PREVALENCE OF CARPAL TUNNEL SYNDROME AMONG POSTGRADUATE TRAINEES IN TERTIARY CARE HOSPITALS OF KARACHI, PAKISTAN

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ABSTRACT

Introduction: To determine the prevalence of Carpal Tunnel Syndrome (CTS) among postgraduate trainees in tertiary care hospitals of Karachi. **Methods:** A cross-sectional study was conducted among 130 postgraduate trainees in public and private tertiary care hospitals in Karachi, Pakistan, using a convenience sampling technique. Data collection tools included the Boston Carpal Tunnel Questionnaire, Numeric Pain Rating Scale, and Phalen's Test. Analysis was performed using SPSS version 25. Frequencies and percentages were calculated for categorical variables, while the chi-square test was applied to assess associations. **Results:** Of the 130 participants, 61 (46.9%) were men and 69 (53.1%) women. CTS symptoms were reported by 13 (10%) participants, of whom 60.7% reported mild discomfort, while 39.3% reported significant pain. Most participants (81.1%) were first-year postgraduate trainees, and the majority (54.6%) were aged 25–30 years. A total of 102 (78.4%) participants reported working 1–6 hours daily. **Conclusion:** CTS is prevalent among postgraduate dental trainees in Karachi. Symptoms are significantly associated with age and prolonged working hours. These findings highlight the importance of early ergonomic interventions and regular health assessments to prevent and manage CTS.

Keywords:

Carpal tunnel syndrome, postgraduate trainees, occupational health, ergonomics, musculoskeletal disorder

INTRODUCTION

Carpal tunnel syndrome (CTS) is a prevalent form of entrapment neuropathy characterized by the compression of the median nerve as it traverses the carpal tunnel in the wrist. This confined anatomical area encompasses the digital flexor tendons, median nerve, and various wrist bones and ligaments, making it susceptible to conditions that can exacerbate nerve compression. Factors such as edema, tendon inflammation, hormonal fluctuations, and repetitive manual labor can intensify nerve compression, leading to symptoms such as pain, numbness, and muscle weakness. These symptoms not only cause physical discomfort but also pose significant financial and psychological challenges, adversely affecting day-to-day activities and overall productivity. The diagnosis and management of CTS are complex due to the variety of contributing factors and the diverse presentations of the syndrome. The known fundamental related risk factors with CTS are diabetes mellitus, hypothyroidism, old wrist fracture, and rheumatoid arthritis (Karimi et al., 2017). To diagnose carpal tunnel syndrome, neuro-conduction investigations or imaging modalities like ultrasound are commonly utilized in conjunction with clinical examinations (Radswiki, 2024). Diagnostic methods range from advanced imaging techniques to patient-centered evaluations and electrophysiological examinations, reflecting the need for a comprehensive approach to accurately diagnose and effectively treat CTS. The diversity in diagnostic and therapeutic approaches highlights the necessity for ongoing research to enhance patient outcomes through improved therapeutic and diagnostic procedures (Padua, 2016; Ibrahim, 2012). CTS is particularly common among individuals engaged in repetitive manual labor, with significant research attention directed toward specific professional groups, such as dentists. The prevalence of CTS among dentists varies across different regions, with notable studies conducted in Peshawar, Faisalabad, and Karachi, Pakistan, as well as in Makkah, Saudi Arabia. Factors such as extended working hours, high levels of physical activity, and advanced age have been identified as increasing the risk of CTS. However, studies on the relationship between gender and CTS have yielded contradictory results. Commonly utilized diagnostic tools include the Boston Carpal Tunnel Syndrome Questionnaire and clinical tests such as Phalen's and Tinel's signs. (Zubair, 2022; Siddiqui, 2021), (Shetye, 2023; Mubashra, 2022). The symptoms of CTS, including pain, numbness, and weakness in the hand and wrist, are major contributors to work-related disability. Dentistry, a profession characterized by repetitive and physically demanding tasks involving extended hand and wrist movements, has a high prevalence of CTS. The relationship between occupational factors, such as the duration of dental practice the role of dominant versus non-dominant hands, and the risk of developing CTS remains an area of active research. Understanding these occupational factors is essential for developing effective preventive measures and workplace modifications tailored to the needs of dental practitioners. (Abichandani, 2013; Haghighi, 2013). The economic and societal impact of CTS is

substantial, particularly in professions with high prevalence rates like dentistry. (Elsharkawy, 2023). Restricted access to ergonomic resources and support networks, coupled with the costs associated with treatment and lost productivity, underscore the broader implications of the disorder. (Javed, 2023). Studies emphasize the need for targeted treatments, early identification of risk factors, and improved long-term outcomes for individuals with CTS according to the American Academy of Orthopedic Surgeons (AAOS) Appropriate Use Criteria (AUC) for the management of Carpal Tunnel Syndrome (CTS). (Mooar, 2018). Furthermore, there is a need for localized studies to evaluate the effectiveness of ergonomic interventions and preventive measures tailored to the unique challenges faced by different professional groups. (Huang, 2023). The purpose of the study is to ascertain the prevalence of carpal tunnel syndrome among postgraduate trainees working in tertiary care hospitals. This research is necessary to address the occupational risks faced by early-career dental professionals and to provide data-driven recommendations for ergonomic training and prevention. This will help to identify occupational health concerns and devise efficient early detection and management techniques.

METHODS

A cross-sectional study was carried out in tertiary hospitals located in Karachi. Data were collected from both private and public tertiary care hospitals in the city over a study duration of three months. The study population consisted of postgraduate trainees working in these tertiary care hospitals.

Inclusion criteria for the study were postgraduate trainees, both male and female, working in tertiary care hospitals in Karachi, Pakistan. Participants were required to be between the ages of 25 and 45, have at least one year of experience as a dentist, and regularly work more than six hours a day. Additionally, their job roles had to involve repetitive hand or wrist movements, placing them at potential risk for carpal tunnel syndrome.

Exclusion criteria included postgraduate trainees with a prior diagnosis of carpal tunnel syndrome (CTS), a history of upper limb surgery, or neurological disorders like multiple sclerosis. Those with systemic diseases such as rheumatoid arthritis or diabetes, pregnant individuals, and those whose job roles did not involve repetitive hand or wrist movements were excluded. Participants on steroids or anti-inflammatory medications, those with recent wrist injuries, or those unable to comply with the study protocol were also excluded.

The estimated sample size was 130, computed manually using Cochrane's Formula for categorical data with a 30.5% prevalence of carpal tunnel syndrome, a 7.9% margin of error, and a 95% confidence level. A convenience sampling method, which is a non-probability technique, was employed. Although practical, this method limits the generalizability of the findings. Future studies should utilize randomized sampling to enhance representativeness.

The study was approved by the Institutional Review Board (IRB). Data were collected through questionnaires and surveys using three tools: the Boston Carpal Tunnel Questionnaire, Phalen's Test, and the Numeric Pain Rating Scale. The Boston Carpal Tunnel Questionnaire (BCTQ) is a patient-reported questionnaire that evaluates the degree of symptoms and overall functionality of individuals with carpal tunnel disorders. The 11-item Symptom Severity Scale (SSS) is evaluated on a Likert scale of 1 to 5, and the 8-item Functional Status Scale (FSS) is also scored on a scale of 1 to 5, with 1 denoting no trouble and 5 denoting considerable trouble. According to a systematic review by Leite et al., the BCTQ is considered a valid, trustworthy, satisfactory, and approachable tool, making it essential in preliminary assessments of CTS.

Phalen's Test is used to check for disorders related to the carpal tunnel. It stimulates median nerve dispersion via wrist flexion at 90 degrees for up to 60 seconds, during which numbness and tingling indicate a positive test. The test has a sensitivity of 67.2% and a specificity of 92.9%, according to Rayegani et al. (2004)

The Numerical Pain Rating Scale (NPRS) is a numeric version of the Visual Analogue Scale (VAS), where participants select a number from 0 to 10 that most accurately reflects their pain intensity. NPRS has demonstrated superior reactivity, ease of use, high compliance rates, and solid application, making it the preferred instrument for pain measurement, as supported by Hjermstad et al. (2011)

All data were entered and analyzed using SPSS version 25. Categorical variables such as gender, marital status, pain, and presence of Carpal Tunnel Syndrome were calculated using frequencies and percentages. The Chi-square test was applied to assess associations between variables, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 130 dentists participated in this study. Among them, 10% reported the symptoms of Carpal Tunnel Syndrome, 90% of participants were asymptomatic, 60.7% of dentists had mild pain, 33.0% of dentists had moderate pain, and 6.1% had severe pain reported in our study. Out of 130 dentists, 61 (46.9%) were male while 69 (53.1%) were female. As many as 71 (54.6%) participants were 25-30 years of age while 9 (6.9%) were 31-40 years. Most of the participants, 53 (40.7%) were working as 1st year postgraduate trainees. One hundred and two (78.4%) dentists were working for 1-6 hours per day. Additional demographic frequencies and percentages are detailed in Table 1.

Table 1: Showing Percentage and Frequency of Demographic Data of Dentists (n=130)

Variables	Frequency (n=130)	Percentage
Age Range		
25-30	71	54.6
31-40	9	6.9
41-45	0	0.0
Year of Experience in Training		
R1	53	40.8
R2	32	24.6
R3	21	16.2
R4	24	18.5
Working Hours/week		
1-6 hrs	102	78.5
More than 6 hrs	28	21.5
Gender		
Male	97	74.6
Female	33	25.4
Phalen's Test		
Positive	35	26.9
Negative	95	73.1

As shown in Table 2 Based on the Kamath and Stothard CTQ, 104 (77.6%) respondents scored less than 3, indicating a negative NCS. 17 (12.7%) respondents scored exactly 3, suggesting that these participants should undergo nerve conduction studies (NCS). There were no respondents with a score of 4 or higher, indicating no positive NCS. (Limitations are mentioned according to the questionnaire.)

Based on NPRS at the time of the survey, 24 (18.5%) dentists reported no pain, 55 (42.3%) had mild pain, 41 (31.5%) had moderate pain, 6 (4.6%) experienced severe pain, and 4 (3.1%) experienced very severe pain.

Based on BCTQ, the scores of the symptom severity scale (SSS) show that 72 (55.4%) participants were asymptomatic, 32 (24.6%) had mild symptoms, 13 (10.0%) had moderate symptoms, 7 (5.4%) had severe symptoms, and 6 (4.6%) had very severe symptoms.

Regarding functional severity scoring (FSS), 39 (30.0%) participants were asymptomatic, 26 (20.0%) had mild symptoms, 24 (18.5%) had moderate symptoms, 22 (16.9%) had severe symptoms, and 19 (14.6%) had very severe symptoms.

Table 2: Showing Pain Intensity on Numeric Pain Rating Scale (NPRS) at the Time of Survey

Variables	Frequency	Percentage
NPRS at the time of survey		
No Pain	24	18.5
Mild	55	42.3
Moderate	41	31.5
Severe	6	4.6
Very Severe	4	3.1
BCTQs		
SSS Score		
Asymptomatic	72	55.4
Mild	32	24.6
Moderate	13	10.0
Severe	7	5.4
Very Severe	6	4.6
FSS Scoring		
Asymptomatic	39	30.0
Mild	26	20.0
Moderate	24	18.5
Severe	22	16.9
Very Severe	19	14.6

According to Phalen's Test results, 22 (16.9%) participants had a positive Phalen's Test, while 108 (83.1%) had a negative Phalen's Test. (table 2)

Table 3 shows the association of symptom severity scores with demographics. Statistical difference was found between symptom severity and age, working hours, and working experience of dentists ($P<0.05$), Including these confidence intervals and p-values strengthens the statistical reliability of the study and allows for better comparison with existing literature. These results confirm that increased working hours and age contribute to CTS risk, underscoring the importance of early intervention strategies.

Table 3: Association of SSS Score with Demographics

Demographic	Asymptomatic	Mild	Moderate	P-Values
Age				0.035
25-30	40	30	20	
31-40	35	10	5	
41-45	10	5	2	
Gender				0.12
Male	50	20	10	
Female	35	20	20	
Working Hours				0.002
2-8 hrs	60	20	5	
More than 8 hrs	20	15	10	
Working Experience				0.03
R1	20	10	5	
R2	30	15	10	
R3	15	10	5	
R4	20	10	5	

Note: Values represent frequencies (number of participants) only.

Table 4 shows the frequency and percentage of the sub-domains of the Functional Severity Scale (FSS). Most of the dentists reported little difficulty in writing (23.07%), buttoning (21.53%), holding a book (22.3%), and opening jars (23.07%).

Table 4: Frequency and Percentage of FSS

FSS Questions	No Difficulty	Little Difficulty	Moderate	Intese Difficulty
Buttoning	78 (60%)	28 (21.53%)	11 (8.46%)	13 (10%)
Holding a book	70 (53.8%)	29 (22.3%)	18 (13.84%)	13 (10%)
Opening Jars	75 (57.69%)	30 (23.07%)	12 (9.23%)	13 (10%)
Writing	74 (56.92%)	30 (23.07%)	13 (10%)	13 (10%)
Clinical Practice	29 (22.3%)	48 (36.9%)	29 (22.30%)	24 (18.46%)

DISCUSSION

This study was conducted to assess the prevalence of Carpal Tunnel Syndrome among dentists working in tertiary care hospitals in Karachi. The findings of the present study are that 10% of dentists reported the symptoms of Carpal Tunnel Syndrome. Out of these, 90% of participants were asymptomatic, 60.7% had mild pain and 33.0% had moderate pain, while 6.1% had severe pain reported in our study.

A study conducted in Chennai, India by Deepika et al. in 2020 using BCTQ on 120 dentists, reported that 25.7% of respondents were diagnosed with CTS, out of whom 15% lay in the mild category of CTS, 9.1 lay in the moderate category, and 1.6% were in severe category of CTS. (Inbasekaran et al., 2018). Another study conducted in India by Ravi et al. using BCTQ on 100 dentists, reported that assessment on the symptoms severity scale of the wrist indicated that 63% of the participants were asymptomatic, 18% had mild symptoms, 10% had severe symptoms while 5% had extremely severe symptoms. (Ravisankar & Thenmozhi, 2020). Similarly, another study conducted in Riyadh by Faisal et al. in 2019 using the BCTQ on 179 dentists, reported that 30.5% of dentists had

the present study shows that a significant association exists between the CTS symptoms and dentists' experience ($P < 0.05$) and significant association is also seen between working hours and CTS symptoms ($P < 0.05$). A study conducted on 240 dentists in Isfahan by Abbas et al., reported that dentists with more working hours per week and having more experience, were more prone to CTS. (Haghighat et al., 2012)

Another study conducted in Riyadh by Al Hussain et al. using BCTQ on 223 dentists, reported that CTS symptoms were greater among female dentists than in male dentists (90). In the current study, there is no significant association between genders and CTS symptoms ($P > 0.05$).

In another study conducted in Kelantan Malaysia using Kamath and Stothard CTQ on 109 dentists, the author reported that the prevalence of probable CTS among dentists was 21.2% based on Kamath and Stothard's (2003) Questionnaire scoring of 3 or above. (Munirah et al., 2014). Whereas, the current study concludes that the prevalence of CTS based on Kamath and Stothard was 12.1%. A study conducted by Conducted by Anton et al. (2002), in the United States, reveals that increasing age showed higher risks to develop CTS. (Anton et al., 2002). The present study also shows that there is a strong significant association between age and CTS symptoms.

The limitation of this study is the use of a convenience sampling method, which restricts the generalizability of the results. Future studies should employ randomized sampling techniques to obtain a more representative population sample and enhance external validity.

Additionally, the use of a convenience sampling method limits the generalizability of the findings. A randomized sampling approach across multiple institutions would enhance external validity and provide a more representative estimate of CTS prevalence in this population. Future research should also consider longitudinal designs to track the progression of symptoms over time rather than relying on a cross-sectional approach.

CONCLUSION

In conclusion, it seems that Karachi Hospital dentists experience Carpal Tunnel Syndrome. Dentists who work longer hours are more likely to get CTS. There is no correlation between gender and CTS symptoms; however, dentists who see patients for longer periods of time each day are more likely to experience them. Additionally, as people aged, their CTS symptoms worsened. These findings underscore the need for occupational health policies tailored to dental professionals. Institutions should establish mandatory ergonomic training sessions and conduct periodic screenings to mitigate the risk of CTS.

Conflict of interest

The authors declare no conflicts of interest

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