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ORIGINAL

EPIDEMIOLOGY OF INJURIES IN PROFESSIONAL AND AMATEUR SPANISH PADDLE PLAYERS

EPIDEMIOLOGÍA LESIONAL EN JUGADORES ESPAÑOLES DE PADEL PROFESIONALES Y AMATEUR

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ABSTRACT

An epidemiological study was conducted using retrospective, observational and descriptive methodologies. We sought to analyse the incidence and features of injuries sustained by professional and non-professional padel players. The injuries suffered by 478 professional and non-professional Spanish padel players were registered between January 1st and December 31st, 2016. We collected data on the number of injuries, the most frequent injuries, their distribution, type, location (tissues and anatomic location), the moment at which these occurred and the cause of the injuries affecting the locomotor system. The injury rate in this population was 2.75 injuries per 1000 hours risk exposure.

Mild injuries and those with intrinsic injury mechanisms were most frequent, taking place towards the end of sports practice. The lower limb was the most frequently injured body area, and the most injured tissue was the musculo-tendinous system. In turn, epicondylitis was the most common pathology.

KEYWORDS: padel; epidemiology; injury; lower extremity; muscles

RESUMEN

Se realizó un estudio epidemiológico descriptivo, observacional y retrospectivo, analizando la incidencia y las características de las lesiones sufridas por jugadores de pádel españoles profesionales y no profesionales. Se registraron las lesiones sufridas por 478 jugadores entre el 1 de enero y el 31 de diciembre de 2016. Se registraron datos sobre el número de lesiones, lesiones más frecuentes, distribución, tipo, ubicación, el momento en que ocurrieron y la causa de las lesiones que afectan el sistema locomotor. La tasa de lesiones en esta población fue de 2,75 lesiones por 1000 horas de exposición al riesgo. Las lesiones leves y aquellas con mecanismos de lesión intrínseca fueron las más frecuentes, y tuvieron lugar el final de la práctica deportiva. La extremidad inferior fue el área corporal más lesionada, y el tejido más lesionado fue el sistema musculo-tendinoso. A su vez, la epicondilitis fue la patología más común.

PALABRAS CLAVE: pádel; epidemiología; lesión; extremidades inferiores; músculos

INTRODUCTION

Padel is a racquet sport, which combines elements of both wall sports and net sports. This sport is played in pairs on closed courts measuring 10x20 meters with a net that is set at a height of 0.88 meters. The International Padel Federation (FIP) is the institution in charge of regulating this sport and overseeing the compliance and modification of a scoring system based on 17 rules (Federación Intenacional de Pádel, 2016; Courel-Ibáñez et al., 2017). In contrast to other sports, such as football, for which the *International Federation of Association Football* (FIFA) has elaborated a consensual definition of injury (Fuller et al., 2006a; Fuller et al., 2006b), in the case of padel, there is no consensus for an injury definition. This situation hampers the performance of epidemiological studies, as well as the ability to compare data with other sports.

There are few studies available on the epidemiology of injuries associated with padel practice, although there is some data regarding the personal incidence rate, i.e. the number of injured players per 100 athletes, which ranges between 49.8% and 86.7% (Castillo-Lozano and Casuso-Holgado, 2015; Castillo-Lozano and Alvero-Cruz, 2016).

The lower limbs have been identified as the most frequent site for padel injuries. More specifically, the elbow joint complex is the most affected joint, with muscle-tendinous injuries being the most common (Castillo-Lozano and

Casuso-Holgado, 2015; Garcia Gonzalez et al., 2015; Castillo-Lozano and Alvero-Cruz, 2016).

There are few studies that analyse padel injuries and the fact that this sport is practiced by millions of players (Gil Solés, 2014), the aim of this study was to analyse the epidemiological features of the injuries sustained by professional and non-professional players within the Community of Madrid, Spain. Specifically, our objectives were to establish and describe the data regarding the number of injuries, the frequency of injuries, their distribution, type, location (tissues and anatomic location), the moment at which these occur, and the cause of injuries affecting the locomotor system.

MATERIAL AND METHODS

Study design

An epidemiological, observational, descriptive, retrospective cross-sectional study.

Methods

The initial sampling for this research consisted of cluster sampling in one stage, covering all the clubs belonging to the Madrid Padel Federation.

It was determined to include in the study all the federated padel players aged between 14 and 65 years old, at any player level, of both sexes, whether or not they had an injury in the last twelve months prior to the study, to determine the incidence and prevalence of injuries during the practice of padel.

Among a total of 130 clubs, the sample was formed by the five clubs with higher number of licenses which accepted to participate in the study. After informing all the 576 federated players belonging to the clubs selected about the accomplishments and objectives of the research, 514 (83.5%) players volunteered to participate. Out of these players, 478 (77.7%) met the inclusion requirements, resulting a significant sample, at 95% of confidence level and with a confidence interval of 1.96 sigmas, for the study population. 61% of the sample were amateur players, 26% were semi-professionals, 4.5% were professional players and 8.5% were coaches.

All participants signed informed consent prior to the data collection and the study was conducted according to the principles of the Helsinki declaration for research involving human subjects (WMA, 2013).

Procedure

We gathered all injuries occurring between January 1st and December 31st, 2016. The questionnaires used in this study were always conducted by the same researcher between February 1st and March 30th, 2017.

This study included all the injuries occurring during padel training or competitions. All training sessions and matches took place on artificial grass or carpeting.

An injury was considered as any incidence requiring health treatment of any type, or causing absence from training or match play (Ekstrand et al., 2004). Players who had suffered one or several previous injuries must have completely recovered in order to perform an accurate analysis of the consequences of the same. This study included new injuries occurring during the research period, but excluded relapses of previous injuries, chronic injuries, as well as any injuries unrelated to the practice of this sport.

Tools

The current study used a data collection form following the latest recommendations to conduct studies in Tennis (Pluim et al., 2009). This aforementioned form compiled personal data, anthropometric data, data about the sports practice of padel and specific data about suffered injuries. Injuries were classified according to their anatomic location into main areas and categories equivalent to the OSICS system (*Orchard Sports Injury Classification System*), (Schoffl et al., 2011). For the classification of injuries according to their type, the aforementioned OSICS system was also used (version 10) which includes a total of 1.626 possible diagnoses (Rae and Orchard, 2007).

Statistical analysis

The SPSS statistical package version 21.0 for Windows was employed for the performance of statistical analyses, considering $p < 0.05$.

Pearson correlation coefficients were calculated and interpreted based on the quantitative variables, in order to analyse correlations, as well as the Spearman correlation coefficients when categorical variables were used. Chi-square contrast tests were used to analyse the association between qualitative variables regarding injuries and athletes.

The Kolmogorov-Smirnov test was used to analyse whether the quantitative variables were normally distributed, in order to compare the means via the Student's t-test in the case of two means or the ANOVA in the case of three or more means. When normality of the data was not found, the non-parametric Wilcoxon test was used for comparing two means and the Kruskal-Wallis test was used to compare two or more means (Pérez, 2009).

RESULTS

Study population

In total, 478 federated padel players participated in this study, belonging to different clubs of the Community of Madrid, Spain. Of these, 332 (69.5%) were men and 146 (30.5%) were women.

Injury rate

In total, 515 injuries were registered. The injury rate or number of injuries per 1000 hours exposure to the risk was 2.75 injuries per 1000 hours sports practice, and 8.44 injuries per 1000 matches, thus the personal injury rate or number of sports players injured per 100 sports athletes was 65.6%. The injury rate or number of injuries per 100 players was 108 injuries. The number of injuries significantly increased with age ($p=0.045$) and with the increase in the BMI ($p=0.009$).

Body region affected

The injuries affecting the lower limb were the most frequent, with 211 registered injuries (41%), followed by those to the upper limb with 183 injuries registered (35.5%) (Figure 1).

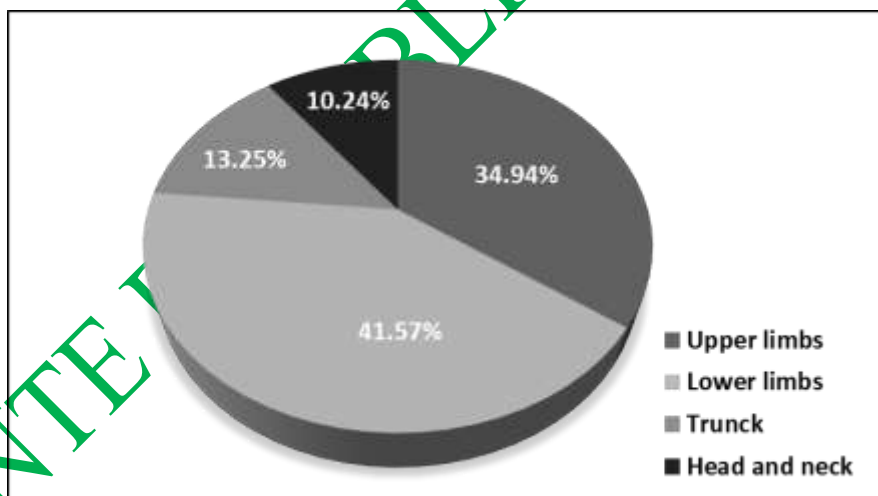


Figure 1. Anatomic location of injuries

Regarding the exact location, the most affected area was the elbow, with 105 injuries registered (20.48%), followed by the foot and the knee, with 59 (11.45%) and 56 (10.84%) injuries, respectively (Table 1).

Table 1. Body region affected

Anatomic location of Injuries	Frequency	Percentage
Elbow	105	20.48%
Pie	59	11.45%
Knee	56	10.84%
Lumbar spine	47	9.04%
Shoulder	44	8.43%
Leg/sural region	44	8.43%
Neck / Cervical spine	44	8.43%
Ankle	40	7.83%
Wrist	25	4.82%
Dorsal spine	12	2.42%
Femoral region / thigh	9	1.81%
Pelvis / Sacrum /Buttocks	9	1.81%
Head /Face	9	1.81%
Arm	6	1.20%
Forearm	3	0.60%
Toes	3	0.60%
Total	515	100.00%

Most frequently injured tissue and injury.

Tendinous injuries were most frequent, 40.4%, followed by muscle injuries, which represented 30.7%. In third place, ligament injuries totalled 17.5% of the total injuries (Table 2).

Table 2. Tissue involved

Tissue involved	Frequency	Percentage
Joint and ligaments	90	17.5%
Muscular	159	30.7%
Tendinous	208	40.4%
Osseous	6	1.2%
Skin	0	0.0%
Others	52	10.2%
Total	515	100%

Regarding the precise diagnosis, epicondylitis was the most frequent injury: representing 20.5% of the total, followed by plantar fasciitis and neck contractures which, in both cases, represented 8.4% and sprains affecting the external lateral ligament complex of the ankle representing 7.8% (Figure 2). We noted a statistically significant dependence between the level of play and the type of injury ($p=0.032$), thus, amateur players suffered tendinopathies and plantar fasciitis most often, whereas professionals had a tendency for muscle overload.

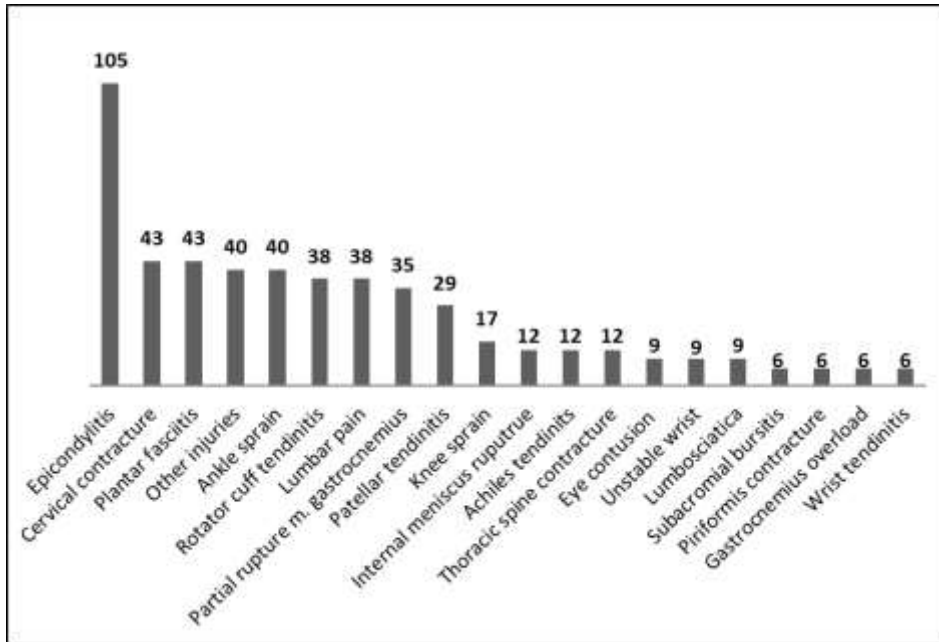


Figure 2. Number of injuries per type

Cause of injury and severity

The most frequent cause of injury were non-contact injuries, representing 68% of the total, observing a considerable association between this mechanism of injury and injuries affecting the shoulder and elbow ($p=0.000$). Those of extrinsic character were a 32.0% rate, standing out among these are the bad conditions of the facilities, 11.0% or the damage and/or bad conditions of the sports material with a rate of 6.4%.

The severity of these injuries, following the proposal of consensus for epidemiological studies in Tennis by Pluim et al. (2009), was classified based on the days of absence that caused. Injuries of minimal nature (1-3 days), minor (4-7 days), moderate (8-28 days), serious (> 28 days to 6 months). Minor injuries were the most frequent with a 30.1% rate, presenting a statistically significant association with musculo-tendinous injuries that affected upper limbs ($p=0.041$). Moderate injuries supposed a 28.3% rate and in this case they presented statistical significance with ligamentous injuries and those that settle in the lower limbs ($p=0.047$). Relapses rate was 25.0%, setting an association statistically significant with the injuries that affected the elbow ($p=0.018$). In padel, 40% of injuries do not require health assistance nor do they require days off. Regarding those that did require leave, 50% required a minimum of 10 physiotherapy sessions. A statistically significant association was found between the number of sessions, the nature of the injury and the consequences of the same, revealing that more severe injuries receive more physiotherapy care and have fewer sequels.

Up to 57.2% of injuries occurring during padel practice did not produce any sequelae. Regarding the injuries that did have after-effects and, specifically, in the case of players who complained of pain, there was a significant relation

between sequalae and tendinous injuries affecting the elbow and shoulder ($p=0.000$).

Equipment and sports habits

Concerning the equipment used by the players, the most commonly used racquet was the teardrop type, used by 35% of players. Up to 35.7% of respondents used racquets weighing less than 370 grams. Also, in 55% of cases, racquets had a soft surface. Players most often used a fine grip and an overgrip.

Regarding the shoes used by players, 97.4% used specific low-top padel shoes, and most (70%) had spikes on the outsole 70%. Furthermore, the padel players did not use a single playing surface, with 64% alternating different types of playing surfaces.

In total, 61% of padel players played for leisure, with most of their practice time occupied by training in class, to which they dedicated a mean 8.15 hours per week. Players competed in 2.9 matches per week, on average.

DISCUSSION

The findings of our study revealed an injury rate of 2.75 injuries per 1000 hours of padel sports practice with 8.44 injuries per 1000 matches. Comparing these results with descriptive epidemiological studies from other related sports, with a comparable design and injury definition to that of the present study, we find similar injury rates: 2.3 (Winge et al., 1989) and 3.0 (Jayanthi et al., 2005). The personal injury rate or number of injured athletes per 100 players (given that 313 players were injured out of 478 total players), was 65.6%. The injury rate or number of injuries per 100 athletes, was 108 injuries. Previous studies on padel injuries have reported a personal injury rate of between 49.9% and 86.70%, therefore, our study is in the mid-range of these figures (Castillo-Lozano and Casuso-Holgado, 2015; Garcia Gonzalez et al., 2015; Castillo-Lozano and Alvero-Cruz, 2016).

Regarding the anatomic location of the injuries, the lower limb was the most affected in our study at a rate of 41,0%, followed by the upper limb (35.5%) and the trunk (13.0%). We found similar results regarding the general anatomic location in the study by Garcia Gonzalez et al., (2015) and in that by Castillo-Lozano and Alvero-Cruz (2016). In tennis, several studies have reported a high rate of injuries to the lower limbs (Steinbruk, 1999; Kuhne et al., 2004; Jayanthi et al., 2005), which is also the case in badminton and squash (Caine et al., 1996; Fortington et al., 2015). We believe this may be due to the characteristics of these types of games, in which abrupt changes in direction, and high intensity accelerations and decelerations take place, as well as jumps with unstable landings. All these actions place great demands on players' joints and muscles, leading to high levels of injuries affecting the lower limbs.

The elbow was injured in 20.5% of all injuries, followed by the foot (11.4%), the knee (10.8%), as well as the lumbar region in 9%. Other padel studies describe identical results, identifying the elbow as the main area of injury (Castillo-Lozano and Casuso-Holgado, 2017; Castillo-Lozano and Casuso-Holgado, 2015; Castillo-Lozano and Alvero-Cruz, 2016). The high percentage of injuries located at the elbow may be due to the high demands placed on the elbow joint complex and the continuous eccentric contractions that occur after hitting the ball necessary to slow down and break the movement. This has been described as a common cause of tendinous injuries as the padel racquet does not have appropriate stringing in order to regulate tension during strokes.

Muscle-tendinous injuries were the most frequent, followed by joint and ligament injuries. The same results were reported by the epidemiological study on padel published by Garcia Gonzalez et al., (2015). Regarding the type of injuries, tendinopathies predominated with 208 injuries (40.4%), fundamentally in the form of epicondylitis (20.5%) and tendinitis affecting the rotator cuff (7.8%). This supports findings reported by other padel studies Garcia Gonzalez et al., (2015) and involving other racquet sports (Caine et al., 1996; Jayanthi et al., 2005). These results may be due to a poor technique during the backhand stroke, the absence of preventative measures or an unsuitable racquet selection. Therefore, we do believe that dedicating time to technical work in the execution of the sport gesture, especially in the initial stages and the first levels of training, along with sessions for general muscle strengthening where emphasis is given on the specific and controlled eccentric contraction of the musculature more involved in the hitting, would contribute conclusively reducing these kind of injuries. Without forgetting that the election of the racket is made in many occasions under aesthetic or media criteria and not according to the player morphology or needs, becoming a frequent reason of injury.

Intrinsic injury types were most frequent, as reported also in the study by Garcia Gonzalez et al., (2015). We found that non-contact injuries most frequently affected the upper limbs while the extrinsic ones tended to affect the lower limbs, something which also happened with the type of injuries. For example, the injuries that affected the meniscus and ligaments had an extrinsic origin, and those that affected the muscles and tendon had an intrinsic nature.

The 25% of injuries in our study were recurrent. These findings are similar to other padel studies, as the one by Navarro et al., (2013) in which 23.5% of injuries were relapses of an injury that occurred before the study period while, during the study period, 24.5% of injuries relapsed.

In 42% of cases, injuries took place during the final stage of the sports activity. This finding is supported by an epidemiological study involving 400 padel players which reported similar data, and which defined this phase as the most damaging Garcia Gonzalez et al., (2015). In addition, we revealed a strong association between injuries affecting the upper limbs and the final stage of matches, it is very likely owed to over sollicitation and lack of physical training and/or technique whereas the lower limb injuries took place mostly at the beginning of matches, we believe that it is owed to and inappropriate warm-up exercise for the lower train.

Regarding the sports habits of the study participants, alternating the covered court with outside play was most frequent and players who alternated the backhand and the forehand were most common in our study. Comparing our data with other reports, we observed different combinations of court type and position, therefore it is not possible to infer a clear tendency regarding these variables (Castillo-Lozano and Caruso-Holgado, 2015; Garcia Gonzalez et al., 2015; Castillo-Lozano and Alvero-Cruz, 2016).

Up to 62% of our players had over six years' experience practicing padel, this rate is similar to other research study carried out with 130 Spanish padel players (Castillo-Lozano and Caruso-Holgado, 2017), dedicating a mean of 8.15 hours per week to padel practice and playing 2.9 games per week. None of these factors have demonstrated to be relevant in terms of a significant increase in the number of injuries nor in the type or location of the same. We were unable to find padel studies reporting or relating these variables. In the case of tennis, increased practice time was associated with an increased incidence of new cases of epicondylitis in leisure tennis players playing more than two hours a day, compared to those who played less than two hours a day (Gruchow and Pelletier, 1979). However, a study by Jayanthi et al. (2005), analysing the incidence of injuries sustained by leisure tennis players reported no difference among sports players who played for less than four hours a week, from four to six hours or more than six hours per week. Consequently, the possible relation between greater playing times and an increase in the injury rate of racquet sports is not clear.

Regarding the equipment used by players, the most common racquet used was the teardrop type, weighing less than 370 grams, and in 55% of cases, with a soft surface. We observed a tendency for the association between injuries affecting the upper limb and round racquets, weighing between 371 and 380 grams. The use of a fine grip and an overgrip is most common, although this is not a factor that seemed significant when suffering injuries, their location or the typology of the same. We failed to find other padel studies that analysed the width of the grip and their relation between injury locations and types. Nirschl (1992), speculated that if the grip were too small, a harder or firmer grip would be necessary, increasing muscle activity, and vice versa, less strength would be necessary with a bigger grip. According to this author, an appropriate grip size may decrease the effort required to hold the racquet, increasing the efficiency of the forearm and hand muscles and decreasing the possibility of overuse injuries in the upper limbs. Several retrospective studies with recreational tennis players have shown an association between the incidence of epicondylitis and the use of an inappropriate grip width, either too small or too big (Gruchow and Pelletier, 1979; Hang and Peng, 1984). In another recent study that evaluated the force employed by the wrist extensor muscles in intermediate and advanced tennis players, using three different grip widths, the grip size was found to reduce the mechanical risk factors that produce overload injuries in the upper limbs (Rossi et al., 2014). However, in a controlled laboratory study with 16 asymptomatic tennis players, statistically significant differences were not found in the electromyographic activity of the epicondyle muscles among players who used a grip that was smaller, greater or the same as that recommended by Nirschl (1992) in the backhand stroke (Hatch et al.,

2006). Even so, we believe that the grip width may be a mechanical risk factor for the appearance of overuse injuries in the upper limb.

Up to 97.4% of players used specific low-top padel shoes, and most had spikes on the outsole (70%). The use of omni type outsoles appears to be a factor that significantly predisposes players to suffer injuries in the lower limbs, which is not the case of injuries registered with other types of outsoles. Regarding the precise anatomic location and type of these injuries, we have not found significant correlations. We were unable to find padel studies that had analysed the relation between shoes and the location and type of injury.

The injuries in padel are little influenced by the level of the game, we have only found differences statistically significantly between amateur and professional player in terms of the general locations of the injuries, being the head and the neck injuries the most frequent in the group of professional players and about the typology, muscular injuries, in particular muscle contraction, are the most frequent in the group of professional players. Possibly, this is due to the small number of professional player in contrast to the higher number of federated players in the amateur level group

Limitations

In the present study registering the data by a questionnaire about the injuries of the previous year, can cause a bias given that in some occasion relevant information might be lost and sometimes that information may be influenced by subjective aspects as the pain perceived.

CONCLUSIONS

Minor injury with intrinsic mechanism is the most frequent in padel, presenting a lesion incidence rate similar to that of other racquet sports.

The muscle-tendinous tissue is the one that suffers the greatest number of injuries, being epicondylitis the most common pathology. The lower limb is the one affected more frequently and the specific location most commonly injured in the elbow.

Padel players play an average of 2.9 games per week, playing in different types of surface and using more frequently the teardrop shaped racquet and soft surface

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