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Using inertial sensors to monitor on-court tennis training sessions

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ABSTRACT

Technological innovation provides coaches with practical tools that allow them to have more information about a player's activity during training and competition. This article presents a study using inertial sensors integrated into a wristband to quantify the different types of shots hit by players during one pre-season training week and to compare them with competition demands.

Key words: training monitoring, connected device, injury prevention
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INTRODUCTION

Training load management and its relation to injury risk has become an important point of interest for sport scientists in recent years (Soligard et al, 2016). More specifically, in tennis, it has been advocated that it is not the load itself but an inappropriate transition to a higher load, called the "road to load" that causes injuries (Pluim and Drew, 2016; Rogowski et al., 2016). Recently, it has been shown that upper arm injuries and in-event treatment frequency increased by ≥2.4 times in both sexes at the Australian Open Grand Slam over a 5-year period (Gesheit et al., 2017). These kinds of injuries are a direct result of the mechanical loads imposed on the musculoskeletal system (especially the serve) and it is suggested that some measure of ball striking be considered to feature in an upper limb/body exposure (Reid et al., 2018). Moreover, studies have shown some differences between junior and senior tennis players regarding the number of strokes hit during matches that coaches have to consider when planning training sessions, in order to match the demands of competition (Myers et al., 2016; Kovalchik et al., 2017; Perri et al., 2018). To quantify shot counts, coaches can use inertial sensors that are non-invasive, portable and able to discriminate between tennis strokes (Whiteside et al., 2017).

The goal of this study was to quantify the number of strokes and the hitting intensities (rate of strokes per minute) performed by junior male players during their on-court sessions over one week using inertial sensors. This training week took place in the preseason period aiming at preparing specifically the players to the upcoming tournaments and the subsequent analysis of data was used to provide coaches with information regarding the potential gap between the content of on-court sessions and competition demands.

METHOD

Five on-court tennis sessions data of 14 junior male players (age: 15.4 ± 2.0 years, ranging from 13 to 19 years old, height: 172.8 ± 9.9 cm, weight: 60.0 ± 10.2 kg, years of experience: 9.7 ± 3.1 years, weekly training: 12.0 ± 2.5 hours, International Tennis Number = 3) were analysed using a sensor-packed smart wearable wristband on the dominant hand (Babolat Pop) (Figure 1). The player's activity was tracked during the tennis session and the information was sent wirelessly to a mobile device to be broken down stroke by stroke.

Figure 1. Babolat Pop device.

The total number of shots and the number of shots per minute were calculated for the full group. The descriptive analysis included average and standard deviation for serves, forehands, and backhands for the five sessions. Correlations between age and number of shots were also calculated. Finally, outcomes between shot types in the same session were compared using Student's

t-tests for paired samples with α set at 0.05. All statistical analyses were performed using SPSS 11.0 software (SPSS, Inc., Chicago, IL, USA).

RESULTS

Figure 2 shows the average distribution of forehands, backhands and serves hit during each of the five tennis sessions for the full group.

On average, the duration of a tennis session was 87.0 ± 32.3 minutes in which players hit 291.1 ± 150.5 forehands, 198.1 ± 100.6 backhands, and 53.5 ± 33.7 serves. The average weekly number of forehand shots was significantly higher than that of backhand shots ($p<0.05$). Both average weekly number of forehand and

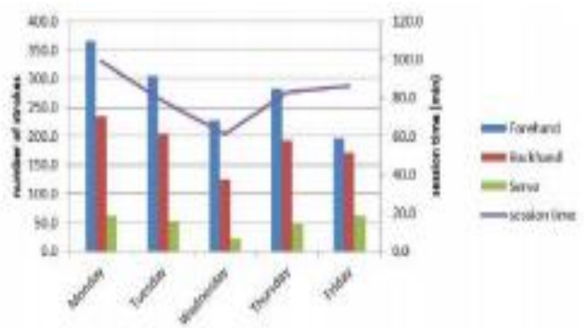

Figure 2. Relative average distribution of tennis shots over the training week.

backhand shots were both significantly higher than that of serves ($p<0.05$). There were no correlations between the age and the number of shots hit over the five training sessions.

DISCUSSION

The main finding is that there is a large disparity between the average numbers of serves, forehands and backhands hit in each session. The average forehand/backhand ratio in our study is 1.58 ± 0.64, which is higher than 1.24 ± 0.37 found for professional male players in competition (Reid et al, 2016). If the overemphasis on forehand shots seems to be a feature of the modern game, it should not be to the detriment of the improvement of backhand shots. Indeed, a study revealed that forehands are associated with a greater number of points won, while more points are lost with backhands played as the final shot (Cam et al., 2013). It could be argued that these results are unsurprising if one shot is played (or practiced) more than the other. Moreover, the average external load of training seems not to match the demands of competition which may be the goal in the pre-season. The hitting intensities (strokes/min) of groundstroke shots range from 4,3 ± 0,6 up to 6,8 ± 1,6 and are lower than those observed by Murphy et al. (2016) for training session (7 ± 1.0), simulated match play (10 ± 5.1) and tournament (14 ± 3.6). This difference could be due to longer rest time and/or a more technical/tactical focus.

Regarding the average number of serves, it was lower than the 120 serves proposed by Myers et al. (2016). Our results are similar to those of Perry et al. (2018) who observed that the number of serves during training session was significantly lower than that of competition for U15 male players (38.6 ± 24.2 vs 82.0 ± 24.8). Because tournament schedules for junior players are often condensed, the players may be required to play several matches in few days with a number of total serves that exceeds that of their current training week. This difference in volume of serves in competition compared to training suggests that coaches should better plan training serve loads (volume and intensity) to match competition to ensure a reduction in injury risk from inadequate exposure. Different recommendations may be implemented during training sessions to both improve serving efficiency and decrease the risk of overload shoulder injury. Firstly, the volume and the intensity of serves should be variable from session to session to allow tissue regeneration and should be planned with intervals simulating the real game (Myers et al, 2016). Secondly other training modalities, as motor imagery (Guillot et al, 2012) or physical training (Fernandez-Fernandez et al, 2013), have been shown to be effective in improving serving performance with junior players and could be combined with a decreased serve volume. Finally, it is also important to limit the imbalances in strength and range of motion between internal and external rotators by following a regular injury prevention program.

CONCLUSION

The inertial sensor is a practical tool allowing coaches to analyse relevant information about the number and rate of strokes. It can help them to better prescribe sessions according to the goals of the different training periods. Future longitudinal studies are warranted to establish references concerning the optimal number of strokes for performance improvement without increasing risk of injury.

REFERENCES

Cam, I., Turhan, B. & Onag, Z. (2013). The analysis of the last shots of the top-level tennis players in open tennis tournaments. Turkish Journal of Sport and Exercise 15(1), 54-57.

Gescheit, D.T., Cormack, S.J., Duffield, R., et al. (2017). Injury epidemiology of tennis players at the 2011-2016 Australian Open Grand Slam. Br J Sports Med, 51(17), 1289-1294. https://doi.org/10.1136/bjsports-2016-097283

Guillot, A., Genevois, C., Desliens, S., Saieb, S., & Rogowski, I. (2012). Motor imagery and 'placebo-racket effects' in tennis serve performance. Psychology of Sport and Exercise, 13, 533- 540. https://doi.org/10.1016/j.psychsport.2012.03.002

Murphy, A.P., Duffield, R., Kellett, A., & Reid, M. (2016). A comparison of the perceptual and technical demands of tennis training, simulated match play, and competitive tournaments. International Journal of Sports Physiology and Performance, 11(1), 40-47. https://doi.org/10.1123/ijspp.2014-0464

Myers, N.L., Sciascia, A.D., Kibler, W.B., & Uhl, T.L. (2016). Volumebased Interval Training Program for Elite Tennis Players. Sports Health, 8(6), 536-540. https://doi.org/10.1177/1941738116657074

Perri, T., Ian Norton, K.I., Bellenger, C.R., & Murphy, A.P. (2018) Training loads in typical junior-elite tennis training and competition: implications for transition periods in a highperformance pathway, International Journal of Performance Analysis in Sport, 18(2), 327-338. https://doi.org/10.1080/24748668.2018.1475198

Pluim, B.M., & Drew M.K. (2016). It's not the destination, it's the 'road to load' that matters: a tennis injury prevention perspective Br J Sports Med, 50(11), 641-642. https://doi.org/10.1136/bjsports-2016-095997

Reid, M., Cormack, S.J., Duffield, R., et al. (2018). Improving the reporting of tennis injuries: the use of time or workload data as the denominator. Br J Sports Med, 0:1-2.

Reid, M., Morgan, S., & Whiteside, D. (2016). Matchplay characteristics of Grand Slam tennis: implications for training and conditioning. Journal of Sports Sciences, 34(19), 1-8. https://doi.org/10.1080/17461391.2015.1031712

Rogowski, I., Creveaux, T., Genevois, C., Klouche, S., Rahme, M., Hardy, P. (2016). Upper limb joint muscle/tendon injury and anthropometric adaptations in French competitive tennis players. Eur J Sport Sci, 16(4), 483-9. https://doi.org/10.1080/17461391.2015.1031712

Soligard, T., Schwellnus, M., Alonso, J.M. et al. (2016). How much is too much? (Part 1) International Olympic Committee consensus statement on load in sport and risk of injury. Br J Sports Med, 50(17), 1030-1041. https://doi.org/10.1136/bjsports-2016-096581 https://doi.org/10.1136/bjsports-2016-096583

Whiteside, D., Cant, O., Connoly, M., & Reid, M. (2017). Monitoring Hitting Load in tennis using inertial sensors and machine learning. Int J Sports Physiol Perform, 12(9), 1212-1217. https://doi.org/10.1123/ijspp.2016-0683