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Overuse Injuries and Epicondylalgia in Recreational Pickleball Players

Lesiones por sobreuso y epicondilalgia en jugadores de nivel recreativo de pickleball

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Abstract

Little is known regarding pickleball-related overuse injuries. The purpose of this study was to determine the prevalence of overuse injuries in recreational pickleball players. Given the high frequency of elbow overuse injuries in other racket sports, this study also sought to determine the relationship between epicondylalgia in pickleball players, player characteristics, and various playing variables. A web-based survey was distributed to a convenience sample of recreational pickleball players. Of the 128 participants (70 females, 58 males) who completed the survey, 28% reported at least one overuse injury. Most did not seek medical interventions and reported no time lost from play. Overuse injuries were significantly associated with higher playing volume, lower level of play, and playing in pickleball tournaments. Epicondylalgia was the most common overuse pickleball-related injury amongst recreational pickleball players. Females and those who participated in pickleball tournaments were more likely to report a history of lateral epicondylalgia. Medial epicondylalgia was not significantly associated with any variable. Overuse injuries amongst pickleball players are common, yet most did not seek medical attention. Epicondylalgia was the most common overuse injury. Epicondylalgia was not a time loss overuse injury, yet the effect on pickleball player's playing abilities unknown. Education on common overuse injuries, the impact of playing volume, and the importance of proper technique may maximize symptom-free pickleball participation.

Keywords: *Pickleball, racket sports, overuse injury, chronic injury, epicondylalgia.*

Resumen

Poco se sabe acerca de las lesiones por sobreuso relacionadas con el pickleball. El propósito de este estudio fue determinar la prevalencia de las lesiones por sobreuso en jugadores de pickleball de nivel recreativo. Dada la alta frecuencia de lesiones por sobreuso del codo en otros deportes de raqueta, este estudio también trató de determinar la relación entre la epicondilalgia en los jugadores de pickleball, las características del jugador y diversas variables de juego. Se distribuyó una encuesta en línea a una muestra de conveniencia de jugadores de nivel recreativo de pickleball. De los 128 participantes (70 mujeres, 58 hombres) que completaron la encuesta, el 28 % reportó al menos una lesión por sobreuso. La mayoría no buscó atención médica y no informó de ninguna pérdida de tiempo de juego. Las lesiones por sobreuso fueron asociadas significativamente con un mayor volumen de juego, un menor nivel de juego y la participación en torneos de pickleball. La epicondilalgia fue la lesión por sobreuso más común entre los jugadores de nivel recreativo de pickleball. Las mujeres y los participantes en torneos de pickleball eran más propensos a declarar antecedentes de epicondilalgia lateral. La epicondilalgia

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medial no se asoció significativamente con ninguna variable. Las lesiones por sobreuso entre los jugadores de pickleball son comunes, aunque la mayoría no buscó atención médica. Aunque la epicondilalgia no fue una lesión por sobreuso con pérdida de tiempo, se desconoce el efecto sobre las habilidades de juego de los jugadores de pickleball. La educación en lesiones comunes por sobreuso, el impacto del volumen de juego y la importancia de una buena técnica pueden maximizar la participación en pickleball sin síntomas.

Palabras clave: *Pickleball, deportes de raqueta, lesión por sobreuso, lesión crónica, epicondilalgia.*

INTRODUCTION

Pickleball is one of the fastest-growing sports in the United States among all age groups. Since its invention in 1965, participation in pickleball has risen exponentially with national associations developing in more than 20 countries. Many individuals play pickleball as a means of attaining or maintaining physical fitness. (Buzzelli & Draper, 2020; Casper & Jeon, 2018) Participation in pickleball also has psychological and social benefits, particularly for older adults. (Casper & Jeon, 2018; Cerezuela et al., 2023) Despite its popularity, little is known about pickleball-related injuries.

An acute injury happens suddenly, often quite dramatically. Acute injury leads to cessation of activity at the time of injury and often requires medical care. One study investigated acute pickleball-related injuries where care was sought in US emergency departments and recorded in the National Electronic Injury Surveillance System (NEISS) data set. The most common acute pickleball-related injuries reported were fractures, sprains or strains. (Forrester, 2020) In contrast, an overuse injury involves damage to bones, muscles, ligaments, or tendons due to repetitive demand over a prolonged period of time. (Aicale et al., 2018) Excessive loading, insufficient recovery, and under-preparedness of tissues to tolerate spikes in loading may increase the risk of an overuse injury. (Gabbett et al., 2016) While overuse injuries may cause pain during or after sports participation, most individuals are able to continue to play, (Jørgensen & Winge, 1987) but may play at a lower level or reduce their playing volume to control symptoms. If severe, some overuse injuries may require prolonged time away from sport to allow time for tissue recovery. (Carroll, 1981) Unfortunately, information regarding pickleball-related overuse injuries is lacking.

The most common overuse injuries reported in tennis (Hassebrock et al., 2019) and paddle sports (Tagliafico et al., 2023) involve the elbow complex. Elbow overuse injuries also account for 11-13% of badminton injuries (Fahlström & Zeisig, 2022; Rangasamy et al., 2022) and 5.9% of table tennis injuries. (Rangasamy et al., 2022) Lateral epicondylalgia is the most frequent overuse injury of the elbow complex. Commonly referred to as “tennis elbow” due to the high incidence among recreational tennis players, lateral epicondylalgia is a progressive overload of the wrist extensor muscles, especially the extensor carpi radialis brevis just distal to its attachment on the lateral epicondyle. (Ma & Wang, 2020; Ranger et al., 2015; Stegink-Jansen et al., 2021) It is estimated that 30-50% of tennis players experience lateral epicondylalgia, (Ahmed et al., 2023; Gruchow & Pelletier, 1979; Hume et al., 2006) with persons playing recreational racket sports infrequently but for long durations (i.e. weekend warriors) being at particularly high risk. (Hartnett et al., 2022) Medial epicondylalgia, commonly referred to as “golfer’s elbow,” is the second most common overuse elbow injury in tennis. While significantly less common than lateral epicondylalgia, (Alrabaa et al., 2020; Cutts et al., 2020) medial epicondylalgia involves the flexor-pronator muscle group near the attachment to the medial epicondyle. (Amin et al., 2015; Hartnett et al., 2022) In both golfers and racket sports players, medial epicondylalgia appears to be related to improper technique (Patel et al., 2021; Vigouroux et al., 2017) and over-gripping. (Jayanthi & Esser, 2013) In tennis players, medial epicondylalgia is associated with the use of spin (Jayanthi & Esser, 2013).

Understanding overuse injuries in persons playing pickleball may lead to specific strategies for injury prevention and treatment. The purpose of this study was to determine the prevalence of overuse injury in recreational pickleball players and to examine player characteristics, playing variables, and injury care. Given the high frequency of overuse elbow injuries in other racket sports, this study also sought more specifically to determine the relationship between epicondylalgia in recreational pickleball players, player characteristics, and various playing variables.

MATERIALS AND METHODS

Participants

Convenience sample of 128 participants (70 females, 58 males) recreational pickleball players at indoor and outdoor pickleball facilities. Participant ages ranged from 18-85 years, with the median age range 50-54 years (Table 1).

Design & Procedures

A confidential web-based survey was developed using the Qualtrics survey platform (Provo, UT). The survey included sections on demographics, pickleball-related overuse injuries, and pickleball playing

variables such as level of play and playing volume. A draft of the survey was trialed by 10 individuals familiar with the sport of pickleball and revised for content, clarity, and brevity. The final survey link was distributed to a convenience sample of recreational pickleball players at indoor and outdoor pickleball facilities. The survey could be completed via computer, tablet, or mobile phone. The survey remained open for three months. Inclusion criteria were voluntary participation, age at least 18 years, signed informed consent, and current participation in the sport of pickleball. Participants were informed of the purpose of the study and were not required to answer every question. The study was approved by the Institutional Review Board of the University of Tennessee at Chattanooga.

Table 1
Participant age range

Age	Female	Male
18-24	11	9
25-29	9	10
30-34	2	6
40-44	1	6
45-49	6	1
50-54	10	2
55-59	8	4
60-64	11	3
65-69	8	5
70-74	2	2
75-79	1	7
80-84	1	1
85-89	0	2

Analysis

Deidentified survey results were imported into SPSS version 29.0 and scanned for duplicate responses. Unanswered questions were coded as missing and not included in data analysis. For overuse injuries, frequency data was reported. A Chi-squared analysis with an a = 0.05 was used to determine associations between both overuse injuries and elbow overuse injuries and the following variables: sex, age, court type, warm-up, volume of play, level of play, years of participation, and tournament play. Effect sizes for significant associations were calculated using phi. For this study, the interpretation of phi with one degree of freedom was as follows: 0 = no relationship; .10 = negligible effect; .20 small effect, .30 medium effect; and .50 large effect. (Kim, 2017) A power analysis using G*Power for a chi-square with 1 degree of freedom and 128 participants to be 94.5%.

RESULTS

128 participants, with ages ranging from 18 to 85 years, completed the survey. Of these, 36 participants (28.1%) reported sustaining at least one overuse injury, with some reporting an overuse injury in more than one body region (Figure 1). Most participants did not seek formal medical interventions for their overuse injuries (Figure 2) and reported no playing time loss due to their pickleball-related overuse injuries (Figure 3).

Overuse Injuries

Overuse injuries were significantly associated with volume of play, level of play, and tournament play (Table 2). Participants who played pickleball more than 6 hours per week reported significantly more overuse injuries than those who played for lower volumes, c^2 (df, N= 1) = 5.265, p = .022, with a small effect (phi = .221). Reported pickleball-related overuse injuries were significantly greater among lower-level players than more advanced players, c2 (df, N= 1) = 1.089, p <.001, with a medium effect (phi = .320). Participants who played in pickleball tournaments reported significantly more overuse injuries than those who did not play in tournaments, c2 (df, N= 1) = 9.041, p = .003, with a small to medium effect (phi = .289). Reporting an overuse injury was not significantly associated with sex and age (less than 55 years of age versus at least 55 years of age). The cut point for age was chosen both because this corresponded to the median participant age group level and many individuals begin to retire or reduce their work hours near 55 years of age, thereby allowing them more time to explore recreational activities such as pickleball more consistently. Reporting an overuse injury was also not significantly associated with court type (indoor versus outdoor), warm-up performance (warm-up versus no warm-up), or years of participation in pickleball (playing for two years or less versus playing more than two years).

Epicondylalgia

The elbow was the most common site for pickleball-related overuse injuries, accounting for 25% of all overuse injuries. Lateral epicondylalgia accounted for 63% of all elbow overuse injuries (and 16% of all overuse injuries), while medial epicondylalgia accounted for 38% of all elbow overuse injuries (and 9% of all overuse injuries). Lateral epicondylalgia was significantly associated with sex and tournament play but not to any other variable (Table 3). Females were more likely to have lateral epicondylalgia than males, χ^2 (df, N= 1) = 5.713, p = .017, with a medium to large effect (phi = .398). Participants who played in pickleball tournaments were more likely to have lateral epicondylalgia than those who did not play

in tournaments, χ^2 (df, N= 1) = 4.092, p = .043, with a medium to large effect (phi = .337). In contrast, medial epicondylalgia was not significantly associated with any variable (Table 4).

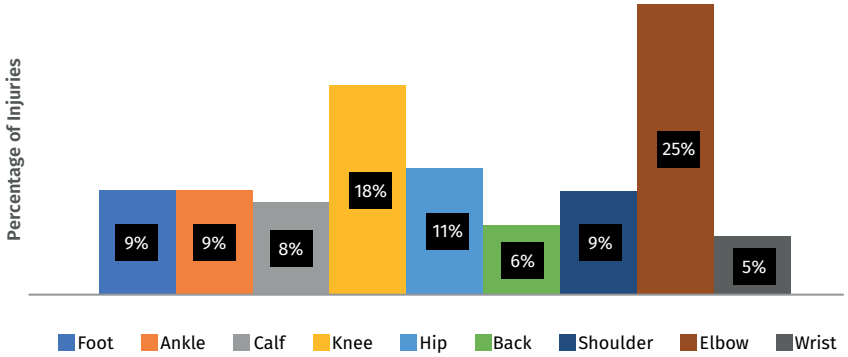

Figure 1. Body regions affected by overuse injuries in pickleball players

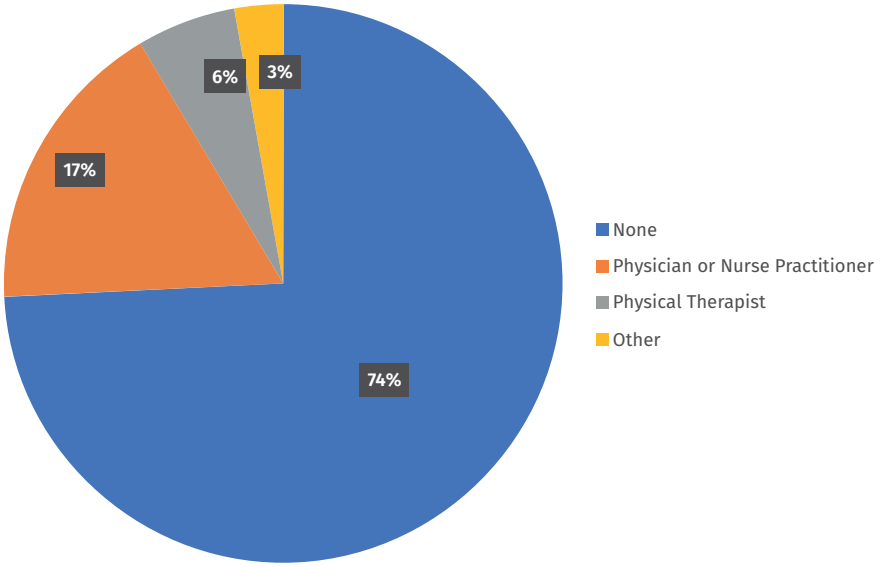

Figure 2. Medical professionals seen for pickleball overuse injuries

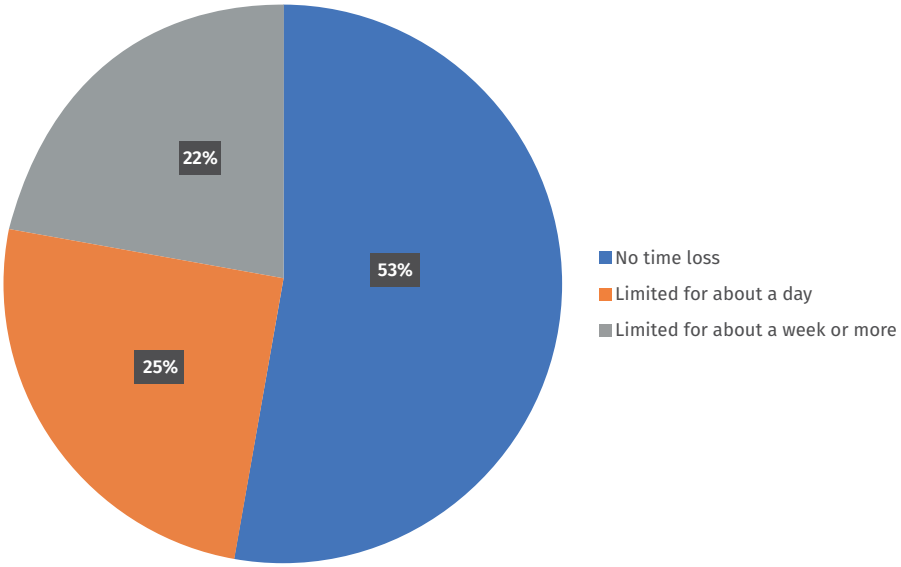

Figure 3. Playing time loss due to overuse injuries

Table 2
Relationship between pickleball and overuse injuries

	Pearson Chi-Square (Degrees of freedom = 1)	*p*
Sex	.023	.880
Age	1.812	.178
Court type	.040	.842
Warm-up	.555	.456
Volume of play	**5.265**	**.022**
Level of play	**11.089**	**<.001**
Years of participation	1.686	.194
Tournament play	**9.041**	**.003**

Table 3
Relationship between pickleball and lateral epicondylalgia

	Pearson Chi-Square (Degrees of freedom = 1)	p
Sex	**5.713**	**.017**
Age	.000	1.000
Court type	1.517	.218
Warm-up	2.757	.097
Volume of play	1.731	.188
Level of play	.224	.636
Years of participation	1.662	.197
Tournament play	**4.092**	**.043**

Table 4
Relationship between pickleball and medial epicondylalgia

	Pearson Chi-Square (Degrees of freedom = 1)	p
Sex	.206	.650
Age	.000	1.000
Court type	.400	.868
Warm-up	1.283	.257
Volume of play	.900	.343
Level of play	.024	.877
Years of participation	.267	.606
Tournament play	.024	.877

DISCUSSION

Racket sports are associated with improved aerobic fitness, optimal body mass index, good bone health, healthy lipid profile, and decreased risk of cardiovascular morbidity and mortality. (Pluim et al., 2007) However, overuse injuries are common in racket sports. In this study, over 25% of recreational pickleball players reported an overuse injury, which is similar to overuse injuries reported among tennis players. (Fu et al., 2018) Overuse shoulder injuries are frequently reported in tennis players (Abrams et al., 2012) and in badminton. (Marchena-Rodriguez et al., 2020) In this study, only 9% of overuse injuries in pickleball players involved the shoulder region. Shoulder overuse injuries in pickleball players may be less frequent because the underhanded serve in pickleball is less stressful to the shoulder complex than the overhead serve in tennis.

Epicondylalgia was the most common overuse injury in pickleball players. In this study, epicondylalgia accounted for 25% of overuse injuries in pickleball players, which is similar to the 30% reported in paddle players. (Castillo-Lozano, 2017) This study's findings that 16% of overuse injuries were due to lateral epicondylalgia are also consistent with the rate of lateral epicondylalgia found in badminton players. (Fahlström & Zeisig, 2022; Rangasamy et al., 2022) In contrast, up to half of tennis players may have epicondylalgia. (Ahmed et al., 2023) The lower rate of epicondylalgia in pickleball players is not surprising because the lighter and shorter pickleball paddle and less heavy ball should result in reduced elbow torque during play.

About a quarter of pickleball players reduced their playing volume for a week or longer due to an overuse injury. While the majority of pickleball players were able to "play through" their injuries and did not seek assistance from a medical professional, it is unclear if these injuries affected how they played, such as how hard they tried to hit the ball, their choice of shots, or their ability to return a hard shot. Given the success rates of physical therapy (Day et al., 2021; Landesa-Piñeiro & Leirós-Rodríguez, 2022; Shahabi et al., 2020) including exercise, (Chen & Baker, 2021; Ortega-Castillo & Medina-Porqueres, 2016) manual therapy, (Girgis & Duarte, 2020) and dry needling on lateral epicondylalgia, (Lucado et al., 2022) it might be wise for pickleball associations to educate their constituency about common overuse pickleball-related injuries and encourage assessment by a medical professional to minimize time loss from play and maximize performance during play.

In this study, sex was strongly associated with lateral epicondylalgia, with females significantly more likely to report lateral epicondylalgia. In contrast, studies on tennis players (Abrams et al., 2012; Fahlström & Zeisig, 2022) found similar injury rates for males and females, while in badminton, males were more likely to have lateral epicondylalgia than females. (Rangasamy et al., 2022) Given these inconsistencies across sports, larger studies are warranted to determine the relationship between sex and epicondylalgia. The prevalence of lateral epicondylalgia in tennis players appears to increase with age, (Kamien, 1988; Pluim et al., 2006) while this study found no such association. It is possible that the lower elbow torque generated during pickleball is dissipated more readily among players of all ages.

Years of participation in pickleball was not related to overuse injuries nor epicondylalgia. Newer players may have had prior experience playing tennis and decided to try this new fad sport due to the relatively lower physical demands of pickleball, including a smaller

court, propensity for doubles play, lighter equipment, and no overhead serve. For newer players such as these, their familiarity with common strokes and changes of direction may have been protective of overuse injuries related to pickleball. A study of lateral epicondylalgia among tennis players found no association between years of play and symptom onset and a lower rate of symptom recurrence among those who had played the longest. (Gruchow & Pelletier, 1979) Proper stroke mechanics among tennis players have been associated with a lower occurrence of lateral epicondylalgia. (De Smedt et al., 2007) It is possible that newer pickleball players participated in other activities such as weight training, jogging, walking, or swimming and, thus, were as prepared for the physical demands of pickleball as those who have been playing longer.

This study found no association between level of play and epicondylalgia. In tennis, amateur/recreational players were more likely to have lateral epicondylalgia (Gabriel et al., 2021; Patel et al., 2021) while professional players were more likely to have medial epicondylalgia. (Chung & Lark, 2017) The lack of professional pickleball players in this study may explain this finding. Since many recreational players do not know their skill level (2.0-5.0), this study compared lower-level players (those who can hit the ball in play for several hits) with more advanced players (those who consistently hit the ball in, hit third shot drops, and play with strategy). This method of describing pickleball player abilities may have insufficiently distinguished between levels of play. However, it is also possible the mechanics of pickleball, e.g. no overhead serve (Dines et al., 2015) and lower torque, makes epicondylalgia less common among pickleball players than tennis players.

Tournament play was related to both overuse injuries and lateral epicondylalgia. One assumption might be that those participating in pickleball tournaments simply play more pickleball, increasing their risk of injury. Similar to tennis players, (Jayanthi & Esser, 2013; Lucado et al., 2020) a higher volume of play was related to a higher rate of pickleball-related overuse injuries. Interestingly, as with tennis, (Lucado et al., 2020) playing volume did not appear to be related to lateral epicondylalgia in pickleball players. Most pickleball tournaments require players to compete in multiple games in one day. Therefore, tournament play, especially if performed infrequently, may increase the risk of these overuse injuries due to the sudden increase in playing volume over a short period of time. Since poor technique is related to epicondylalgia in tennis players, (Ahmed et al., 2023) epicondylalgia in pickleball players may result from the combination of high playing volume with poor technique.

Performance of a warm-up prior to play was not protective of either an overuse injury or epicondylalgia. While these findings are consistent with a recent systematic review, (McCrary et al., 2015) they are in contrast with commonly recommended injury prevention strategies as well as a survey of recreational badminton players in which a lack of warm-up was associated with increased injury risk. (Rangasamy et al., 2022) Court type was also not related to overuse injuries in pickleball. Outdoor pickleball courts are made from concrete or asphalt making them hard and with little shock absorption. Pickleball-specific indoor courts are made of a concrete or asphalt base with a layer of acrylic on top for cushioning, but many indoor pickleball courts are created in spaces designed for other sports. For examples, indoor pickleball may be played on converted basketball courts made of wood or indoor courts may simply be painted on existing concrete surfaces. In tennis, it is believed that the increased pace of play, higher coefficient of friction, and lack of shock absorption found in hard courts result in higher injury rates for professional players. (Fu et al., 2018) However, similar to this study's findings, playing surface was not related to injury in recreational tennis players. (Fu et al., 2018)

This study found no association between medial epicondylalgia and any variable. In tennis, medial epicondylalgia appears to be related to valgus stress at the elbow. (Hartnett et al., 2022) Valgus stress in tennis is greatest during the overhead serve, (Bahamonde, 2005) when hitting an open-stance forehand, or if players use poor form, such as contacting the ball too close to the body. (Patel et al., 2021) Therefore, the rules of the game (i.e. lack of overhead serve) and the equipment used (i.e. shorter and lighter weight paddle) may render medial epicondylalgia less common than in tennis.

Limitations to this study exist. First, survey data is at risk for recall bias and, to a certain extent, on participants' interpretation of the definition of an injury. Second, it is possible that there are interactions between age, sex, and playing variables that cannot be determined without a significantly larger study population. Third, because the survey addressed playing volume, it is not possible to determine the effect of prolonged play time (more than 2 hours) with extremely low play frequency (less than weekly) on overuse injury. As noted previously, the survey did not address if participants were new to exercise or simply new to pickleball. It is also unknown if participants had significantly changed their workout routine (Ahmed et al., 2023) or used suboptimal equipment (Ahmed et al., 2023; Hennig, 2007; Rossi et al., 2014) (e.g. running shoes rather than court shoes or improperly sized grip) which are known to be associated with overuse injuries and epicondylalgia. Last, it was not possible in this study to examine the potential influence of poor mechanics or the use of spin on overuse injuries in pickleball players.

CONCLUSION

Overuse injuries affect up to a quarter of all pickleball players, yet most players did not seek medical attention. Overuse injuries were significantly

associated with higher play volume, lower level of play, and participating in pickleball tournaments. Controlling playing volume may be a modifiable risk factor to prevent overuse injuries, particularly for players new to the sport. Epicondylalgia was the most common overuse injury amongst recreational pickleball players. Females and those who participated in pickleball tournaments were more likely to report a history of lateral epicondylalgia.

While epicondylalgia was not a time loss injury, the effect on pickleball player's playing abilities is unknown. Pickleball associations and players should be educated on common overuse injuries and the benefits of interventions, such as exercise and technique training, to maximize symptom-free participation in the sport of pickleball.

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