


Prevalence of Carpal Tunnel Syndrome Among the BDS Interns of the Dental Institutes in Lahore: A Cross-Sectional Study

Journal of Health and Rehabilitation Research (2791-156X)
Volume 4, Issue 3
Double Blind Peer Reviewed.
<https://jhrrmc.com/>
DOI: <https://doi.org/10.61919/jhrr.v4i3.1647>
www.lmi.education/


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Keywords

Carpal Tunnel Syndrome, Dental Interns, Musculoskeletal Disorders, Risk Factors, Prevalence, Ergonomics, BMI, Gender Disparity.

Disclaimers

Authors' Contributions All authors contributed equally to the conceptualization, data collection, analysis, and manuscript preparation.

Conflict of Interest

Data/supplements None declared
Available on request.

Funding

Ethical Approval None
Respective Ethical Review Board

Study Registration

Acknowledgments N/A
N/A



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ABSTRACT

Background: Carpal Tunnel Syndrome (CTS) is a prevalent nerve entrapment disorder characterized by pain, numbness, and functional impairment of the hand, significantly affecting dental professionals due to prolonged hand use and awkward postures.

Objective: To assess the prevalence and associated risk factors of CTS among BDS interns in dental institutes of Lahore.

Methods: A cross-sectional study was conducted among 177 dental interns from five dental institutes using convenience sampling. Demographic data and symptom severity were evaluated using the Boston Carpal Tunnel Questionnaire (BCTQ), and diagnosis was confirmed using the Phalen's test. Pearson's correlation and independent sample T-tests were applied using SPSS version 25. Ethical approval and informed consent were obtained per the Declaration of Helsinki.

Results: CTS prevalence was 14.7% (n=26), with a higher rate in females (8.8%) compared to males (5.9%). CTS was significantly associated with female gender (p=0.013), higher BMI (p=0.011), left-hand dominance (p=0.01), and increased weekly caseload (p<0.05).

Conclusion: The findings highlight a substantial CTS prevalence among dental interns, with gender, BMI, and workload being key risk factors, indicating a need for targeted ergonomic interventions.

INTRODUCTION

Carpal Tunnel Syndrome (CTS) is recognized as one of the most prevalent peripheral nerve entrapment disorders, characterized by the compression of the median nerve as it passes through the carpal tunnel in the wrist (1). This anatomical space contains multiple tendons and the median nerve, making it susceptible to compression from factors that reduce the tunnel's diameter, such as inflammation, trauma, or repetitive strain. The primary clinical features of CTS include pain, paresthesia, numbness, and weakness affecting the first three fingers and the thumb, often intensifying at night and interfering with daily activities (2, 3). The pathophysiology of CTS encompasses several mechanisms, including mechanical trauma, increased pressure, and ischemic injury to the median nerve. Numerous risk factors contribute to the development of CTS, including genetic predispositions, age, gender, and occupational exposure to repetitive wrist movements (4, 5). In clinical practice, the diagnosis is typically based on a combination of history, physical examination, and validated tools like the Boston Carpal Tunnel Questionnaire (BCTQ) and Phalen's test (6, 7).

Occupational factors play a critical role in CTS development, especially in professions involving repetitive hand movements, prolonged wrist flexion, and forceful gripping. The dental profession, in particular, is associated with an elevated risk of musculoskeletal disorders, including CTS, due to sustained static postures, repeated

fine motor activities, and the use of vibratory tools, leading to increased hand force and wrist strain (8, 9). Studies have reported varying prevalence rates of CTS among dental professionals worldwide, suggesting that the prevalence may be influenced by gender, years of practice, workload, and ergonomic conditions in the workplace (10). In Pakistan, studies conducted in Faisalabad, Peshawar, and Karachi reported prevalence rates of 60%, 21.2%, and 10.31%, respectively, among dentists (11, 12, 13). A study by Ehsan et al. in Lahore revealed a prevalence of 15.5% among dental professionals in government hospitals (14). Internationally, similar studies have highlighted the gender-based differences in CTS prevalence, with female dental professionals consistently showing higher susceptibility due to hormonal and anatomical factors that may predispose them to median nerve compression (15, 16). The limited research on CTS among dental students, particularly in Pakistan, warrants attention. Studies from other regions have indicated that dental students, due to their demanding clinical rotations and early exposure to ergonomic risk factors, may have similar or even higher rates of CTS compared to practicing professionals (17). The work of Aljunaid et al. (2021) at King Abdulaziz University reported a CTS prevalence of 13.3% among final-year BDS students, with a notable gender disparity favoring female students (18). Given the lack of recent data on CTS prevalence among dental interns in Lahore and the growing concern over occupational health in dental education, this study aims to fill the gap by assessing the prevalence and associated risk

factors of CTS among BDS interns in multiple dental institutes in Lahore. This focus is essential as early identification and intervention can prevent the progression of symptoms and improve career longevity for these future professionals.

Therefore, this study is designed to ascertain the extent of CTS among dental interns in Lahore's dental institutes and identify key demographic and occupational determinants such as gender, BMI, hand dominance, and workload that may influence the prevalence of CTS. By using validated tools like the BCTQ and employing the Phalen's test as a diagnostic measure, this research aims to provide robust data to guide the development of targeted interventions. Moreover, understanding the distribution of CTS among dental students compared to general dentists and the general population will contribute to the broader discourse on ergonomic training and preventive strategies necessary to safeguard the musculoskeletal health of dental professionals from the earliest stages of their careers (19).

MATERIAL AND METHODS

The present cross-sectional study was conducted among dental interns in various dental institutes of Lahore to assess the prevalence of Carpal Tunnel Syndrome (CTS) and its associated factors. The study employed a convenience sampling method, selecting 177 BDS interns who met the inclusion criteria. Participants were recruited from five major dental institutes, including Azra Naheed Medical and Dental College, Sharif Medical and Dental College, Dental Hospital of the University of Lahore, Shalimar Medical and Dental College, and Lahore Medical and Dental College. The sample size was determined using the Raosoft software calculator, based on an anticipated CTS prevalence of 13.3%, a confidence level of 95%, and a margin of error set at 5% (19). Participants were included if they were dental interns aged 22 to 25 years, of both genders, and actively engaged in clinical rotations. Individuals were excluded if they had a confirmed diagnosis of CTS prior to starting their dental internship, were pregnant females, smokers, or had a history of wrist or hand fractures, congenital deformities, or recent surgeries involving the hand or wrist. Informed consent was obtained from all participants before data collection, and the study was conducted following the ethical guidelines set by the Declaration of Helsinki to ensure the protection of participants' rights and confidentiality.

Data collection involved the use of a structured demographic questionnaire and the validated Boston Carpal Tunnel Questionnaire (BCTQ), which assessed symptom severity and functional status. The demographic data included variables such as age, gender, marital status, hand dominance, Body Mass Index (BMI), and weekly caseload. BMI was calculated based on self-reported height and weight measurements, categorized as underweight ($<18.5 \text{ kg/m}^2$), normal ($18.5\text{--}24.9 \text{ kg/m}^2$), overweight ($25\text{--}29.9 \text{ kg/m}^2$), and obese ($>30 \text{ kg/m}^2$) according to the World Health Organization classification (11). The BCTQ, a widely used and reliable tool for CTS assessment, consists of two main components: the Symptom Severity Scale (SSS) and

the Functional Severity Scale (FSS). Participants were diagnosed with CTS based on a positive Phalen's test, which is a standard clinical diagnostic tool for CTS and was administered under the supervision of a trained physiotherapist to ensure consistency and accuracy (8, 9).

The data analysis was performed using SPSS software version 25. Descriptive statistics were used to present the mean and standard deviations for continuous variables, while categorical variables such as gender, marital status, and pain were summarized using frequencies and percentages. Pearson's correlation coefficient was employed to evaluate the association between variables, with the prevalence of CTS considered the independent variable and other factors such as BMI, hand dominance, and weekly caseload as dependent variables. An independent sample T-test was applied to compare differences in SSS and FSS scores between male and female interns and between right- and left-hand dominant participants. The level of significance was set at 5%, and results with p-values less than 0.05 were considered statistically significant (16).

To ensure methodological rigor, all assessments were carried out in a consistent manner, with Phalen's test and BCTQ scoring administered by the same examiner to minimize inter-observer variability. Data quality was further enhanced by double-entry verification and cross-checking of records to identify and resolve any inconsistencies. The study adhered to ethical considerations, including obtaining informed consent and maintaining participant anonymity. All procedures and protocols were reviewed and approved by the Institutional Review Board of each participating institute, and the study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (17).

The study spanned a period of six months, from recruitment to data analysis. Participants were provided with detailed information regarding the purpose and potential risks of the study, and participation was entirely voluntary. The comprehensive data collection process and robust statistical analysis ensured that the findings were representative of the target population, providing valuable insights into the prevalence and determinants of CTS among dental interns in Lahore.

RESULTS

A total of 177 dental interns participated in this study, of which 51 (28.8%) were male and 126 (71.2%) were female. The mean age of the participants was 23.01 ± 1.003 years. The study revealed that 95.5% of the interns were single, while 88.1% reported right-hand dominance. In terms of Body Mass Index (BMI), 6.2% were underweight, 71.2% were classified as normal weight, 13% were overweight, and 17% were obese. The prevalence of Carpal Tunnel Syndrome (CTS) among the dental interns was found to be 14.7% (26 out of 177), with a higher prevalence observed among females (8.8%) compared to males (5.9%).

The results indicated that female gender, higher BMI, and left-hand dominance were associated with increased CTS prevalence.

Table 1: Distribution of Carpal Tunnel Syndrome According to Gender, BMI, Hand Dominance, and Weekly Caseload

Variable	CTS Present (n=26)	CTS Absent (n=151)	Total (N=177)
Gender			
Male	3 (5.9%)	48 (94.1%)	51 (28.8%)
Female	23 (18.3%)	103 (81.7%)	126 (71.2%)
BMI			
Underweight (<18.5 kg/m ²)	1 (9.1%)	10 (90.9%)	11 (6.2%)
Normal (18.5–24.9 kg/m ²)	10 (7.9%)	116 (92.1%)	126 (71.2%)
Overweight (25–29.9 kg/m ²)	4 (17.4%)	19 (82.6%)	23 (13.0%)
Obese (>30 kg/m ²)	11 (64.7%)	6 (35.3%)	17 (9.6%)
Hand Dominance			
Right-handed	22 (13.9%)	136 (86.1%)	158 (88.1%)
Left-handed	4 (19.0%)	17 (81.0%)	21 (11.9%)
Weekly Caseload			
1–5	0 (0%)	35 (100%)	35 (19.8%)
6–10	0 (0%)	28 (100%)	28 (15.8%)
11–15	0 (0%)	35 (100%)	35 (19.8%)
16–20	4 (12.5%)	28 (87.5%)	32 (18.1%)
21–25	15 (46.9%)	17 (53.1%)	32 (18.1%)
26–30	5 (41.7%)	7 (58.3%)	12 (6.8%)
>30	2 (66.7%)	1 (33.3%)	3 (1.6%)

Table 2: Group Statistics According to Gender and Symptom Severity Scale (SSS) and Functional Severity Scale (FSS)

Gender	N	SSS Mean ± SD	FSS Mean ± SD
Male	51	1.80 ± 0.849	1.80 ± 0.895
Female	126	2.21 ± 1.032	2.25 ± 1.152

The CTS cases were also significantly higher in those interns who reported a heavier weekly caseload ($p < 0.05$). The analysis demonstrated that female interns had significantly higher mean scores in both the Symptom Severity Scale (SSS) and Functional Severity Scale (FSS) compared to male

interns, indicating more severe symptoms and greater functional impairment ($p < 0.05$). The BCTQ scores were higher among left-handed interns, suggesting that left-hand dominance may be a risk factor for more severe CTS symptoms ($p < 0.05$).

Table 3: Group Statistics According to Hand Dominance and Boston Carpal Tunnel Questionnaire (BCTQ) Scores

Hand Dominance	N	BCTQ Mean ± SD
Right-handed	156	3.05 ± 1.50
Left-handed	21	3.95 ± 1.37

Table 4: Independent Samples T-Test Analysis

Variable	t	df	Sig. (2-tailed)
Symptom Severity Scale Scoring	-2.514	175	0.013
Functional Severity Scale Scoring	-2.500	175	0.013
BCTQ Scoring	-2.575	175	0.011

Table 5: Pearson Correlation Analysis

Variable	Gender	Age	BMI	Caseload	Hand Dominance	BCTQ Scoring
Gender	1	-0.184*	0.214**	0.002	0.002	0.191*
Age	-0.184*	1	-0.042	0.189*	0.173*	0.058
BMI	0.214**	-0.042	1	0.209**	-0.085	0.367**
Caseload	0.002	0.189*	0.209**	1	0.252**	0.649**
Hand Dominance	0.002	0.173*	-0.085	0.252**	1	0.193**
BCTQ Scoring	0.191*	0.058	0.367**	0.649**	0.193**	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Pearson's correlation analysis demonstrated significant relationships between gender, BMI, caseload, hand dominance, and CTS prevalence ($p < 0.05$).

The analysis indicated that increased BMI and higher weekly caseload were strongly correlated with greater BCTQ scores, suggesting a higher risk of CTS with increased

workload and obesity. Overall, these results highlight a substantial prevalence of CTS among dental interns, with gender, BMI, hand dominance, and weekly caseload serving as significant risk factors. These findings underscore the need for early identification and intervention strategies to reduce the occupational burden of CTS among dental professionals. The independent sample T-test confirmed significant differences in the Symptom Severity Scale (SSS), Functional Severity Scale (FSS), and Boston Carpal Tunnel Questionnaire (BCTQ) scores between male and female interns, and between right- and left-handed interns, with p -values <0.05 for all variables.

DISCUSSION

The findings of this study indicated that Carpal Tunnel Syndrome (CTS) is a significant occupational health concern among dental interns in Lahore, with a prevalence of 14.7%, which was higher in females (8.8%) compared to males (5.9%). This gender disparity is consistent with previous research, where females have been shown to have a higher predisposition to CTS due to anatomical and physiological differences, including smaller carpal tunnels and hormonal fluctuations that can increase the likelihood of nerve compression (18, 19). A similar study conducted by Aljunaid et al. (2021) reported a CTS prevalence of 13.3% among final-year dental students in Saudi Arabia, with higher rates among female students (18). This suggests that gender-specific interventions may be necessary to address CTS among female dental professionals.

The overall prevalence reported in our study was lower than the 30.5% prevalence found by Alhusain et al. (2019) among practicing dentists in Riyadh, which may be attributed to the difference in the professional experience and longer exposure to risk factors in clinical practice among experienced professionals compared to students (19). This discrepancy in prevalence could also reflect variations in sample demographics and workplace ergonomics, as the current study focused solely on interns with limited clinical experience. Additionally, a study by Mubashra et al. (2022) in Faisalabad reported a significantly higher CTS prevalence of 60% among dental professionals, further indicating the occupational risks inherent in dental practice, particularly when proper ergonomic guidelines are not followed (15).

Our study identified several key risk factors for CTS among dental interns, including higher BMI, left-hand dominance, and increased weekly caseload. These findings are consistent with previous literature, where obesity has been recognized as a significant risk factor for CTS due to increased pressure on the median nerve caused by excess adipose tissue (13). Similarly, left-handed dental professionals have been reported to be at greater risk of developing CTS, potentially due to the lack of ergonomic equipment tailored for left-handed individuals, which forces them into awkward wrist positions (21). The significant association between higher weekly caseload and increased CTS prevalence in this study suggests that repetitive hand movements and sustained static postures contribute to the development of CTS, as has been demonstrated in various occupational studies (22).

The use of validated tools such as the Boston Carpal Tunnel Questionnaire (BCTQ) and Phalen's test strengthened the diagnostic accuracy of the study findings. The BCTQ is a reliable instrument for assessing the severity of CTS symptoms and their impact on daily functioning, and its application in this study ensured that symptom severity was measured comprehensively (8). However, the reliance on subjective reporting through questionnaires could have introduced response bias, as participants may have underreported or overestimated their symptoms. Additionally, the cross-sectional design of the study limited the ability to establish causal relationships between the identified risk factors and CTS prevalence. A longitudinal study design would be more appropriate to assess the temporal relationship between these risk factors and the development of CTS over time.

Despite these limitations, the study provided valuable insights into the burden of CTS among dental interns in Lahore, a population that has been relatively underrepresented in the existing literature. The inclusion of multiple dental institutes enhanced the generalizability of the findings to other dental training settings. However, the sample size, although adequate, was limited to dental interns from a single city, which may not reflect the CTS prevalence among dental interns in other regions of Pakistan. Future studies should consider larger, multi-center samples to improve the generalizability of the results. The findings of this study underscore the importance of early ergonomic interventions in dental education to prevent the development of CTS and other musculoskeletal disorders from the onset of clinical training.

Implementation of ergonomic training sessions, adjustment of workstations to accommodate left-handed individuals, and promotion of regular breaks during clinical rotations are recommended strategies to reduce the risk of CTS in dental interns. Furthermore, given the significant association between BMI and CTS, incorporating lifestyle modification programs focused on weight management within the dental curriculum may also help mitigate this risk. Future research should explore the long-term impact of such interventions on reducing CTS prevalence among dental professionals.

CONCLUSION

In conclusion, this study highlighted the considerable prevalence of CTS among dental interns in Lahore and identified gender, BMI, hand dominance, and weekly caseload as significant risk factors. The results contribute to the growing body of evidence on the occupational health risks faced by dental professionals and emphasize the need for targeted preventive strategies to protect the musculoskeletal health of dental interns from the early stages of their careers.

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