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Prevalence of Carpal Tunnel Syndrome in Dentists Executing Complex Task with The Upper Extremities

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Abstract:

Carpal tunnel syndrome (CTS) is a complex condition characterized by various symptoms caused by the compression of the median nerve within the inflexible carpal tunnel at the wrist. Imbalances in the musculoskeletal system resulting from overuse and underuse of hand and forearm muscles can contribute to the narrowing of the carpal tunnel, making it less resilient to the strain imposed by the flexor muscles. The repetitive wrist and hand movements commonly seen in dental professionals can exacerbate the muscular imbalance in the carpal tunnel. While there is limited literature on the prevalence of CTS in dental professionals, this study aimed to determine its occurrence among dentists performing intricate tasks with their upper extremities. A prevalence study was conducted in 2021 among dentists aged 27 to 45 in Calicut, Malappuram, and Kannur. The study enrolled 101 dentists who met the inclusion criteria, and the Boston Carpal Tunnel Questionnaire (BCTQ) was employed to assess the prevalence of CTS. Participants completed the questionnaire through a Google form. Among the 101 subjects, comprising 59 females and 42 males, the prevalence of Carpal Tunnel Syndrome in dentists was 47.5%. Most affected individuals were in the 25-35 age group. Notably, 14% of dentists reported experiencing severe symptoms, while 17% faced difficulties completing their daily tasks. In conclusion, the study highlights the significant prevalence of carpal tunnel syndrome among dentists. It underscores the importance of recognizing and managing this occupational disease to enhance affected individuals' quality of life and overall well-being. The findings emphasize the need for further research to validate and expand on these results and stress the importance of implementing preventive measures to safe guard the hand health of dentists.

Keywords: Carpal tunnel syndrome, Dental professionals, Dental technicians, Posture, Boston Carpal Tunnel questionnaire, Pain severity.

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Introduction

Carpal tunnel syndrome (CTS) is a complex condition characterized by a constellation of symptoms resulting from the compression of the median nerve at the wrist within the rigid carpal tunnel[1]. One of the conditions that affects the nerves in the hands is carpal tunnel syndrome (CTS), which is often brought on by exposure to vibrations in the wrist. In the general population, CTS occurs 1 to 2% of the time[2].

The carpal tunnel functions as a closed compartment, providing a passageway for the median nerve and several tendons as they traverse from the forearm to the hand. The median nerve, originating from the brachial plexus, comprises roots from C5 to T1, and it courses down the arm alongside the brachial artery[3]. As it enters the forearm, the median nerve navigates between the two heads of the pronator teres before gliding between the flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP). Eventually, the nerve emerges deep into the flexor retinaculum, passing through the carpal tunnel along with four tendons of FDS, four tendons of FDP, and one tendon of flexor pollicis longus (FPL). These structures interact and slide past each other during wrist flexion, creating a dynamic environment vulnerable to compression and inflammation[4].

The primary cause of CTS is the entrapment of the median nerve by an inflamed and swollen transverse carpal ligament, reducing the available space within the carpal tunnel[5]. Furthermore, musculoskeletal imbalances resulting from overuse and underuse of hand and forearm muscles can contribute to the narrowing of the carpal tunnel, making it less capable of withstanding the strain imposed by the flexor muscles. Consequently, individuals affected by CTS experience a range of symptoms, such as numbness, pain, and tingling sensations in the first three fingers and the radial side of the ring finger 3. Nocturnal symptoms, including pain, numbness, and impaired fine motor control, often disrupt sleep, and they are believed to be exacerbated by prolonged wrist flexion or extension during sleep. Prolonged wrist flexion or extension during sleep has been associated with the prevalence of nocturnal symptoms[4].

The condition can impact anyone, but it is most prevalent in the general population, affecting approximately 3.8% of people[6]. However, it has a higher prevalence rate in women (3%-5.6%) than men (0.6%-2.8%). Studies estimate that about 1 out of 20 individuals may experience the effects of CTS. Interestingly, the prevalence rate among women is significantly higher than that of men within the age range of 25 to 55[4].

Despite the diverse nature of CTS, it is more comprehensive than specific demographics or professions. In addition to the general population, specific occupational groups are at an elevated risk of developing CTS due to the repetitive hand movements involved in their work[7]. Musicians, carpenters, farmers, sewers, handloom weavers, meat packers, shoemakers, dental technicians, nurses, clerks, computer operators, and various other professions all fall into this category. Dentists, like many other professions that involve repetitive hand movements, are at an increased risk of developing CTS due to the demands of their work. This suggests that repetitive use of the hand is a significant contributing factor to the development of CTS[8] .

Dentists, in particular, face a notable risk of developing CTS due to the nature of their profession[9]. The constant and repetitive use of dental instruments and the need for precise and delicate hand movements place a substantial strain on the median nerve within the carpal tunnel. As a result, dentists are among the subpopulations at higher risk of developing CTS, which highlights the importance of understanding and addressing this prevalent condition within the dental community[10].

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Researchers have looked into a number of diagnostic methods and standards to validate CTS. Among these are the Tinsel's nerve percussion test, the Phalen's Sign, the wrist flexion test, the reverse Phalen test, the Tourniquet test, the tethered median nerve stress test, the carpal compression test, and lastly the electrodiagnostic test (EDX), which is the gold standard test[11]. The most successful strategy has been proposed as a combination of clinical symptoms and electric conductivity. This could result in the accurate diagnosis of CTS in high-risk populations[12].

Boston carpal tunnel syndrome questionnaire (BCTQ) is a highly valid questionnaire that is easy to administer and helps to identify the severity and functional status of individuals with CTS[13]. The Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) is a validated self-administered tool to assess the severity of symptoms and functional limitations in individuals with carpal tunnel syndrome (CTS). It consists of two subscales: The Symptom Severity Scale, which evaluates the intensity and frequency of CTS symptoms, and the Functional Status Scale, which assesses the impact of CTS on daily activities[13]. The BCTQ is widely used in clinical practice and research to monitor symptom progression and treatment efficacy, providing valuable insights into the patient's well-being and guiding individualized treatment plans[14].

Carpal tunnel syndrome is a prevalent and multifaceted condition that results from compression of the median nerve within the carpal tunnel. Dentists, alongside numerous other professions, requiring repetitive hand movements, face an increased risk of developing CTS due to the demands of their work[15]. Recognizing the prevalence and risk factors associated with CTS in the dental profession can aid in implementing preventive measures and appropriate management strategies to ensure the well-being of dental professionals and mitigate the impact of this condition on their careers and quality of life. Since there are few studies on the prevalence of carpal tunnel syndrome in dental professionals, this study aimed to identify the prevalence of carpal tunnel syndrome in dentists executing complex tasks with the upper extremities

Methodology

This study is cross-sectional research conducted at various Calicut, Malappuram, and Kannur district dental clinics. Before commencing the study, ethical clearance was obtained from the institutional ethical committee. The participants recruited for the study consisted of 145 dental surgeons and dental assistants practicing in the selected areas. The study's inclusion criteria were dental practitioners with a minimum of 5 years of experience in the field and were primarily involved in clinical practice. The selected participants belonged to the age group of 27 to 45 years, encompassing both genders. However, individuals who had pre-existing complaints of upper limb pain, non-clinical practitioners, and those with any wrist or forearm fractures were excluded from the study.

All participants were personally contacted, while some were reached via telephone, and their email IDs were obtained. A Google form with a pre-designed questionnaire using the Boston Carpal Tunnel Syndrome (BCTQ) questionnaire was created. The questionnaire was provided only in the English language, and a consent form was attached at the end of the questionnaire. The study's duration was set to two months. The Google form with the questionnaire was emailed to all participants, allowing them two weeks to complete it.

At the end of the initial two weeks, only 46 forms were returned. In response, reminders were sent to the remaining participants through telephone and messaging. After granting an additional grace period of two weeks, 55 forms were eventually received, resulting in a final dataset of 101 forms for analysis. The collected data were then entered and subjected to statistical analysis using SPSS 24.0 software.

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Results

The demographical representation of the students is tabulated in Table I. The mean age group of participants was 32.80, with male students with an age group of 31.07 years and female students with an age of 32.11 years. Out of 101 study subjects, 59 females and 42 male's prevalence of Carpal Tunnel Syndrome in dentists was 47.5%, and most of the affected subjects were from the 25-35 years of age group. This prevalence study has been done using Boston Carpal Tunnel Questionnaire. This study shows that 14% of dentists experience severe symptoms, and 17% have difficulty in daily tasks.

Table I
Demographic Data

Gender	Sampels	Percentage
Male	42	41.2%
Female	59	58.8%

Table II
BCTQ: Shows the symptom severity scale

Severity	Percentage
Normal	49%
Mild	36%
Moderate	6%
Severe	2%
Very severe	6%

Table III
BCTQ: Shows the level of severity in functional status

Level of Difficulty	Percentage
No difficult	54.40%
Little difficult	28%
Moderate difficult	15%
Intense difficult	2%

Conclusion

This study concluded that the prevalence of Carpal Tunnel Syndrome (CTS) among dentists performing complex tasks with their upper extremities is 47.5%. Age, years of working, and hours worked per day were identified as factors affecting the incidence of CTS. Further research is needed to validate and expand on these findings, emphasizing the importance of preventive measures for dentists' hand health.

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Conflict of Interest: Authors declare no conflict of interest

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