolonged tours.[4] As off-court training is at the mercy of on-tour circumstances, it may be that pre-tour physical preparation (i.e. preparatory training load) is important to provide a prophylactic benefit against the regression of these physical capacities following prolonged tours. If so, pre-tour training loads may allow the favourable balance between maintenance of fitness within competition and tennis-specific training demands, potentially impacting subsequent performance outcomes.

Analysis of total load (a combination of training and match load) and physical capacity development (alongside match performance), ultimately describes the dose-response relationship of training within tennis sessions (i.e., fitness responses based on training and match loads). Often training and match loads are determined using methods described by Foster et al.,[5] multiplying session rating of perceived exertion (RPE) by duration. Consequently, previous investigations have established RPE as a valid, reliable and non-invasive measure of internal load for tennis.[6,7] However, certain literature has examined the dose-response relationships for marathon runners and later professional youth soccer players, comparing session RPE to heart rate (HR) based monitoring (i.e., Banisters TRIMP and Individual TRIMP) to establish internal validity.[8,9] While neither paper opposes the use of session RPE as a useful load monitoring tool, Individual TRIMP was observed to be of best dose-response relationship to blood lactate accumulation - compared to the relatively poor relationships observed with Banisters TRIMP and session RPE.[8,9] While particular training load monitoring measures (i.e., iTRIMP) may provide enhanced clarity and confidence in the interpretation of performance changes, insufficient resources and athlete engagement can be a major reason for not using certain measures. As previously acknowledged, HR monitors worn around the chest are viewed suspiciously by tennis coaches and athletes due to a perception of restriction through stroke play, particularly the serve.[7,10] Thus, when placed in a competitive situation where ranking points or remuneration is involved, coaches and athletes will seldom agree to wearing such equipment. As such, session RPE could serve as a suitable, valid and reliable measure of training and match load for tennis athletes.

As previously observed, international tennis tours and periods of unsupervised training can result in decrements in speed capacities; paradoxically, lower-body power, change of direction (COD), aerobic, and anaerobic capacities are maintained.[4,11] We have suggested[4] that the preservation of these physical capacities may be explained by the associated match and on-court training loads. Correspondingly, maintenance of lower-body power may be achieved via eccentric loading. Specifically, it may be associated with serve repetitions and end of range COD, while maintenance of agility, aerobic and anaerobic capacities logically stem from match and on-court locomotive demands.[4,12,13] Kelly & Coutts[14] highlight the importance of providing an appropriate training stimulus throughout competition periods in team sports, implementing plans to counteract associated physical regressions. However, tennis players and coaches cannot predict match loads (and subsequently training loads), and must react and adjust training loads around tournaments, particularly as most subsequent opponents are unlikely known until 24-h prior. Therefore, pre-tour preparation *and* on-tour maintenance of physical capacities become vital for ensuring athletes are prepared for any situation, as well as for minimizing regression of physical capacities. Research into seasonal training plans for other sports (i.e., handball and volleyball) demonstrates that with the implementation of an appropriate in-season training program, speed and power qualities can be maintained and even improved.[15-17] Specifically, Gorostiaga et al.[15] reported that with completion of 5-6 strength and conditioning (S&C) training sessions per week in-season, both speed and explosive lower body strength were successfully maintained in elite level handball. While Hakkinen et al.[16] and later Marques et al.[17] identify that lower body power in elite female volleyball athletes can be improved upon throughout a competitive period with an appropriately designed training program (i.e., including strength and plyometric exercises). Combined, these observations highlight a potentially critical balance between pre-tour fitness and physical regression across an international tour.[18,19] In tennis, match loads, as well as on- and off-court training loads have been shown to poorly correlate with changes in physical capacities on-tour.[4] However, whether classic (i.e., undulating or non-linear) periodisation models (pre and on tour) can be implemented effectively to reduce on- and post-tour physical regression remains unknown.

Another important issue for elite tennis environments is the struggle with access to on-tour S&C support due to financial restraints, inadequate facilities or facility access, and conflicting match scheduling (one S&C coach across multiple athletes playing different schedules).[3,11,20] As a result, the most appropriate focus for S&C support - pre-tour preparation or on-tour support (that is, training vs. competing) - is debated.[3] Clearly part of this debate is confounded by the abovementioned scheduling complexities which challenge both load management as well as the use of the S&C on-tour. With a need to optimize the on-tour role of tennis S&C support, where tours are prolonged and continuous, previous research has identified the need for informed and precise training and match load monitoring (i.e., RPE, stroke count).[2,6,7,18,21] This challenges the implementation and validity of classic periodisation models in tennis, due to the reactive scheduling of training and the multitude of unknown variables (i.e., match duration). Moreover, Kelly & Coutts[14] identify the challenges experienced by S&C coaches in educating skills coaches (i.e., tactical/technical) and athletes on the intricacies of appropriate periodised training plan. As such, presence of the S&C coach responsible may prove critical in ensuring sufficient training occurs (preventing regression of physical capacities). Also allowing for targeted monitoring of on-tour training and match loads, and thus prescription of specific off-court type and volume of training.

In summary, our current understanding of the interactions between physical capacity changes and associated training and match loads surrounding and throughout the competition blocks is lacking in tennis. Therefore, this study aimed to examine the difference between training and match loads completed prior to and on-tour, and their subsequent relationships with the observed changes in fitness characteristics across a 4-week tournament period. Further, a secondary aim was to determine the effect of S&C coach presence on training loads whilst on-tour. We hypothesized that training loads completed prior to leaving for tour would be greater than on-tour, and that this greater pre-tour training load would share a stronger relationship with changes in physical capacity than on-tour training and match load. Finally, we also hypothesized that greater training load will be completed on-tour in the presence of S&C support.

Methods

Subjects

Thirty high-performance junior tennis players (age: 17±1.3y, matches/year: 135±22, International Tennis Federation junior ranking: 157±112, Association of Tennis Professionals

- ranking: 1309±370, Women's Tennis Association - ranking: 792±41) representing Australia at junior international events were recruited. The cohort consisted of 20 males (age: 17.3±1.4, mass: 66.9±8.6 kg, stature: 176.7±6.0 cm) and 10 females (age: 16.5±0.9y, mass: 60.5±5.5 kg, stature: 170.2±3.8 cm). All athletes were provided verbal and written description of all procedures and aims of the project. All athletes, and parents where appropriate, provided written informed consent to participate in the study and a University Human Ethics Review Committee approved the investigation.

Research Design

This study compared training and match loads performed in preparation for, and during three different international tours throughout the Asia-Pacific region. Training and match loads were compared and analysed to determine the respective relationship with changes in physical characteristics over the duration of international tennis tours. Furthermore, the effectiveness of on-tour S&C support was investigated through comparison of training loads completed in the presence vs. absence of an S&C coach. Participants were approached after selection onto the Tennis Australia international tours. The tours involved travel to the following countries (approximate travel time in parenthesis): 1) New Zealand (3.5 h); 2) Thailand, Malaysia and Philippines (10 h); 3) Japan and Korea (10.5 h). To ensure minimal detrimental interference from travel (jet-lag), athletes completed fitness testing protocols two days prior to and two days following the tour.[22] As outlined later, testing protocols were designed by Tennis Australia and each athlete had prior familiarity with all procedures. Previous literature using the current testing protocols have established the tests to be of relatively low typical error of measurement, with low variability and therefore are useful in tracking and analysing underpinning physical capacities of athletes.[23,24] Warm-up and testing was standardised from 09:00 each morning, and a standardised test order was maintained at all times. Specific testing protocols were performed in succession, approximately 15-mins apart. An in-depth description of the protocols have been explained previously explained along with respective technical error (TE; table 1).[4] All physical activity, fluid, and food intake in the preceding 24 h were standardised for testing, and normal fluid and food intake throughout tour preparation was maintained. Care was taken to guarantee that the same researcher carried out each testing battery, and environmental conditions (i.e., surface, temperature, clothing, shoes) were identical to ensure accuracy and reliability of test measures. It is also of particular importance to note that authors are confident that research staff did not manipulate or impede on the planned tour preparations of the assigned coaches in the days immediately prior to departure.

Measures

Countermovement jump (CMJ)

A CMJ protocol for double leg (CMJ-DL), dominant single leg (CMJ-DOM), and non-dominant single leg (CMJ-NON) was used to determine lower body power through peak height in vertical displacement using a yard-stick (Vertec, SWIFT Performance Equipment, Lismore, Australia) jumping device with multiple vanes distanced 1cm apart.[25] The intra-class correlation coefficient (ICC) of CMJ-DL, CMJ-DOM and CMJ-NON was ICC = 0.96. The technical error (TE) of CMJ-DL was 1.0cm, while the TE of both CMJ-DOM and CMJ-NON was 2.0cm.

Speed- 5-, 10-, 20-m sprints

Dual-beam, electronic timing gates (Speedlight, SWIFT Performance Equipment, Lismore, Australia) were used to measure maximal 5-m, 10-m and 20-m sprint times, as a 20-m sprint test with split times taken at 5- and 10-m. Three trials were completed with the best time used for each distance.[25] The ICC of the 5, 10, and 20m sprints were ICC =0.84, 0.87, and 0.96 respectively. The TE of each sprint distance (5-, 10-, and 20-m) was 0.06 s.

Agility- Modified 5-0-5 left and right

The athlete's ability to perform a single, rapid 180-degree change of direction over 5m was measured using a modified version (stationary start) of the 5-0-5 agility test.[23,25,26] Three trials pivoting on both left and right foot were completed (Speedlight, SWIFT Performance Equipment, Lismore, Australia). The ICC and TE of both left and right 5-0-5 agility was ICC = 0.92 and 0.05 s respectively.

Multistage fitness test

The multistage test was used to determine aerobic power using previously cited protocols.[25,27] Athletes performed continuous interval running over 20m indicated by a compact disc (Australian Sports Commission, Canberra, Australia). The ICC was, ICC = 0.90, while the TE was 0.5 arbitrary units (au).

Repeat sprint ability (RSA) test

The 10x20-m RSA test protocol was used to evaluate the capacity to maintain maximum acceleration and speed across multiple efforts, each sprint summed for total time (Speedlight, SWIFT Performance Equipment, Lismore, Australia).[25,28] The ICC was, ICC = 0.86, while the TE of the RSA test total time was 0.61 s.

Load monitoring

Physical demands were calculated for total (all sessions), total on-court (i.e., all tennis related sessions, including matches), total off-court (i.e., all S&C training sessions), singles matches, doubles matches, tennis training, strength (i.e., resistance) training and conditioning (i.e., metabolic conditioning) sessions (arbitrary units; AU). Daily training and match loads were collected and analysed to depict fluctuations and trends. RPE was obtained 30 min after all sessions.[4,7] Pre-tour and on-tour, athletes' schedules were established by the assigned coach. The S&C coach collected training loads in the 4-week preparatory period as well as training and match loads throughout the on-tour period before leaving the touring group. Following S&C coach departure from the tour group, a single tennis coach, who was familiar with data collection techniques, collected all training and match load data for the entire tour group. While bias caused by social desirability cannot be avoided within high-performance groups, standardisation was provided by way of a single tennis coach who was deemed 'neutral' in that they were not the regular coach of any athlete (in their home environment). Accordingly, in this sense we attempted to minimise any coach-athlete reporting bias. For each of the 4-week international tours, the S&C coach was present for the initial 2 weeks of competition.

Statistical analysis

Results are presented as means ± standard deviations. Repeated-measures ANOVA were performed to compare: 1) Training and match loads completed between pre and on-tour phases (Phase x Time [where time is defined through weekly training and match load]); 2) Different modes (i.e., match load, on- and off court training load) completed with and without S&C support (Mode x Support). The level of significance was set at $p \leq 0.05$, and normal distribution of data was confirmed through Shapiro-Wilk analysis. Cohen's *d* effect size analysis was also used to establish the magnitude of effect of training loads completed pre to on-tour training and match loads, and with and without S&C support. Effect size results were interpreted as described by Christensen & Christensen.[29] with effect sizes of <0.2 classified as small, 0.4-0.6 as medium, and >0.8 as large. Previous work has suggested that the smallest clinically worthwhile change (*SWC*) represents the smallest change that is of benefit to athletic performance and can be calculated as 0.2 × between-subject *SD*.[30] As a result, variables in Table 1 were considered capable of detecting the *SWC* if the *TE* was ≤ *SWC*.[30] Further, 90% confidence intervals (CI) and percentage change provide a measure of the uncertainty in the magnitude of change.[31] Pearson correlation coefficients were calculated to assess the association between pre and on-tour training and match loads, and physical capacity test results. The following criteria were adopted to interpret the magnitude of the correlations: 0.1 - 0.3 small, 0.3 - 0.5 moderate, 0.5 - 0.7 large, 0.7 - 0.9 very large, and 0.9 - 0.99 nearly perfect.[31] If the 90% CI over-lapped positive and negative values, the magnitude was deemed unclear; otherwise that magnitude was deemed to be the observed magnitude.[31] Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) (Version 20, SPSS Inc., Chicago, IL, USA).

Results

Previously we have reported the absolute change in physical capacities following 4-week international tennis tours,[4] and consequently Table 1 presents the results as % change. Accordingly, only trivial - small differences were evident for changes in most physical capacities from pre to post-tour tests (*d*=0.13 - 0.41). However, a moderate effect was observed highlighting greatest susceptibility of decrement in 5-m, 10-m and 20-m speed (*d*=0.70, 0.61, 0.51 respectively).

*** Table 1 near here ***

Figure 1A highlights the mean daily total load, tennis (training and match load), S&C training loads in the 4 weeks prior to and whilst on-tour. Mean daily total load completed on-tour was larger than pre-tour (*d*=1.43). Such discrepancy in total load appears due to larger tennis load (training and match) (*d*=1.60), combined with match loads on-tour. However, there was only trivial difference between S&C training load pre-tour and on-tour (*d*=0.20). Figures 1B and 1C further compare training volume and RPE individually, to distinguish whether discrepancies in pre and on tour training and match loads are due to increased duration or intensity. An increase of large effect was observed for the duration completed in tennis sessions and total training on-tour compared pre-tour (*d*=0.80). However, only medium differences in RPE were identified between sessions completed prior to and on-tour (*d*<0.60). Finally, to present typical training and match variations around tours, Figure 2 depicts the daily variation in all modes completed prior to and whilst on-tour. Notably training and match load data from only 25 days pre and on tour are reported in Figure 2 due to travel and transit days between Australia and the destination of the inital tournament.

*** Figures 1 and 2 near here ***

Correlations were used to establish the strength of association between training and match loads completed pre-tour/on-tour and changes in fitness post-tour (Table 2). There were moderate, positive correlations between on-tour total load/on-court training and match load and reductions in 5-m (r=0.31; 0.26), 10-m (r=0.38; 0.45), 20-m speed (r=0.44; 0.52) and multistage test (r=0.40; 0.48) performance. No other correlations between training and match load and physical capacity measures were of notable relation.

*** Table 2 near here ***

Finally, Table 3 presents training and match load completed on-tour in the presence of S&C coach support. When an S&C coach accompanied players a large increase in on-tour total load, on-court training and match load, and off-court training load was completed (*d*=2.39, 2.08, 2.86 respectively). It was apparent that this discrepancy manifested through a large increase in strength training load (*d*=3.25) and conditioning training load (*d*=1.90), rather than match load (*d*=0.30) or on-court training load (*d*=0.05), when S&C coaches were on-tour.

*** Table 3 near here ***

Discussion

The current paper aimed to examine training and match loads performed prior to and on-tour, and further determine the effect of S&C coach presence on training loads whilst on-tour.

Contrary to our hypotheses, our findings showed that on-tour total loads and tennis training loads were greater than training loads completed prior to tour departure. Furthermore, individual analysis of training and match load properties (volume and RPE) revealed that discrepancies in pre and on-tour TL were due to greater on-tour tennis volume. On-tour training and match loads (total and on-court training) were positively correlated with increases in time for 5-m, 10-m and 20-m speed (i.e., greater decrement with increased on-tour training and match loads). Similarly, there were negative relationships between on-tour training and match loads (total and on-court) and multistage fitness test performance (i.e., greater decrement with increased on-tour training and match loads). Finally, analyses of on-tour training loads with and without S&C support revealed that greater strength, and conditioning training loads were undertaken in the presence of S&C support, highlighting the important role of specialist S&C coaching staff in the management of on-tour training loads. Given such findings, the ensuing discussion helps to explore the potential mismanagement of training load prescription during overseas tour, with specific consideration to declines in physical capacities whilst on tour.

Loads completed prior to and on-tour were analysed to substantiate the strength of relationships observed between training and match loads, and resultant post-tour physical capacity change. A negative interaction was observed between on-tour training and match loads and change in physical capacities; specifically, subjects who completed more on-tour, match and on-court training load suffered the greatest decrements to linear speed capacities (5-m, 10-m, 20-m sprints). Furthermore, there were also similar negative associations in multistage test result. Such findings suggest that extended tournament play across a 4-week tour - during which match loads dominate - does not provide sufficient exposure to maximal effort linear speed training. As such, with the observed moderate relationships between speed decrement and on-tour total and tennis training and match load, further research is needed to determine whether linear speed is a valid and important physical capacity measure for tennis. If relevant, it is vital near-maximal velocity is supplemented with appropriate conditioning training on-tour; if not, perhaps linear sprint tests of certain distances (i.e., 10-m & 20-m) are not relevant performance indicators for tennis success. Accordingly, previous time-motion analysis has identified that players are required to cover ~3m per shot and 8-12m (multilaterally) per point.[1,32] Whilst speed intervals of 5-m, 10-m, and 20-m are common 'athletic' capacity measures of speed,[23] Ferrauti et al.,[32] report that ~80% of all strokes played during tennis matches are within 2.5m, with only 10% of strokes encountering 2.5m - 4.5m. Therefore, perhaps more relevant performance indicators for speed in tennis are 2.5m (i.e., inner range), 5m (i.e., extended range) and 7.5m (i.e., end range). Moreover, consideration should be taken in the sensitivity of training and match loads (via RPE) in the dose-response relationships for the specific physical capacities reported here. Accordingly, with only small - moderate relationships observed between training and match loads and all capacity types, perhaps the relevance of RPE for the interpretation of physical capacities should be questioned, along with the validity of capacity tests.

There were clear observational discrepancies between training loads completed in the weeks leading into the international tour and training and match loads completed on-tour (Figure 1). Specifically, total training and match loads (due to increased tennis volume) was increased on tour. Further, the visual representation of the daily variation in training and match loads completed pre-tour and on-tour is presented in Figure 2 and highlights that there are obvious weekly training segments characterised by heavily reduced training load (pre-tour) on weekends, as well as consistently higher tennis training load than S&C training load. Correspondingly, it appears as though there is limited taper in total training load leading up to the departure for the tour. Significantly, a stable state of total training load in the final four days before departure is recognized. However, this steadiness in total load is not through stable training loads, but an inverse relationship between reduced tennis and increased S&C training loads - including, but not affected by fitness testing (as previously stressed). Such observations align with greater tennis volume identified to take place on tour, without differences in intensity (RPE). As such, we speculate that training loads in the lead up to tour departure may have been mismanaged or incongruent with the desired dose-response. Notably, despite a reduction in the prescription of training volume to compensate for the increase in high intensity training during the taper period, the volume reduction was not enough to decrease overall training load. Upon arrival at the tournament location, training loads are maintained, possibly owing to the importance placed on immediate practice at the tournament courts to adjust to the conditions.[33] Ensuing total loads during the tour are seemingly a product of the increase in match load.

In Figure 1, tennis training and match loads are greater, generally balanced between tennis training and match load throughout the tours. Figure 2 was thus included to assist in the description of training and match loads throughout the study. It is apparent that total loads are sustained on low match load days with increases in tennis training load (Figure 2). Meanwhile we see a marked increase in S&C training load coinciding with dramatic reductions in match load (following tournament losses). While the current data are the first to describe pre and on-tour training and match loads for tennis, previous rugby league literature has identified fluctuations in physical capacities related to changes in training and match loads over a competitive season.[34] Accordingly, rugby league players can expect increases in aerobic capacity and muscular power, reductions in skinfolds, and stable 10-m, 20-m, and 40-m speed, during the initial weeks of competition, when training and competition loads are greatest.[34] However, as the competitive season progressed each aforementioned physical capacity experienced maladaptation as preparatory training loads decreased, with match loads and injury rates at their highest.[34] In tennis, Kovacs et al.[11] reported negative changes to physical capacities over 5-weeks, although the time frame was unsupervised, therefore limited training and match load information was collected. The training and match loads reported in this study appear to differ from those documented in rugby league and Australian football in so far as higher training loads were reported out of competition in these sports.[34] Such disparity to field-based sports may be explained by the nature of tennis training, whereby skills are practiced in a ballistic repetitive fashion (i.e., high intensity stroke-play and changes in direction), combined with the unpredictable duration of matches which makes it challenging to forecast match loads in advance.

Given the reduction in certain physical capacities on-tour and knowing that if S&C coaches are present S&C training loads are maintained on-tour, it is concievable that the importance of prescribing targeted S&C training modes (i.e., speed sessions) may out weigh volume of S&C in preparation and on-tour. For instance, with increased match demands (i.e., winning more matches), the training focus may be more appropriately focused on capacities not inherent to on-court training/ match loads (i.e., 5-m speed). As such, the value of on-tour S&C coach presence is supported through; the apparent increase in training load prescription (particularly S&C training load), as well as the ability to reactively manipulate training loads to target specific physical capacities at risk of decline. Such responsiveness may reduce the likelihood of inappropriately high (i.e., non-functional over-reaching or injury) or low (i.e., maladaptation of physical capacities) training loads being prescribed. Accordingly, the knowledge of S&C support staff, and close alignment with skills coaches, may also explain the ability of athletes to complete more total training load (on and off court) on tour.

Practical Applications

Coaches should be aware that training loads completed prior to overseas tours may not match the required total loads of 4-week tours possibly under-preparing athletes, and exacerbating declines in physical capacities post-tour (speed and aerobic capacity). Specifically, we have identified that the disparity in training and match loads were due to reduced tennis volume pre-tour rather than intensity, with no difference in volume or intensity for S&C sessions. As such, S&C coaches may find greater value in the prescription of speed sessions over other physical training sessions (i.e., lower body power sessions). Further, S&C support was identified to be of great importance in the maintenance of strength, and conditioning training load prescription. Additionally, on-tour support allows the ability to reactively manipulate training loads targetting specific domains of physical capacities based on match play requirements (i.e., linear speed). More research is needed to determine the validity of current physical testing protocols as performance measure for tennis. Specifically, whether a more tennis specific and appropriate measure may provide greater information describing the dose-response relationship of capacities to training and match load seems required.

Conclusions

Pre-tour training, and on-tour total load data revealed that pre-tour total and tennis training loads were lower than training loads completed on-tour - as a product of reduced volume rather than intensity. However, there was no difference between pre- and on-tour S&C training loads completed. While pre-tour training loads seemingly provide minimal maintenance effect on physical capacities, on-tour total and on-court training and match loads seem aligned with decrements to linear speed and aerobic test results (i.e., 5-m, 10-m, and 20-m speed, and multistage test). With these potential repercussions of increased total load completed on-tour, it is apparent that the presence of S&C coach is vital for training load management, as well as the prescription of specific training modes when physical capacities may be compromised by tournament demands (i.e., linear speed and aerobic capacity). With the uncovered discrepancy between presence and absence of support on-tour- due to greater strength, and conditioning training loads- the support an S&C coach can provide to assigned tour tennis coaches is likely indispensable. Successful evaluation and informed prescription of training loads in tour preparation, as well as the fundamental role that S&C support can provide for on-tour training load maintenance, should contribute to sustained physical capacities upon return.

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