COACHING & SPORT SCIENCE REVIEW

International Tennis Federation
www.itfcoachingreview.com
April 2024. 32th Year. Issue 92. 18-23
ISSN 2225-4757
https://doi.org/10.52383/itfcoaching.v33i92.488

Severity of medical conditions of top-level male tennis players: implication for prevention

Giulio Sergio Roi[1, 2] & Federico Zambelli[1]

[1]University of Verona, Department of Neuroscience, Biomedicine and Movement Sciences, Verona, Italy.
[2]Italian Tennis Federation, Higher Education Institute Roberto Lombardi, Rome, Italy

ABSTRACT

Although tennis is one of the most popular sports practiced worldwide by millions of players, there are no data on the time necessary to return to playing after injuries or illnesses. To contribute to the discussion regarding time-loss medical conditions (TLC), a retrospective web search was conducted on the first fifty tennis players listed in the ATP ranking on February the 20th 2022, looking for TLC in a five-year period (1-1-2018 to 25-12-2022). We recorded 267 TLC 137(51%) of them occurred during tournaments and 130(49%) during training sessions. Recurrences were 31% affecting 27(54%) players. Most TLC were treated conservatively (N=256; 96%), while 11(4%) needed surgery. The median time loss of all the 267 TLC was 17 days (range 1-378). For conditions requiring surgery (n=11), the median was 61 days (range 10-367). Injuries, as opposed to illnesses, accounted for 81% of all TLC. Players and coaches should know the effects of medical conditions on the career of players and how to set-up an effective prevention program starting from early childhood. Prevention in top players should consider also playing surfaces and overall lifestyle including nutrition and sleep, together with other healthy measures such as vaccinations, especially for players traveling around the world.

Key words: epidemiology, illness, injury, return to play.

Received: 11 August 2022

Accepted: 10 November 2023

Corresponding author: Giulio Sergio Roi. Email: gs.roi@isokinetic.com

INTRODUCTION

Tennis is one of the most popular sports practiced worldwide by millions of players at recreative and professional levels, reaching individuals of all ages and all skill levels. The metabolic demands of a tennis match are satisfied by both aerobic and anaerobic metabolisms because of the typical intermittent nature of the sets characterized by repetitive actions of short-duration and high intensity (Kovacs, 2007). Consequently, players perform hundreds of power strokes per match, looking for high ball velocities through a variety of technical movements including overhead serves, smashes, and groundstrokes. Furthermore, a tennis match can extend for hours because there is no time limit on how long players can play, although in most tournaments matches played to three sets lasts about 1.5 hours on average and are characterized by 5-10 seconds of attack and 10-20 seconds of recovery on average (Fernandez-Fernandez et al., 2009).

From all the above, tennis players are susceptible to develop a variety of injuries indexes (Dines et al., 2015) form acute traumatic, commonly occurring in the lower extremity, to chronic overuse conditions, most often manifesting themselves in the upper extremity and trunk (McCurdie et al., 2017). Pluim et al. (2006) reported a cumulative incidence ranging from 0.04 to 3.00 injuries per 1000 hours played, although the incidence of injuries in tennis varies according to age, gender, level of play, study design and definition of injury or medical condition.

There are several articles published in literature regarding the epidemiology of tennis however, there are no reports regarding time-loss and severity of medical conditions occurred during the career of top-level tennis players, including conditions not related to tennis. Thus, the aim of the present study is to contribute to the discussion regarding this aspect of the epidemiology of top tennis players analyzing the first fifty positions of the ATP ranking, to suggest implications for prevention.

METHODS AND PROCEDURES

To collect information on both injuries and illnesses, the term "medical condition" was adopted (Pluim et al., 2009). However, differently from the consensus statement on epidemiological studies of medical conditions in tennis (Pluim et al., 2009), conditions not related to tennis were also included to explore the effects of being unhealthy on the career of top players. Thus, a time-loss condition (TLC) was defined as an injury or illness that leads a player to be unable to take full part in future matches or training sessions.

The retrospective search was conducted on the first fifty tennis players listed in the ATP ranking on February the 20th 2022, looking for TLC in a five-year period from January the 1st 2018, to December the 25th 2022.

Data were collected by consulting the websites of the tournaments and searching the personal websites of the players and online sports newspapers for TLC. Searches were conducted using Google and Yahoo as web search engines typing several keywords: tennis, injury, illness, training, withdraw, and the names of the tournament and of the players variously associated with each other. When a medical condition was found, the information was checked, and the web search was deepened for the place, date, and name of player and of the tournament.

The analysis was performed on publicly available data, in accordance with the 1964 Helsinki declaration involving human participants and its later amendments or comparable ethical standards. Data were anonymized and analyzed with descriptive statistics.

The overall severity of TLC was reported as both the mean (±Standard Deviation) and the median number of days lost and grouped according to the time lost — namely, slight (0 days), minimal (1-3 days), mild (4-7 days), moderate (8-28 days), severe (29 days-6 months) and long-term (>6 months) (Pluim et al., 2009).

RESULTS

The anthropometric characteristics of the players are reported in Table 1.

Table 1. Anthropometric characteristics of the first fifty players of the ATP ranking (20th February 2022).

	Age (yrs)	Body mass (kg)	Height (m)	BMI (kg/m2)
Mean ±SD	27.7±4.9	81.3±8.9	1.89±0.09	22.3±1.3
Range	18.3-37.3	64-108	1.70-2.11	19.8-24.8

BMI: Body Mass Index.

In the five years period 267 TLC were recorded (Table 2), 137 of them occurred or were reported during the tournaments (51%) and 130 during training sessions (49%). Recurrences were 31% affecting twenty-seven players (54%).

Table 2. Locations of all the recorded medical conditions.

LOCATIONS		N°	%
Head/Neck	Neck	3	1.1%
	Eye	1	0.4%
Upper limbs	Shoulder	26	9.7%
	Wrist	15	5.6%
	Elbow	10	3.7%
	Hand	3	1.1%
	Arm	2	0.7%
Trunk	Back	23	8.6%
	Abdomen	17	6.4%
	Chest	1	0.4%
Lower limbs	Shank	23	8.6%
	Foot	23	8.6%
	Knee	21	7.9%
	Thigh	19	7.1%
	Ankle	18	6.7%
	Hip	12	4.5%
Other	Hillness	38	14.2%
	Gastrointestinal	7	2.6%
	Pulmonary	3	1.1%
	Nervous system	1	0.4%
	Dental	1	0.4%
	Total	267	100.0%

Most of these TLC were treated conservatively (N=256; 96%; Table 3), while only 11 (4%) needed surgery (Table 4).

Table 3. Locations and diagnosis of medical conditions requiring surgery and their severity.

Location	Diagnosis	Days out from competitions	Severity
Shoulder	Rotator cuff injury	367	Long term
Ankle	Sprain	187	Long term
Hip	Arthrosis	153	Severe
Groin	Hernia	111	Severe
Foot	Heel spur	85	Severe
Elbow	Tendinopathy	61	Severe
Elbow	Tendinopathy	60	Severe
Abdomen	Hernia	43	Severe
Knee	Meniscopathy	26	Moderate
Ankle	Calcification	14	Moderate
Dental	Removal of wisdom tooth	10	Moderate

Considering all the TLC (n=267), the median time loss was 17 days (range 1-378; mean 33.2±48.1). For conditions requiring surgery (n=11), the median was 61 days (range 10-367; mean 102±105).

Table 4. Locations and severity of medical conditions treated conservatively. SD: Standard Deviation.

Location	N°	%	Days out from competitions				Severity
			Median	Min	Max	Mean ±SD	
Illness	48	18.8	10	1	183	24±29	Minimal to long term
Shoulder	25	9.8	16	3	100	27±25	Minimal to Severe
Back	23	9.0	8	2	179	22±41	Minimal to severe
Shank	22	8.6	16	3	179	30±38	Minimal to severe
Foot	22	8.6	12	1	128	31±39	Minimal to severe
Knee	20	7.8	22	5	99	31±26	Mild to severe
Thigh	18	7.0	18	4	190	33±44	Mild to severe
Abdomen	16	6.3	29	5	187	40±43	Mild to severe
Ankle	16	6.3	14	3	63	20±17	Minimal to severe
Wrist	15	5.9	27	7	378	61±101	Mild to long term
Hip	11	4.3	27	6	178	45±52	Mild to severe
Elbow	7	2.7	12	4	75	20±25	Mild to severe
Other	5	2.0	35	8	87	39±30	Mild to severe
Neck	3	1.2	25	1	110	45±57	Minimal to severe
Hand	3	1.2	10	6	13	10±5	Mild to moderate
Arm	2	0.8	69	10	127	69±83	Moderate to severe
ALL	**256**	**100.0**	**17**	**1**	**378**	**30±42**	**Minimal to long term**

Table 5. Time-loss by diagnosis and severity. SD: Standard deviation.

Diagnosis	N°	%	Days out from competitions				Severity
			Median	Min	Max	Mean ±SD	
Muscle tear	50	19.5	18	1	190	34±44	Minimal to long term
Tendinopathy (shoulder)	23	9.0	17	3	378	45±89	Mild to long term
Back pain	22	8.6	8	2	179	19±37	Minimal to severe
COVID-19	22	8.6	17	6	63	26±19	Mild to severe
Blisters	18	7.0	12	1	94	17±22	Minimal to severe
Tendinopathy (unspecified)	17	6.6	34	6	127	41±32	Mild to severe
Sprain	16	6.3	21	3	63	26±20	Minimal to severe
Tendinopathy (wrist-hand)	15	5.9	12	3	128	29±44	Minimal to severe
Illness	13	5.1	6	4	38	10±10	Mild to severe
Knee problem	12	4.7	15	5	99	27±31	Mild to severe
Other	10	3.9	23	3	128	37±40	Minimal to severe
Tendinopathy (elbow)	7	2.7	12	4	75	20±25	Mild to severe
Gastrointestinal	6	2.3	10	8	28	15±9	Moderate
Hip problems	5	2.0	18	6	62	26±25	Mild to severe
Bone fracture	5	2.0	92	43	109	84±28	Severe
Arthrosis hip	4	1.6	32	10	178	63±77	Moderate to severe
Flu	4	1.6	6	4	9	6±3	Mild to moderate
Groin pain	4	1.6	23	17	36	25±8	Moderate to severe
Asthma	3	1.2	5	1	7	4±3	Minimal to mild
ALL	**256**	**100.0**	**17**	**1**	**378**	**30±42**	**Minimal to long term**

Furthermore: 89% of blisters affected the feet, 88% of sprain affected the ankle, 34% of muscles injuries affected the shank, 32% of muscle injuries affected the abdominal muscles, 28% of muscle injuries affected the thigh. Among "Other" (Table 5) we listed cases of pain to the tibia, problem to clavicle, bone oedema to the elbow, eye problem, heat stroke, Müller-Weiss syndrome, and muscle cramps.

Finally, in the population considered we did not find significant relationships between number of TLC and age (R2=0.147) or ranking (R2=0.016) of the players.

DISCUSSION

The studies on medical conditions usually explore several aspects of the epidemiology of injuries, such as prevalence, incidence, injury rate, and mechanism of injury. These studies are almost always conducted without collecting information on times of return to competitions, although time-loss is an outcome that top tennis players want to minimize (Kovalchik, 2020).

To our knowledge, the present study is the first that try to highlight the effects of medical conditions on the continuity of the career of a selected group of top male tennis players. In the examined five-year period, we found that players suffered on average 5.3 TLC each ranging from 1 to 15, with a median time-loss of 17 days (i.e., moderate severity), reaching 61 days (i.e., severe) when surgery was needed. Moreover, there was a wide variance of the time-loss, from minimal severity to long term, resulting from the different medical conditions depending on type, nature, and possibility of therapy or management. In fact, in some cases, and in particular of chronic conditions, affected players can participate in the tournaments or shorten the length of time-loss utilizing different form of therapies, including non-steroidal anti-inflammatory drugs (NSAIDs), topical analgesics, injectable NSAIDs, local anesthetics (Bourgonjon et al. 2022), prolotherapy (Zhu et al., 2022), extracorporeal shock wave therapy (Ozturan et al., 2010), and even injections of corticosteroids or platelet rich plasma (Kemp et al., 2021).

In our study we did not find significant relationships between the number of TLC and the age of the players, probably because of the small number of subjects and the limited time span explored. Indeed, a recent analysis of tens of thousands of competition weeks over the complete professional careers of 389 top male tennis players found significant increases in the risk of time-loss from competition with greater total competition load (Kovalchik, 2020). It was also demonstrated that the risk for the same increase in load increased with a player's biological age, indicating that the harmful effects of load are magnified for older players compared to younger players (Kovalchik, 2020).

As for the diagnosis, 45% of the injuries recorded in the present study were due to tendinopathies (26%; 9% were recurrences) and muscle tears (20%; 12% were recurrences), meaning that the musculo-tendinous unit is particularly sensitive to the effects of training and competition loads of tennis. Indeed, Colberg et al. (2015) in their study reported that one out of four athletes had a gradual onset condition that was commonly attributed to the training environment and length of each training session.

Our data confirm that lower limbs were the locations most affected by injuries (43% of all TLC) (Fu et al., 2018, Pluim et al., 2016), followed by upper limbs (21%) and trunk (15%), while illnesses were 19%. In our study, injuries, as opposed to illnesses, accounted for 81% of all TLC, similar to previous findings of 80% (Hartwell et al., 2017) and 78% (Okholm Kryger et al., 2015), indicating a consistent trend in different samples of tennis players. It is interesting to note that the Covid-19 pandemic affected twenty-two players i.e., 44% of our sample, with a time-loss severity between one week and two months, leading to consider the importance of adopting preventive measures in the sporting context to manage the danger of transmissible illnesses.

LIMITATIONS

This is an observational retrospective study, in which the use of different web and media sources of information posed a challenge to data collection and understanding of the circumstances of the injuries. These sources allow for the collection of limited data regarding injuries and illnesses and their accurate diagnosis, so it is challenging to obtain detailed information about the casualty and precisely analyze it. As an example, sometimes websites reported an unspecified "problem" such as "muscular problem" or "problem to the ankle" which prevent from a correct classification, especially for medical condition occurred out of competitions which is difficult to confirm by multiple web reports. Furthermore, an absence of data identified in the search does not necessarily equate to an absence of cases leading to a possible underestimation of the results. For example, minor injuries sustained during match play do not prevent from finishing the match (Colberg et al., 2015) and cannot appear in our study. Another limit is the small number of players and the time span restricted to 5 years.

Despite these limitations, this study still provides an idea on the main conditions that lead to absence from training and/or tennis tournaments and their severity, which should be investigated with further prospective studies.

CONCLUSIONS

This short paper focuses on the medical conditions entailing time-loss in top ranked ATP tennis players. Our results agree with most of the published data regarding tennis epidemiology, adding for the first time, some information about the severity of these conditions. Considering that time-loss is an outcome that top tennis players want to minimize, it became clear that both players and coaches should implement all the measures aimed to prevent the consequences of any kind of condition, especially those due to functional overload and transmissible illnesses. Nonetheless, Güler and Abdio?lu (2022) observed that many male tennis players they studied did not take precautions for sports injuries.

Prevention should start early in the career of tennis players, from childhood where early specialization and high training volumes may increase risk for injury (Rose et al., 2008), although early intense training seems to be non-essential for attaining an elite level in all sports (Jayanthi et al., 2013), tennis included. Literature data show that players who specialized only in tennis were 1.5 times more likely to report an injury (Jayanthi et al., 2011), and medical withdrawals increased in national tennis players after playing more than five matches per year in supernational tournaments (Jayanthi et al., 2009).

It is well known that training has protective effects against injuries (Gabbett, 2016), but principle of load progression means that from beginners to elite athletes the training workload must increase gradually, and be varied periodically according to athlete's physiological capacity, psychological abilities, and work tolerance (Bompa & Haff, 2009), deeply understanding the training process leading to elite performance (Smith, 2003), without forgetting tennis-specific exercises such as decelerations (Kovacs et al., 2008).

As far as elite athletes are concerned, prevention should consider not only training loads, but also playing surfaces (Alexander et al., 2022) and overall lifestyle including nutrition and sleep, together with other healthy measures such as vaccinations (Edouard et al., 2019), especially for players traveling around the world.

Players and coaching staff should know the effects of medical conditions on the career of a tennis player and how to set up an effective prevention program aimed at minimizing the risk of medical conditions. We think that this paper can help.

Further prospective studies are necessary to better understand the relationships between risk factors and severity of medical conditions, looking for injury prevention and health promotion of all the tennis players.

CONFLICT OF INTERESTS AND FUNDING

The authors declare that they do not have any conflict of interest and that they did not receive any funding to conduct the research.

REFERENCES

Alexander, S., Naaz, N., & Fernandes, S. (2022). The incidence of injuries across various tennis surfaces: A systematic review. ITF Coaching Sport Science Review, 88, 39-44. https://doi.org/10.52383/itfcoaching.v30i88.353

Bompa, T.O., & Haff, G.G. (2009). Periodization. Theory and methodology of training. Human Kinetics, Champaign (IL).

Bourgonjon, B., Vermeylen, K., Tytgat, N., & Forget, P. (2022). Anaesthesia for elite athletes. European Journal of Anaesthesiology, 39(10), 825-834. https://doi.org/10.1097/EJA.0000000000001719

Colberg, R., Aune, K., Choi, A., & Fleisig, G. (2015). Incidence and prevalence of musculoskeletal conditions in collegiate tennis athletes. Journal of Medicine and Science in Tennis, 20(3), 137-44.

Dines, J.S., Bedi, A., Williams, P.N., Dodson, C.C., Ellenbecker, T.S., Altchek, D.W., Windler, G., & Dine, D.M. (2015). Tennis injuries: epidemiology, pathophysiology, and treatment. Journal American Academy Orthopedic Surgery, 23, 181-189. https://doi.org/10.5435/JAAOS-D-13-00148

Edouard, P., Richardson, A., Murray, A., Duncan, J., Glover D., Kiss, M., Depiesse, F., & Branco, P. (2019). Ten tips to hurdle the injuries and illnesses during major athletics championships: practical recommendations and resources. Frontiers in Sports and Active Living, 1, 12. https://doi.org/10.3389/fspor.2019.00012

Fernandez-Fernandez, J., Sanz-Rivas, D., & Mendez-Villanueva, A. (2009). A review of the activity profile and physiological demands of tennis match play. Strength and Conditioning Journal, 31(4), 15-26. https://doi.org/0.1519/SSC.0b013e3181ada1cb

Fu, M.C., Ellenbecker, T.S., Renstrom, P.A., Windler, G.S., & Dines, D.M. (2018). Epidemiology of injuries in tennis players. Current Reviews in Musculoskeletal Medicine, 11(1), 1-5. https://doi.org/10.1007/s12178-018-9452-9.

Gabbett, T.J. (2016). The training-injury prevention paradox: should athletes be training smarter and harder? British Journal of Sports Medicine, 50(5), 273-280. doi: http://dx.doi.org/10.1136/bjsports-2015-095788

Güler, M., & Abdio?lu, M. (2022). Effects of athlete personality on variables related to tennis injuries. European Journal of Physical Education and Sport Science, 9(1), 8-20. http://dx.doi.org/10.46827/ejpe.v9i1.4463.

Hartwell, M.J., Fong, S.M., & Colvin, A.C. (2017). Withdrawals and retirements in professional tennis players. Sports Health, 9(2), 154-161. https://doi.org/10.1177/1941738116680335.

Jayanthi, N., O'Boyle, J., & Durazo-Arvizu, R. (2009). Risk factors for medical withdrawals in United States tennis association junior national tennis tournaments: a descriptive epidemiologic study. Sports Health, 1(3), 231-235. https://doi.org/10.1177/1941738109334274.

Jayanthi, N.A., Dechert, A., Durazo, R., & Luke, A. (2011). Training and specialization risks in junior elite tennis players. Journal of Medicine and Science in Tennis, 16(1), 14-20.

Jayanthi, N., Pinkham, C., Dugas, L., Patrick, B., & Labella, C. (2013). Sports specialization in young athletes: evidence-based recommendations. Sports Health, 5(3), 251-257. https://doi.org/10.1177/1941738112464626.

Kemp, J.A., Olson, M.A., Tao, M.A., & Burcal, C.J. (2021). Platelet-rich plasma versus corticosteroid injection for the treatment of lateral epicondylitis: a systematic review of systematic reviews. International Journal of Sports Physical Therapy, 16(3), 597-605. https://doi.org/10.26603/001c.24148.

Kovacs, M.S. (2006). Applied physiology of tennis performance. British Journal of Sports Medicine, 40, 381-385. http://dx.doi.org/10.1136/bjsm.2005.023309

Kovacs, M.S., Roetert, E.P., & Ellenbecker, T.S. (2008). Efficient deceleration: the forgotten factor in tennis-specific training. Strength and Conditioning Journal, 30(6), 58-69. https://doi.org/10.1519/SSC.0b013e31818e5fbc.

Kovalchik, S.A. (2020). 'In search of lost time': Identifying the causative role of cumulative competition load and competition time-loss in professional tennis using a structural nested mean model. PLoS ONE, 15(4): e0231568. https://doi.org/10.1371/journal.pone.0231568.

McCurdie, I., Smith, S., Bell, P.H., & Batt, M.E. (2017). Tennis injury data from The Championships, Wimbledon, from 2003 to 2012. British Journal of Sports Medicine, 51(7), 607-611. https://doi.org/10.1136/bjsports-2015-095552.

Okholm Kryger, K., Dor, F., Guillaume, M., Haida, A., Noirez, P., Montalvan, B., & Toussaint, G.F. (2015). Medical reasons behind player departures from male and female professional tennis competitions. American Journal of Sports Medicine, 43: 34-40. https://doi.org/10.1177/0363546514552996.

Ozturan, K.E., Yucel, I., Cakici, H., Guven, M., & Sungur, I. (2010). Autologous blood and corticosteroid injection and extracoporeal shock wave therapy in the treatment of lateral epicondylitis. Orthopedics, 33(2), 84-91. https://doi.org/ 10.3928/01477447-20100104-09.

Pluim, B.M., Staal, J.B., Windler, G.E., & Jayanthi, N. (2006). Tennis injuries: occurrence, aetiology, and prevention. British Journal of Sports Medicine, 40(5), 415-423. https://doi.org/10.1136/bjsm.2005.023184.

Pluim, B.M., Fuller, C.W., Batt, M.E., Chase, L., Hainline, B., Miller, S., Montalvan B., Renstrom, P., Stroia, K.A., Weber, K., & Wood, T.O. (2009). Consensus statement on epidemiological studies of medical conditions in tennis. British Journal of Sports Medicine, 43, 838-897. https://doi.org/10.1136/bjsm.2009.064915

Rose, M.S., & Emery, C.A., Meeuwisse, W.H. (2008). Sociodemographic predictors of sport injury in adolescents. Medicine and Science in Sports and Exercise, 40(3), 444-450. https://doi.org/10.1249/MSS.0b013e31815ce61a.

Smith, D.J. (2003). A framework for understanding the training process leading to elite performance. Sports Medicine, 33(15), 1103-1126. https://doi.org/10.2165/00007256-200333150-00003.

Zhu, M., Rabago D., Chung, V.C., Reeves, K.D., Wong, S.Y., & Sit, R.W. (2022). Effects of hypertonic dextrose injection (prolotherapy) in lateral elbow tendinosis: a systematic review and meta-analysis. Archives of Physical Medicine and Rehabilitation, 103(11), 2209-2218. https://doi.org/10.1016/j.apmr.2022.01.166.

RECOMMENDED ITF TENNIS ACADEMY CONTENT (CLICK BELOW)