

Prevalence of Carpel Tunnel Syndrome as an Occupational Risk Hazard among Dentists Working In North India- A Cross Sectional Study

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Abstract

Background: Dentistry is a profession which deals with skillful activity of hand in small workplace as patient’s mouth. Continuous static posturing can lead to Carpal Tunnel Syndrome of hand & wrist very often. Carpal tunnel syndrome (CTS) is a commonest musculoskeletal disorder seen among Dentists.

Aim & Objective: To determine the prevalence of musculoskeletal disorders (MSDs) developing among dental professionals and to explore the potential differences among distinct dental specialties.

Material & Methods: A cross-sectional study was conducted on 300 practicing dentists of different specialities especially Orthodontics, Endodontics, Periodontics and Oral Surgery in North India. A self-

administered two-part questionnaire consisting of demographic details of the individual and work characteristics in the first part and the Boston CTS questionnaire consisting of the second part was used and distributed through electronic media. Data was analysed by multiple logistic regression analysis using SPSS software 20.

Results: Among the dentists who participated in the study, 39.5% were males and 60.4% were females, the maximum number of dentists were in the age group of 25–50 years and 56.3% held a master degree. A total of 12.7% of dentists reported with symptoms of CTS, that includes general dentists and specialities. Endodontics were most affected specialty (23.01%) followed by Periodontics

(14.28%). The least affected speciality was Orthodontics (6.79%).

Conclusion: The prevalence of CTS among dentists in this study population is relatively high, and awareness of the condition and method to prevent it needs to be implemented.

Keywords: Carpel Tunnel Syndrome, Dentistry, Musculoskeletal disorder, Occupational disease.

Introduction

Dentists and Dental Hygienists frequently have musculoskeletal disorders involving the upper limbs. Studies show that dentists have a high frequency of finger related and other upper-limb symptoms [1] and a high prevalence of osteoarthritis involving the distal interphalangeal joints. [2] The physical stress of dental hygiene practice is an occupational risk factor for developing musculoskeletal disorders (MSD). The well-documented, high incidence rate of work-related MSDs among Dental Professional's attest to the trauma exerted on the practitioner. [3,4] In practice, clinicians use highly repetitive arm, hand and wrist motions for extended periods of time causing physical stress. Dental practitioners may require the clinician to hold his or her wrist in awkward positions for long periods of time adding to the risk for cumulative trauma, muscle disorders and Carpal Tunnel Syndrome. Researchers have been challenged with determining exact etiology and preventive strategies for Dental practitioners since MSDs threaten work productivity, income, career longevity and health of the professionals affected.[5]

Various strategies have been suggested to minimize risk factors associated with MSDs which include the use of powered scaling devices, larger diameter instrument handles and improved work pacing. Dentistry demands continuous use of the hands and includes several risk factors involving the upper limbs [6, 7]. Work-related risk

factors for Carpal Tunnel Syndrome include repetitive forceful pinching and non-neutral wrist positions. Especially dentists use their thumb, index and middle fingers in precision gripping [8,9]. In addition, a long work history of dental filling and root canal treatment, as well as a high body mass index (BMI), seems to be associated with frequent finger symptoms that are perceived as being vibration-related by dentists.

Carpal Tunnel Syndrome is one of the most common disorders of the upper extremities and the most prevalent compression neuropathy. Brain (1947) and George Phalen (1950) have been responsible for the recognition of Carpal Tunnel Syndrome (CTS) as a disease entity; however, the term "Carpal Tunnel Syndrome" was first used by Kremer et al. in 1953. The American Academy of Orthopedic Surgeons (AAOS) Clinical Guidelines on the Diagnosis of CTS defines it as a symptomatic compression neuropathy of the median nerve at the level of the wrist [10]. CTS can lead to pain, numbness or tingling in the thumb, index finger, middle finger and half of the ring finger. Physiological evidence indicates increased pressure within the carpal tunnel, and therefore decreased function of the median nerve at that level. In dentistry, repetitive movements of wrist during exfoliation and canal cleaning can compress median nerve leading to CTS. This cross-sectional questionnaire-based study aimed to assess the prevalence of CTS among the Dental Professionals and in different specialties of Dentistry.

Materials and Methods

The cross-sectional questionnaire-based study was conducted from May 2020 to July 2020, among the Dental professionals and in different specialties of Dentistry. Prior to start of the study, a protocol and purpose of the present study was discussed with the participants and included those participants who are willing to participate in the study. A sample size of 300 Dental Professionals

and in different specialty of Dentistry such as Orthodontics, Endodontics, Periodontics and Oral Surgery in North India were selected and duration of study was three months.

Inclusion Criteria

1. Participants willing to participate.
2. Participants who filled the entire questionnaire.
3. Both male and female dentists were selected
4. Subjects were selected from any private and government hospitals.
5. Age group was 25-50 years
6. Subjects who had an experience of more than 1 year
7. Subjects without underlying pathology, non-obese and non-smokers were included in the study

Exclusion Criteria

1. Subjects who had major accident or major surgery in any part of the body
2. Dentists who were suffering from Diabetes, Rheumatoid Arthritis, Thyroid Gland Disease and Wrist Fractures and having wrist swelling were excluded.
3. Pregnancy, obesity and smokers were also excluded from the study.

Questionnaires

A self-administered two-part questionnaire was distributed to Dental Practitioners. The first part consisting of questions on sociodemographic data related to age, gender working experience, education level, and area of specialization of the subjects. The second part of questionnaire consists of The Boston Carpel Tunnel questionnaire related to numbness, tingling and pain in the fingers or hand during the day or night was to be filled in by the participants. The questions assessing the difficulty in performing selected dental procedures were included to analyze the frequency of CTS in particular specialties. The scale consisted of 11 questions with multiple-choice

responses, scored from 1 point (mildest) to 5 points (most severe). The overall symptom severity score (SSS) was calculated as the mean of the scores for the eleven individual items. The functional status scale (FSS) assessed the effect of the CTS on daily living. The scale consisted of 8 questions with multiple choice responses, scored from 1 point (no difficulty with the activity) to 5 points (cannot perform the activity at all). The overall score for functional status was calculated as the mean of all eight. Thus, a higher symptom severity or functional status score indicated worse symptoms or dysfunction. All data was analyzed by multiple logistic regression analysis using SPSS software, version 20 ($\alpha = 0.05$).

Results

Out of 300 study subjects, a total of 220 responded positively by participating in this study. In this way, the response rate was 73.3%. Rest of the subjects either didn't participate or didn't complete the questionnaire. Missing data was excluded from the analysis.

As shown in Table I, the participating dentists were categorized into different working experience groups. Results found that percentage of CTS increased with the increasing job or working experience. An overall CTS% among dentists having working experience of 2-5 years, 6-10 years, 11-15 years and 16-20 years was found to be 13.0%, 15.4%, 10.0% and 12.5% respectively. No major difference could be found in the rate of CTS cases in both the genders. The total prevalence among the dentists working in North India was 12.7%.

Among the respondents, the distribution of participants' frequency is given in Table II. Table III shows the CTS syndrome according to different specialties among the participants. Endodontists were more prone to CTS i.e. 23.01%. Declining trend was shown in Periodontists i.e. 14.28%, Oral Surgeons 12.25%, General Dentists 7.01% and least affected were the orthodontists i.e. 6.79%. Table

IV shows the effect of working hours per day of the Dental Practitioners and its relation with incident of CTS.

Discussion

Carpal Tunnel Syndrome (CTS) is the most common peripheral nerve entrapment in the arm and contributes to one of the most frequently performed hand surgeries in the United States.¹¹ It is caused by compression of the median nerve at the wrist. CTS can lead to pain, numbness or tingling in the thumb, index finger, middle finger and half of the ring finger.

Chronic hand and wrist pain that can affect quality of life, productivity or career longevity is experienced by 40 and 70 percent of Dental Professionals. High repetition, force, duration and flexed wrist are four primary risk factors that contribute to occupational CTS in Dentistry. All these four factors cause microtrauma and compression of median nerve and fibrosis and edema of the lining of the tendons at the wrist eventually cause increased pressure within the carpal tunnel and decreased blood flow to the median nerve within the tunnel. The swelling of the lining of the tendons is often painful, and it is the pressure on the median nerve at the wrist from this swelling that causes numbness in the fingers and weakness of the muscles at the base of the thumb.

The present cross-sectional study evaluated the prevalence of CTS among 300 Dental Professionals with different ages, years of working experience and working hours per day. According to this study, the prevalence of CTS among Dentists in North India is 12.7%, with an increased prevalence among Periodontists and Endodontists when compared to other specialties of Dentistry. The comparison regarding CTS among different dental specialties provides more fresh and in-depth understandings to this issue. The studies conducted by B. Valachi in 2008 stated that the work carried on certain

specialties in Dentistry has increased incidence of Carpal Tunnel Syndrome.[12]

In the present study, results show that Endodontists and Periodontists show higher frequency of CTS symptoms i.e. pain numbness and tingling sensation. The repetitive movements performed during scaling and root planning or the vibration of the ultrasonic scaler could be the possible reason for the increased prevalence among Periodontists. The vibrations of the high as well as low-speed handpieces during tooth preparation as well as the repetitive movements performed during the biomechanical process of cleaning and shaping of the root canal are the probable cause of increased prevalence among Endodontists. Nancy Carter described that CTS is particularly associated with dentists involved in certain tasks including repetitive hand motion, awkward hand position, strong gripping, mechanical stress on the palm and vibration.[13]

Karwaski et al. reported that the symptoms are a product of many risk factors including prolonged static postures, repetitive movements, and poor positioning.[14] Ratzen on the other hand, linked musculoskeletal pain occurrence in the dentists to the frequent assumption of static postures, which usually requires more than 50% of the body's muscles to contract to hold the body motionless, while resisting gravity. The static forces resulting from these postures have been shown to be much more tasking than dynamic forces. Repeated prolonged static postures are thought to initiate a series of events that could account for pain, injuries, or career-ending problems seen in MSDs.[15]

A number of studies have been done in literature such as Hamann et al., 2001, Stenz et al., 1994 and Ghousoub et al., 2005 which have evaluated the symptoms of carpal CTS among the Dental Professionals, but comparatively lower to that of the studies of Anton et al., 2002 and Fish

et al in 1998, Lalumandier et al., 2004 and Werner et al in 2002 and Purine et al in 2008 and their results are similar to our present study.

In the present study, 39.5% were males and 60.4% were females with mean age of 36 years. In another study conducted on dentists in North America, the mean age was 38 years. In a study conducted in Mangalore, India, the mean age was 29.05 years. Study conducted in Karachi the female dentist's percentage was high (59%) compared to male dentist's percentage (41%). The present study was conducted on the basis of Boston Carpel Tunnel questionnaire[16] (BCTQ) also called Levine scale, Brigham and Women Carpal Tunnel Questionnaire and Carpal Tunnel Syndrome Instrument. It is a patient-based outcome measure that has been developed specifically for CTS. The BCTQ has been used as an outcome measure in clinical studies, and has also undergone extensive testing for validity, reliability and responsiveness for knowing the prevalence of CTS. It is used for exploring the prevalence and association of symptoms of CTS and functional assessment among dentists in the Indian subcontinent.

As this cross-sectional study is questionnaire based, recall bias by the participants could be a limitation of the study; furthermore, nerve conduction tests of the participants would provide more accurate results, but this method is time-consuming and requires a great deal of cooperation from study respondents.

Conclusion

This study concludes that Dental Professionals are more prone to develop hand problems and CTS. The study revealed that various socio-demographic variables contributed to the MSDs experienced by the Dental Surgeons. The importance of ergonomics and its application in Dentistry is another possible intervention. The syllabus in Dental Schools should include chapters on ergonomics including stress relief exercises and

strengthening exercises to overcome risk factors. Further studies are needed to confirm the present results with the use of electro diagnostic procedures and hand diagrams taking into account the possible synergistic effect of workload, vibrations and use of other gadgets and sports related activities.

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Legend Tables

Table 1: Charting the distribution of Pain, Numbness, and Tingling sensation among the Dental Practitioners according to their year of practice

Year of Practice	Pain (Day)		Pain (Night)		Numbness		Tingling Sensation		Weakness in Hand		Pain, Numbness and Tingling sensation TOTAL	Male & Female CTS (frequency)		Male & Female CTS in %		Overall CTS % M&F	Mean %
	M	F	M	F	M	F	M	F	M	F		M	F	M	F		
2-5 years	21	26	20	27	20	24	21	29	20	22	20	4/34	10/69	11.7	14.4	13.0	12.7
6-10 years	9	20	8	20	9	17	23	20	19	18	21	7/44	9/60	15.9	15	15.4	
11-15 years	6	4	5	3	3	5	6	6	6	6	1	1/5	0/2	20	0	10	
16-20 years	1	1	1	1	1	1	2	3	2	3	0	1/4	0/2	25	0	12.5	
Total	37	51	34	51	33	47	52	58	47	49	42	13/87	19/133				

Table 2: Frequency and percentage frequency of General Dentists and Specialists according to their working experience

Specialist	Working Experience					
	2-5 years	6-10 years	11-15 years	16-20 years	Frequency	%Frequency
General Dentist	92	21	2	2	117	53.18%
Periodontist	10	35	2	0	47	21.36%
Oral Surgeon	0	26	1	2	29	13.18%
Endodontist	0	12	1	0	13	5.90%
Orthodontist	1	10	1	2	14	6.36%
Total	103	104	7	6	220	100%

Table 3: Frequency of CTS among General Dentists and Specialists

Specialist	Carpel Tunnel Syndrome CTS (Pain, Numbness and Tingling Sensation)					
	2-5 years	6-10 years	11-15 years	16-20 years	Frequency	%Frequency
General Dentist	8	7	0	0	15	7.01%
Periodontist	2	3	2	0	7	14.28%
Oral Surgeon	0	2	1	2	5	12.25%
Endodontist	0	7	2	3	11	23.01%
Orthodontist	0	3	2	0	5	6.79%

Table 4: Prevalence of CTS among participating dentists on the basis of number of working hours/days

Gender	Age Mean: 36 years		Min: 23 years		Max: 48years	
Male	87	Male %	39.5%	Female	133	Female% 60.4%
Working hours/day	Frequency	% Frequency		CTS	CTS%	
≤ 3 hours	32	14.54%		1	2.85%	
≤ 5 hours	85	38.63%		12	11.75%	
≤ 8 hours	103	46.81%		25	9.06%	