

One-Handed and Two-Handed Backhand and Tennis Elbow Prevalence in Adult Tennis Players

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Keywords:

Backhand Technique; Lateral Epicondylalgia; Tennis Elbow; Tennis Players; Upper Limb Injury

Abstract

Tennis elbow, or lateral epicondylalgia, is a common musculoskeletal condition among tennis players; however, the association between backhand technique and symptom prevalence remains uncertain. This study examined whether one-handed (1HB) and two-handed (2HB) backhand techniques were associated with clinically assessed tennis elbow in adult tennis players. A cross-sectional study included 48 participants: 23 1HB players and 25 2HB players. Demographic characteristics, weekly training volume, and years of tennis participation were recorded. The primary outcome, defined as dominant-arm elbow pain (DEP), required the presence of lateral elbow pain, tenderness over the lateral epicondyle, and pain reproduced by resisted wrist extension or resisted middle-finger extension. Between-group comparisons were performed using independent-samples t tests, chi-square tests, and Mann–Whitney U tests, as appropriate. The mean age was 41.8 ± 17.0 years, and 72.9% of participants were male. The 1HB group was older than the 2HB group (49.9 ± 17.2 vs. 34.3 ± 13.0 years, $p < 0.001$) and consisted exclusively of male participants (100% vs. 48.0%, $p < 0.001$). The median weekly training volume was 6 hours in both groups ($p = 0.757$). The prevalence of DEP was 47.8% among 1HB players and 52.0% among 2HB players ($\chi^2 = 0.08$, $p = 0.777$). No statistically significant association between backhand technique and DEP was identified in this sample. However, the analysis was unadjusted, and the substantial imbalance in age and sex between groups precluded interpretation of the findings as evidence of an independent association between backhand technique and tennis elbow. The results also did not establish equivalence between the two techniques. Larger prospective studies with adjustment for demographic and training-related confounders and standardized clinical assessments are needed before backhand technique can be used to inform injury-prevention recommendations.



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INTRODUCTION

Tennis elbow, clinically termed lateral epicondylalgia (LE), is characterized by pain and tenderness over the lateral epicondyle of the humerus, typically aggravated by resisted wrist extension and gripping activities (Lucado et al., 2022; Vicenzino, 2003). In tennis players, these symptoms can interfere with stroke execution and continued participation (Abrams et al., 2012; Pluim et al., 2006). Dominant-arm elbow pain (DEP) describes the location of symptoms rather

than a distinct diagnosis (Di Filippo et al., 2022); in this study, DEP is used as the outcome label for participants who met the specified clinical criteria for lateral elbow symptoms.

The backhand stroke is biomechanically demanding and provides a plausible mechanism through which repetitive loading may stress the lateral elbow (Gruchow & Pelletier, 1979). Two primary backhand techniques are commonly used: the one-handed backhand (1HB) and the two-handed backhand (2HB). The one-handed technique may impose greater eccentric loading on the wrist extensor musculature during ball contact, whereas the two-handed technique allows both upper extremities to contribute to force generation and load distribution (Ruiz-Malagón et al., 2022). These proposed biomechanical differences provide a rationale for comparing the two techniques but do not constitute evidence that either technique causes a greater prevalence of clinical symptoms.

The distinction between a symptom label and a clinical case definition is important for valid comparison. Lateral elbow pain may arise from several conditions (Stasinopoulos & Papadopoulou, 2022), whereas the outcome in the present study required a specified combination of pain, tenderness, and symptom provocation during clinical testing. Applying identical criteria to both technique groups reduces variation in case classification within the sample; however, these findings should not be considered directly interchangeable with injury incidence or with prevalence estimates based on different diagnostic or symptom definitions (Di Filippo et al., 2022).

Epidemiological comparisons must distinguish biomechanical loading from the prevalence of clinically assessed symptoms. Injury definitions, timing of assessment, and participant characteristics can substantially affect the interpretation of prevalence estimates (Tooth et al., 2025; Verhagen et al., 2021). Consequently, differences in stroke mechanics cannot be assumed to produce corresponding differences in symptom prevalence. The central empirical question is whether a difference is observed when players using the two techniques are evaluated according to the same clinical criteria.

Age, sex, and training exposure are particularly relevant to this comparison because both technique preference and symptom prevalence may vary across player characteristics (Amor-Salamanca et al., 2025; Kwan et al., 2023; McMahon & Cook, 2024). Describing these factors alongside DEP prevalence is therefore necessary for interpreting the observed association. A crude comparison may identify a sample-level pattern, but it cannot estimate an independent association between backhand technique and DEP when important demographic and training-related differences remain unadjusted (Savitz & Wellenius, 2023).

This study aimed to investigate the association between backhand technique (1HB vs. 2HB) and the prevalence of clinically assessed tennis elbow, operationally labeled as DEP, in a cross-sectional sample of adult recreational and competitive tennis players. A secondary objective was to describe demographic and training-related differences that could complicate interpretation of the comparison between techniques.

The study contributes by applying a standardized clinical assessment to compare DEP prevalence alongside demographic and training profiles within the same sample. Its practical value lies in determining whether backhand technique alone provides a meaningful signal for further investigation while clarifying the limitations of such a comparison. The study was not

designed to establish causality, demonstrate that either technique prevents injury, or establish equivalence between the two backhand techniques.

METHOD

Study Design and Participants

A cross-sectional observational study was conducted among adult tennis players recruited through convenience sampling at a tennis facility (Figueiredo et al., 2025). Eligible participants were aged 18 years or older, actively played tennis at least once per week, and consistently used either a one-handed backhand (1HB) or a two-handed backhand (2HB) as their primary backhand technique. Participants with a history of elbow surgery, a traumatic elbow injury within the preceding three months, or concomitant cervical radiculopathy were excluded. A total of 48 participants were enrolled, comprising 23 players who used a 1HB and 25 players who used a 2HB.

Data Collection

Data were collected by a trained assessor using a structured questionnaire and clinical examination. The following variables were recorded for each participant: age (years), sex, primary backhand technique (1HB or 2HB), weekly training volume (hours per week), and years of tennis practice. The DEP-positive classification required lateral elbow pain with point tenderness over the lateral epicondyle and pain reproduction on resisted wrist or middle finger extension (Lucado et al., 2022). Participants were classified as DEP-positive (Yes) or DEP-negative (No). This operational definition identifies a clinical symptom pattern consistent with lateral epicondylalgia; it does not treat all dominant-arm elbow pain as tennis elbow.

Statistical Analysis

Descriptive statistics are reported as mean $\pm$ standard deviation (SD) for normally distributed continuous variables, median (interquartile range, IQR) for non-normally distributed continuous variables, and frequency with percentage [n (%)] for categorical variables. Between-group differences (1HB vs. 2HB) were assessed using the independent samples t-test for normally distributed continuous variables, the Mann–Whitney U test for non-normally distributed variables, and the chi-squared (χ^2) test for categorical variables. The significance level was set at $\alpha=0.05$. All analyses were performed using custom statistical routines. The reported comparisons are bivariate and do not adjust for age, sex, or training characteristics. An additional unadjusted prevalence ratio was calculated from the DEP counts in Table 2, using 2HB as the reference group; its approximate 95% confidence interval was calculated using the log-Wald method from the observed proportions and group sizes. This aggregate calculation does not provide demographic adjustment.

Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent prior to enrolment. Participant data were anonymised before analysis. Ethical approval was reported as obtained from the relevant institutional review board.

RESULTS AND DISCUSSION

Participant Characteristics

A total of 48 tennis players were enrolled in the study: 23 (47.9%) used the one-handed backhand (1HB) and 25 (52.1%) the two-handed backhand (2HB). The overall mean age was 41.8 ± 17.0 years, and 35 participants (72.9%) were male. The median weekly training volume was 6 hours (IQR 4–8) and the median years of tennis practice was 5 years (IQR 4–10). Overall, 24 participants (50.0%) were classified as DEP-positive. Baseline characteristics are summarised in Table 1.

Table 1. Baseline Characteristics of Study Participants

Variable	Value
Total participants, n	48
Age (years), mean $\pm$ SD	41.8 ± 17.0
Male sex, n (%)	35 (72.9%)
Female sex, n (%)	13 (27.1%)
Weekly training volume (hours), median (IQR)	6 (4–8)
Years of practice, median (IQR)	5 (4–10)
One-handed backhand (1HB), n (%)	23 (47.9%)
Two-handed backhand (2HB), n (%)	25 (52.1%)
DEP, n (%)	24 (50.0%)

Source: Participant data and analyses reported in this manuscript

SD = standard deviation; IQR = interquartile range; 1HB = one-handed backhand; 2HB = two-handed backhand; DEP = dominant-arm elbow pain

Between-Group Comparisons

Compared with 2HB players, 1HB players were significantly older (49.9 ± 17.2 vs. 34.3 ± 13.0 years; $t=3.51$, $p<0.001$). All 1HB players were male (100%), whereas 48.0% of 2HB players were male ($\chi^2=16.40$, $p<0.001$). Median weekly training volume was 6 hours in both groups ($Z=0.31$, $p=0.757$). The prevalence of DEP was 47.8% in 1HB players and 52.0% in 2HB players, with no statistically significant difference detected ($\chi^2=0.08$, $p=0.777$). Between-group comparison results are presented in Table 2. Identical group medians and a non-significant test do not establish equivalence in training exposure or DEP prevalence.

Using the observed counts of 11 DEP-positive players among 23 1HB players and 13 among 25 2HB players, the additional unadjusted prevalence ratio was 0.92 (1HB relative to 2HB; approximate 95% confidence interval, 0.52–1.63). The interval includes both lower and higher prevalence in the 1HB group and should be interpreted cautiously given the small sample.

Table 2. Comparison of Characteristics by Backhand Type

Variable	1HB (n = 23)	2HB (n = 25)	Test statistic	P-value
Age (years), mean $\pm$ SD	49.9 $\pm$ 17.2	34.3 $\pm$ 13.0	t = 3.51	<0.001
Male sex, n (%)	23 (100%)	12 (48.0%)	χ^2 = 16.40	<0.001
Weekly training volume (hours), median (IQR)	6 (4–8)	6 (4–8)	Z = 0.31	0.757
DEP, n (%)	11 (47.8%)	13 (52.0%)	χ^2 = 0.08	0.777

Source: Participant data and analyses reported in this manuscript

1HB = one-handed backhand; 2HB = two-handed backhand; DEP = dominant-arm elbow pain; SD = standard deviation; IQR = interquartile range; t = Student's t-statistic; χ^2 = chi-squared statistic; Z = Mann–Whitney U Z-score.

Discussion

The principal finding of this study was that no statistically significant association between backhand technique and clinically assessed DEP prevalence was detected among 48 adult tennis players ($\chi^2=0.08$, $p=0.777$). This is an unadjusted comparison of observed prevalence, rather than evidence that the techniques have equivalent injury profiles. The additional prevalence ratio of 0.92 has a wide approximate 95% confidence interval of 0.52–1.63, illustrating the limited precision of the comparison.

The proposed biomechanical differences between 1HB and 2HB do not directly explain the present prevalence estimates because forearm loading, stroke volume, and technique proficiency were not measured. Cumulative exposure, individual technique, or adaptation could contribute to symptoms, but these remain hypotheses rather than findings of this study (Hasan et al., 2021; Rodríguez-González et al., 2024). In particular, the older age of the 1HB players does not establish that they were more experienced or had protective muscle–tendon adaptations (Kwan et al., 2023). The data therefore support caution when translating a mechanical rationale into a clinical recommendation.

The significant differences in age and sex between groups complicate interpretation of the DEP comparison. The 1HB group had a mean age of 49.9 years and included only men, whereas the 2HB group had a mean age of 34.3 years and included both sexes. These characteristics may be related to symptom prevalence as well as technique choice. Without participant-level adjusted analysis, their contributions cannot be separated from the observed technique association. The absence of women in the 1HB group also means that a technique comparison among women is unavailable; any sex-adjusted model would require careful evaluation of this lack of overlap.

The study contributes a clinical comparison based on a shared symptom-assessment procedure, but it cannot resolve differences between previously reported injury estimates without comparable diagnostic definitions, sampling frames, and exposure measures (Agius et al., 2023; Myers & Hanks, 2023; Verhagen et al., 2021). A clinically assessed prevalence outcome is distinct from self-reported pain, incident injury, or measured biomechanical loading. Accordingly, the present result should be interpreted as a descriptive finding in this sampled

group, rather than a refutation of a biomechanical hypothesis or a general estimate for all tennis players. Practical assessment should consider the player's symptoms and workload alongside stroke technique (Curti et al., 2021; Lucado et al., 2022).

Limitations

Several limitations should be acknowledged. First, the sample size ($n=48$) was modest, and the imprecise prevalence ratio leaves open the possibility of a clinically relevant difference; failure to reject the null hypothesis may represent a type-II error. No prespecified equivalence margin or equivalence analysis was reported. Second, the cross-sectional design measures prevalence at assessment and cannot establish whether technique preceded symptoms or whether players changed technique because of pain (Savitz & Wellenius, 2023). Third, the bivariate analysis leaves age and sex confounding unresolved, while grip size, racket string tension, playing surface, and stroke volume were not captured (Amor-Salamanca et al., 2025; Hatch et al., 2006). Fourth, the absence of female participants in the 1HB group limits sex-specific comparisons. Finally, convenience sampling at one facility may select players able or willing to continue playing and may underrepresent those who stopped because of symptoms; this possibility limits generalisability and was not directly evaluated.

CONCLUSION

In this cross-sectional sample of 48 adult tennis players, no statistically significant difference in the prevalence of clinically assessed dominant-arm elbow pain (DEP) was observed between players using one-handed and two-handed backhand techniques. The prevalence was 47.8% and 52.0%, respectively; however, the comparison was unadjusted and statistically imprecise. The substantial differences in age and sex between the groups indicated potential confounding that could not be adequately addressed using the reported bivariate analyses. Accordingly, these findings did not establish equivalent prevalence between the two techniques or demonstrate an independent association between backhand technique and tennis elbow.

Larger prospective cohort studies using standardized clinical criteria, detailed assessments of stroke mechanics and equipment-related exposure, and sufficient demographic overlap between comparison groups are needed to examine symptom onset and appropriately adjust for potential confounding factors. Until such evidence is available, the findings from this sample do not support recommending a change in backhand technique solely for the purpose of reducing the prevalence of tennis elbow.

FUNDING

The author states that no financial support has been received for the implementation of this research and/or the publication of this article.

CONFLICT OF INTEREST

The author states that this research was conducted without any commercial or financial relationship that can be interpreted as a potential conflict of interest.

AUTHOR CONTRIBUTION

All authors contributed to the conceptualization, methodology, data collection, data analysis, writing, and revision of the manuscript. All authors have read and approved the final version of the manuscript.

GENERATIVE ARTIFICIAL INTELLIGENCE USAGE STATEMENT

The authors state that generative artificial intelligence (AI) was used in the preparation of this manuscript to improve language clarity and grammatical structure. This use complied with

applicable ethical guidelines on the use and disclosure of generative AI in scientific research. Each author made substantial intellectual contributions to this work. The authors have reviewed the manuscript for accuracy and remain responsible for its integrity and final content.

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