

ORIGINAL ARTICLE

Musculoskeletal injuries involving Greek recreational tennis athletes**Malliou Paraskevi**

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Introduction

As tennis is a very popular sport, it attracts many participants from different age groups. Also, single tennis play has the characteristics of a moderate to vigorous intensity sport, because of its exercise intensity. Many studies in the literature studying training adaptations through tennis

participation examined exclusively young, regular tennis practitioners who were exercising intensively for becoming proficient at sport-specific skills (Bergeron 1991, MF, Christmass 1998, MA, Elliott, B 1985, Fernandez, J 2006, Mazzeo, RS 2001, Mendez-Villanueva, A 2007, Novas, AM 2003, Pluim, BM 2007, Reilly, T 1994 Palmer, J 2006, Fernandez 2009).

When practitioners are adults who choose tennis as their preferred physical activity to promote and/or maintain health, they might have lower skill levels than younger. Considering the fact that tennis performance is much depended on technical skill level acquired, it is important to ensure that important training adaptations through tennis play are obtained (Haskel, 2007). A related study obtained for tennis players on a regular basis (2 to 3 times a week) (Fernandez, 2009) showed impressive results for health promotion. It was stated that this workout proved to have a sufficient intensity to meet the ACSM's recommendations for enhancing aerobic fitness and promoting total body mass and fat weight loss (ACSM 1995, Pluim et al, 2006) and this conclusion was the same for recreational and advanced players. It seems that training adaptations for tennis players with low to average skill capacities were significant enough to get positive health benefits when training frequency was regular enough. ACSM adds in the literature that adults who participate in activities that maintain or increase muscular strength and endurance for a minimum of 2 d_{wk}21 (Haskel, 2007) would also benefit in terms of health promotion (Fernandez, 2009). Those suggestions make tennis an ideal sport for improving physical conditioning in general population and it may have positive and long-term health benefits. This makes tennis very popular among active and non-active individuals but also to recreational tennis players.

But, playing tennis either professional or recreational set players at risk of injury, as any other competitive sport. Actually it is stated that even though tennis players' muscle skeletal injuries are very common among other sports, however this sport has a unique injury profile presenting overuse syndromes in the upper limbs and acute injuries in the lower limbs (Pluim et al, 2006). It is concluded that injuries happened in the tennis court very often cause disability or absence from work (Breedveld K 2003, Van Bottenburg M 2005, Pluim BM 2004). This means that recreational tennis players might have a most significant interest to be examined related to the general population in terms of injury rate and profile in order to be protected from becoming injured again.

To our knowledge it remains a question if specifically recreational players are highly injured or not. Therefore, the aim of the present study was to examine the rate of musculoskeletal injuries on recreational tennis athletes by recording the injury type and its anatomical location in relation to the clinical diagnosis. Any conclusions concerning the injury profile of recreational' tennis players would add important information to the prevention of those injuries.

Methods**Abstract**

Purpose of the present study was to record the type and the anatomical position in relation to diagnosis of muscular skeletal injuries in recreational tennis players. Also, questions to record the mechanics of injury according to athlete's opinion were applied. 100 recreational tennis players (80 male) reported a total of 170 injuries. In their tennis participation period 12 players injured once (15%), 45 injured twice (56%) and 22 player (28 %) injured 3 times and 5 players more than 3 times (6%). According to their personal opinion the injury happens due to "Inadequate warm up" "Fatigue" and "High intensity matches". The repetitive arm and elbow joints movements causes overuse injuries in the upper extremity while the enrich running tennis patterns leading at an increased risk for acute injury for the lower extremities. Fortunately, the low total tennis injury rate places the tennis not only a pleasant but a safe sport for junior athletes.

Keywords: tennis injuries recreational tennis players

Sample selection

In the present study the term “recreational” referred to the males tennis athlete aged 18+ and they don't participate in regular matches as veterans according to Europe and to Canada classification (Tennis Canada seniors 2005). A retrospective research with tennis recreational athletes during a 12- month recording period was conducted. 10 tennis clubs in Greece, with almost 100 recreational male tennis players, were contacted and were asked to participate in the study. All of them accepted to participate at the study but only the 80 fulfill the mentioned criteria . Continually they gave their informed consent to participate. The inclusion criteria were: Male age range > 18 years old, at least 2 training session weekly (Kirialanis 2002, Malliou 2004). The exclusion criteria were Less than 3 years tennis training participation and registered muscular skeletal problem irrelevant to tennis participation. The participants (80 males) had age 51,2 ($\pm 8,1$), tennis years 6,8 ($\pm 4,8$) and total tennis h/ week 3,4 ($\pm 3,7$).

Data collection

Initially the participants filled out a questionnaire about personal data and training profile (left or right handed, dominant leg, years of tennis participation, tennis training hours per week, number of matches per year etc). Also additional information concerning previous muscular skeletal injuries including the accurate diagnosis (when it was possible), the type of injury (if it was traumatic or overuse), the mechanics of injury, the time and the mechanics of injury (training or game), the days of tennis training and matches absence etc were collected.

Injury definition

Injury was defined as “any mishap occurring during training or match on tennis court that made an athlete miss 1 or more days of practice sessions and was diagnosed as such, by a health care professional” (Kirialanis 2002, Malliou 2004). Therefore, injuries that cause musculoskeletal pain but not absence of the participating were not included in the present study. Injuries that cause absence of the tennis court and there wasn't diagnosis by the healthcare professional was registered also. Injuries were classified into three degrees of severity: mild (absence from tennis training for less than 1 week to 2 days), moderate (absence for 1 week to 1 month) and major (absence for more than 1 month). A number of studies adapted the same classification (Kirialanis 2003, Malliou 2004). The study was approved by the Ethical Committee of the Department of Physical Education and Sports Science at the Democritus University of Thrace, Greece.

Statistics: For the statistical analysis of the data, the method used was the analysis of frequencies, the non-parametric test X^2 (chi square distribution) and linear regressions analysis from the SPSS statistical package, in order to determine whether any of the previously mentioned factors were related. In all cases, the null hypothesis was rejected when $p < 0.05$.

Results

Injury patterns

100 recreational tennis players (80 male) reported a total of 170 injuries. The injury incidence (number of injuries /1000 h of playing tennis) was 0,62. In their tennis participation period 12 players injured once (15%), 45 injured twice (56%) and 22 player (28 %) injured 3 times and 5 players more than 3 times (6%).

80% of the injuries happen during a tennis game and 20% ($n=43$) during tennis practice. As a result 31% of the total injuries were minor, involving maximum one week of absence. Moderate (8-30 days) and severe (more than 30days) injuries were 35% and 34% of total injuries, respectively.

The lower extremity injuries were 32 %, the upper extremity injuries were 30% and the trunk accounted for 38% of the total injuries reported by the present study. According to the statistical analysis the injuries in relation to anatomical region did not revealed a specific anatomical area as the most common injured area ($X_{(2)}^2 = 2,48$; $p > .05$).

The Table 2 presents the clinical diagnosis of the reported injuries. Furthermore, the low back, the shoulder and elbow tendinopathy , the ankle sprain and knee acute injury are the most common injuries. Also, the chronic injuries were 67% , and the acute injuries were 33% of the total injuries and the analysis revealed a significant occurrence of chronic injuries ($X_{(1)}^2 = 67.65$; $p < .05$).

Table 1. Severity of injuries

Severity	Males injuries N=170, 100%
Mild (1-7 days)	90(53%)
Moderate (7-30 days)	50(30%)
Severe >30 days	30(17%)

According to their personal opinion the injury happens due to “Inadequate warm up” “Fatigue” and “High intensity” ($X_{(8)}^2 = 17.15; p < .05$). Also, the “Bad technique” and “Step on the ball” contribute to injury mechanics (Table 3). Also, the racquet selection was according to their personal choice (92%, n=102).

Table 2. Clinical diagnosis of the injury

	Males injuries N=165, (82,5%)
Ankle sprain	13 (8%)
Knee injury (lingament- meniscus- patella)	11 (7%)
Muscle injury (Back and lower extremities)	10 (6%)
Back pain*	66 (40%)
Shoulder tendinopathy*	29 (17,5%)
Tennis and golfers elbow	20 (12%)
Other	16 (10%)
Total	165 (%)
*($X_{(6)}^2 = 102; p < .05$)	

Table 3. Injury mechanics

Injury mechanics	
Step on the ball	7,5%
Bad technique	7,5%
Hitting a ball	4%
Twists	2%
Inadequate warm up*	26%
Fatigue*	25%
High intensity*	26%
Other	2%
*($X_{(8)}^2 = 65.15; p < .05$)	

Discussion

Although this type of study does not hold the benefits of a prospective study, the results are given further validity by the fact that the interview was undertaken for the purpose of the present study, so data were not collected from physician's old records (Dean 2004)

The results of the present interview-based retrospective study revealed important information about the incidence rate of muscle-skeletal injuries in recreational tennis players. First, most of the recreational players reported 2 or more injuries during their tennis participation and the majority of injuries recorded were chronic conditions (back pain, shoulder tendinopathy, tennis or golfer's elbow), while acute ones were not so frequent (knee and ankle injuries). This result seems rational according to the participants' characteristics, since their training experience in tennis was very significant varying from 7 to 13 years with more than 4 hours per week tennis playing.

The finding of more chronic injuries than acute ones could also explain why the majority of the injuries recorded in the present study were classified as moderate and severe. Similar results were found by Hjelm (2010) with a significant higher severe injury rate in comparison to more mild injuries in junior tennis players. The researchers supported that their results were reasonable and the registered high severity possibly explained by the long time rehabilitation period that the overuse syndromes needed to heal. Considering the fact that the definition of severity of injury in the present study was also related to the time of absence from tennis playing (as adopted also by other researchers (Kirialanis 2003, Kirialanis 2004, Malliou 2004) it would be suggested that age might be an important factor defining the rehabilitation time in chronic injuries.

Moreover, the different climate usually set recreational tennis players to follow always outdoor training sessions, in insufficient surfaces which are usually hard court and can cause overuse syndromes. The high rate of low back pain could also be explained by the alternate running on insufficient or hard court surface. It is true that the outdoor material courts' floors are distinguished from lack of quality and/or poor maintenance. Previous study reported a significantly lower injury rate in tennis players when playing on clay or synthetic sand when compared with others playing on hard court in relation to many tennis hours (Hjelm 2010, Nigg & Segesser, 1998).

Moreover, it is mentioned that players with back pain in the lumbar spine showed also a decreased internal rotation of the leading hip joint as well as deficits in extension of the lumbar spine (Hjelm 2010, Vad et al 2003). It would be suggested that an assessment of the range of motion of the hips and the lumbar spine could be a prevention tool for back pain especially in experienced players such as recreational tennis players.

Aside from the low back pain, the shoulder and elbow tendinopathy, the ankle sprain and knee acute injury were the most common injuries. The relevance of the present upper limb injury rate is in agreement with previous similar studies (Ben Kiblera, 2005, Pluim et al, 2006), since the majority of the upper extremity injuries were chronic injuries presenting the tennis elbow and shoulder's tendinopathy as the most common of them (Ben Kiblera, 2005, Pluim et al, 2006) In tennis, the repetitive arm and elbow joints movement's causes overuse injuries in the upper extremity while the developed forces in the lower limbs possible produce traumatic effect on contractile and non-contractile elements of the lower limb musculoskeletal system which place the athlete at increased risk for acute injury (Ben Kiblera, 2005).

Also previous studies examined the effect of the racquet description to the injury occurrence and they found that oversized head, heavier, stiffer, more tightly strung rackets, incorrect grip size and increased vibration have been associated with problems like "tennis elbow" (Pluim et al, 2006, Hjelm 2010, Kamien 1989). Those conclusions seem to justify the high relevance of shoulder and elbow chronic injuries since the recreational tennis players in the present study were playing with a racquet of their own preference and not of a specialist's suggestion.

Nevertheless, the total injury rate found in the present study remains small comparing that found in other sports. For instance, according to previous studies, the injury rate in tennis is relatively low in comparison to the soccer (Hagglund M 2006), the artistic gymnastics (Kirialanis 2003, Kirialanis 2004) and ice hockey (Hjelm 2010).

Looking at the anatomical location injured more frequently, the study showed no difference between upper's, lower limbs' and trunk's rates. Reece et al (1986) reported that the lower extremities are injured more often in relation to other body parts for both genders, but their participants in the study were junior tennis players and not recreational. Also Hjelm et al (2010) concluded that injuries to the lower extremity were the most common ones (51%) followed by the upper extremity (24%) and the trunk (24%). Both of these studies examined junior tennis players but in relation to the results of the present study for recreational tennis players it seems that acute injuries occur in the first place but they might be replaced by chronic conditions as long as tennis playing hours are getting more significant. Aside from the participants' age, also the participation criteria, the definition of injury and the different competitive tennis level of the participants, make difficult the comparison of results of previous studies with the present. In addition, cold and windy weather during winter months could eliminate participation hours in recreational recreational players whereas younger players are following a more competitive long-term training schedule.

Finally, injury rate in relation to sex seems to reveal an increased injury rate in male recreational tennis players than female. Although the present size sample is relatively small, these results are similar

to many relevant studies (Silva, 2003, Winge, 1989, Hjelm 2010) . According to their personal opinion the injury happened due to “Inadequate warm up” “Fatigue” and “High intensity” but also, the “Bad technique” and “Step on the ball” might contribute to injury mechanics. This result seems rationale, since recreational athletes usually don’t pay attention to adequate warm up or to gradually rise of intensity and is related also to the finding that most of the injuries reported in the present study occurred during tennis match (official and non official games) related to the tennis practice. Also it is well documented that factors such as ‘fatigue’ ‘high intensity’ and ‘inadequate warm up’ are related to injury risk in many sports (Du Toit 1999, Janis 1990, Malliou 2007)

In conclusion, recreational tennis players’ injury profile is characterized by relatively low rate, more chronic conditions (upper limbs and trunk) than acute trauma (lower limbs) and affects equally the whole body. Fortunately, the severity of injury is mild and moderate places the tennis not only a pleasant but a safe sport for recreational athletes.

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