# PREVALENCE OF UPPER EXTREMITY NEUROPATHY IN A CLINICAL DENTIST POPULATION

JOHN W. STOCKSTILL, D.D.S., M.S.; STANTON D. HARN, PH.D.; DANIEL STRICKLAND, PH.D., RON HRUSKA, P.T.

ABSTRACT

**When asked about altered sensation in hands or arms, forearms, cervical area or neck, 29 percent of Nebraska dentists surveyed said they felt pain, followed by numbness and tingling. The prevalence suggests the possibility of an occupational concern.**

Acute and chronic cervical and back pain related to injury and disease is a significant problem in the general population. Neck pain in general may involve nearly all of the population at some time and about 10 percent at any one time—with or without radicular pain in the arms.[1]

Back pain occurs in about 70 percent of adults at some point in their lives. While this same or similar peripheral pain may be caused by systemic disorders such as diabetes, aging or malignancies,[2] more often it is tied to the biomechanics of work-related movement.[3] Work-related disorders involving repetitive movements and cumulative loading include tendonitis, tenosynovitis, ulnar nerve entrapment, median nerve entrapment, radial nerve entrapment, carpal tunnel syndrome and thoracic outlet syndrome.[4-7]

One such disorder commonly associated with altered sensations of the upper extremities or peripheral neuropathy is thoracic outlet syndrome, a diagnostically controversial classification of neurogenic and vascular disorders pertaining to the upper thoracic and cervical regions. The term "thoracic outlet" refers to the area between the base of the neck and uppermost part of the thorax and axilla. The area most commonly involves the compression of the subclavian artery or vein, brachial plexus or any combination of these.[2]

Another commonly diagnosed disorder, carpal tunnel syndrome, has been linked to chronic, repetitive movements of the upper extremities (hands, wrists). The incidence of this particular disorder in the general population has been documented.[8] Efforts have been made to investigate CTS in the dental hygiene profession, especially with the cumulative loading effect of repetitive movements on the extremities.[9-12]

In any profession, repetitive motion injuries and neuropathic disorders have a profound impact on the quality and quantity of time and energy expended. But professions most dependent on upper extremity movement—such as dentistry— are at great risk. Loss of technical skills as a result of upper extremity injury and involvement has been reported more frequently in the work environment.[8-16]

With these concepts in mind, we formulated a survey focusing on two major points:

- What is the prevalence of upper extremity neuropathies in practicing dentists in Nebraska?
- What associations exist between the occurrence of this class of disorders and work-related conditions?

## REVIEW OF LITERATURE

Along with the general acceptance of a disease entity as present within the general population, it is most important that incidence or prevalence data concerning this disorder be established, especially in those groups of individuals sharing some common demographic or occupational factors. Several studies have been done to determine the prevalence of this group of neuropathic disorders in dental hygiene.[13,14]

One investigation used vibrometry to assess the degree

**TABLE 1**

**REPORTED SYMPTOMS BY RIGHT AND LEFT HAND DOMINANCE**

| Dentists with symptoms | Dominant hand | | Total |
|---|---|---|---|
| | Left | Right | |
| Yes | 14<br>4.84 | 275<br>95.16 | 289<br>100.00 |
| No | 80<br>11.17 | 636<br>88.83 | 716<br>100.00 |
| **Total** | **94**<br>**9.35** | **911**<br>**90.65** | **1,005**<br>**100.00** |

$\chi^2 = 9.7272; P = .002$.

of sensory nerve entrapment in a group of 58 dental hygienists.[9] Of those tested, 15 (25.9 percent) had identifiable carpal tunnel symptoms and seven (12.0 percent) had diagnosed median nerve dysfunction. Before the vibrometric testing, the participants had completed a questionnaire concerning risk factors involved in carpal tunnel syndrome. Test results indicated that those hygienists subjectively reporting symptoms tended to have lower vibrogram scores when compared to an asymptomatic group. Scores were based on the participants' ability to perceive a standardized vibratory stimulus—the lower the score, the weaker the vibratory sense in the tested hand. No attempt was made to compare the questionnaire responses statistically with the vibrometry testing results.

Other studies have examined the prevalence of these repetitive motion injuries in poultry processing[15] as well as the microelectronics industry.[16] Associated musculoskeletal pain (neck, shoulder, lower back) has been investigated as it relates to clinical dentists.[17,18] Little if any data are available concerning the prevalence of these disorders or upper extremity neuropathies in a similar professional population.

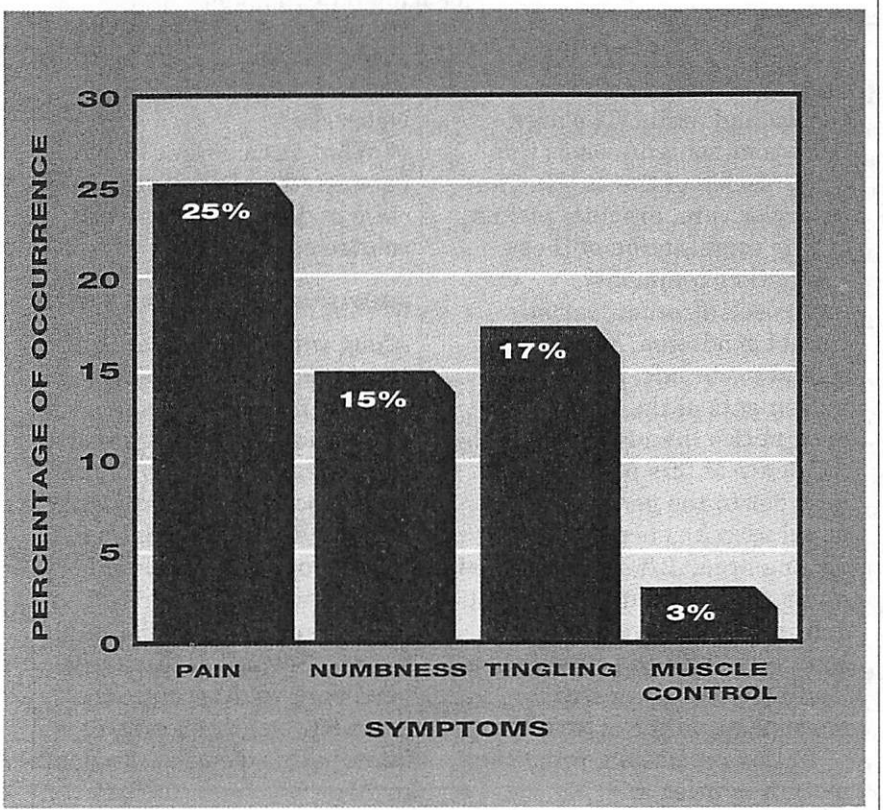


**Figure 1. Symptoms and percentage of their occurrence reported by Nebraska dentists.**

## METHODS AND MATERIALS

All licensed dentists in Nebraska were sent a 24-item mail questionnaire during late summer in 1991, with a follow-up mailing in the late fall. A cover letter explaining the significance and intent of the study was included with a consent form. The questionnaire and consent form were returned to the primary author in a stamped, addressed envelope. Initial response was 66 percent. The total returned after the second mailing was 1,016 of 1,041, for a final response rate of 98 percent.

All respondents were asked for demographic information and some questions regarding their practice. These included years in practice, dominant

hand, most common position of patient to dentist when working, employment of a chairside assistant, history of altered sensations in upper extremities and type of practice.

Dentists were asked if they had symptoms of peripheral neuropathy described as "altered sensation in your upper extremities (hand or hands, forearm, arm, cervical area/neck)." They were asked to categorize the sensations as "pain, numbness, tingling or loss of muscle control." Those respondents reporting symptoms were asked for details on their symptoms such as specific site, characterization, physician diagnosis, duration of symptoms, days of work missed because of symptoms, treatments, dental procedures commonly performed and procedures that exacerbated symptoms.

Statistical analysis was restricted to descriptive techniques including proportion of respondents reporting symptoms, demographic description and measures of central tendency for continuous variables. Where contingency tables showed differences in proportions, the role of change in and strength of those differences was assessd by estimation of odds ratios with associated confidence limits.

**TABLE 2**

**SEVERITY OF DISEASE BY FREQUENCY AND DURATION OF SYMPTOMS AND DAYS OF WORK MISSED.**

| Frequency of symptoms (%) | | Duration of symptoms (%) | | No. days missed from work (%) | |
|---|---|---|---|---|---|
| Constant | 16 | Before career in dentistry | 12 | None | 24 |
| Nighttime | 23 | After involvement in dentistry | 25 | <5 days | 3 |
| Daytime | 37 | | | >5 days to <15 days | 1 |
| While working with hands | 41 | | | >15 days | 2 |

## RESULTS

Most respondents were in mid-30s to early 40s in age, with only 7 percent women. There was an even distribution of years in practice with 28 percent in practice more than 25 years. Dentists worked more often with their patients supine, 92 percent worked with a chairside assistant. The type of practice for 960 respondents was general dentistry. There were 17 orthodontists, 11 periodontists, eight oral and maxillofacial surgeons, eight

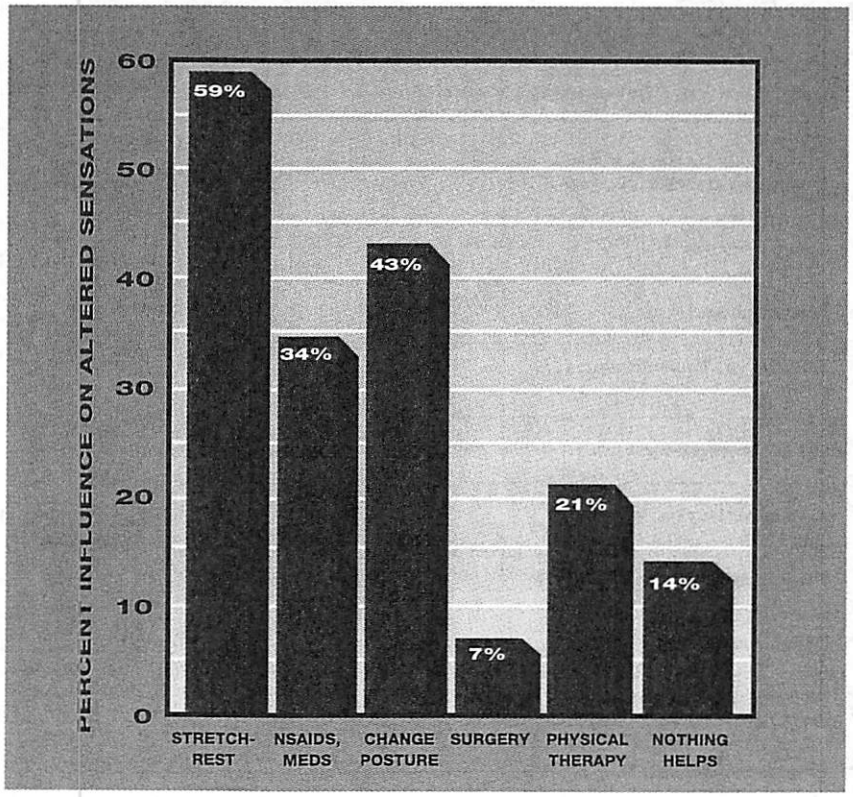


**Figure 2. Resolutions of altered sensations by respondents.**

**TABLE 3**

**PROCEDURES PERFORMED AND REACTIONS IN FREQUENCY, INTENSITY, DURATION (N = 294).**

| Procedures performed | | |
|---|---|---|
| | N | (%) |
| Crown and bridge | 144 | 49 |
| Operative | 17 | 6 |
| Endodontics | 19 | 6.4 |
| Prophy, scaling, etc. | 11 | 4 |
| Oral surgery | 10 | 3.4 |
| Orthodontics | 6 | 2 |
| Periodontics | 8 | 2.7 |
| Pediatric | 0 | 0 |
| Miscellaneous procedures | 28 | 9.5 |
| Not applicable | 31 | 10.5 |
| **Frequency, intensity, duration of reactions** | | |
| | N | (%) |
| Crown and bridge | 144 | 49 |
| Operative | 17 | 6 |
| Endodontics | 18 | 6.1 |
| Prophy, scaling, etc. | 11 | 4 |
| Oral surgery | 15 | 5.1 |
| Orthodontics | 4 | 1.3 |
| Periodontics | 12 | 4 |
| Pediatric | 0 | 0 |
| Miscellaneous procedures | 21 | 7.1 |
| Not applicable | 53 | 18 |

prosthodontists, six pediatric dentists, five endodontists and one operative dentist.

Of the 1,016 respondents, 294 reported symptoms of peripheral neuropathy, a prevalence rate of 29 percent. Of these, 154 (25 percent) reported pain, 95 (15 percent) reported numbness, 103 (17 percent) reported tingling and 19 (3 percent) reported loss of muscle control. Respondents sometimes reported more than one symptom, resulting in responses greater than a single response per participant. The symptom reported as occurring most often was pain followed by tingling, numbness and loss of muscle control (Figure 1).

Of the initial questions asked, only the dominant hand differed by symptomatic status. Only 4.8 percent of the symptomatic were left-handed compared with 11.2 percent of the non-symptomatic (Table 1).

The odds ratio of risk for symptoms in right-handed dentists is 2.5 with a 95 percent confidence interval of 1.4 to 4.5. The interpretation is that right-handed dentists are 2.5 times more likely to report symptoms of peripheral neuropathy. Responses for this particular question were received from 1,005 dentists. Only 11 failed to answer this question.

Severity of disease was measured in several ways: the frequency and duration of symptoms and the number of days of work missed because of the condition (Table 2). Multiple choices were made by the survey participants in several categories, resulting in responses greater than a single response per participant.

Days of work missed because of the condition were not

associated significantly with age, years in practice, type of practice or patient position. Neither were days missed associated with any particular dental procedures. There was no statistically significant difference between specialists and generalists as to their responses to the questions.

When questioned about how symptoms were relieved or reduced, responses included halting the dental procedure, stretching and resting (59 percent); anti-inflammatory medication (34 percent); changing posture (43 percent); surgery (7 percent); physical therapy (21 percent). In 14 percent of the symptomatic respondents, none of the listed treatments helped in resolving the pain, numbness, tingling and/or loss of muscle control experienced by the clinician. Multiple responses to the questions are reflected in the survey data (Figure 2).

Frequency of symptoms was not associated significantly with age, years in practice, type of practice or patient position. Frequency of symptoms was positively associated with the question "Which procedure might you be performing when altered sensations are noticed?" and "What procedure increases the frequency, intensity and/or duration of these altered sensations?" Respondents with more frequent symptoms answered "crown and bridge" more often to these two questions. They did not differ on type of procedure most commonly performed. Multiple responses were anticipated and reported. Responses may not equal 100 percent.

TABLE 4

SITE OF NEUROPATHY.

| Location | (%) |
|---|---|
| Cervical | 45.7 |
| Arm (unspecified side) | 24.3 |
| Left arm | 11.4 |
| Right arm | 13.3 |
| Forearm (unspecified side) | 26.4 |
| Left forearm | 12.7 |
| Right forearm | 19.4 |
| Elbow (unspecified side) | 11.4 |
| Left elbow | 4.9 |
| Right elbow | 7.6 |
| Hand (unspecified) | 55.8 |
| Left hand | 32.0 |
| Right hand | 44.2 |
| Thumb | 30.2 |
| Index finger | 25.6 |
| Middle finger | 22.8 |
| Ring finger | 22.3 |
| Smallest finger (fifth digit) | 19.8 |

## DISCUSSION

A survey with nearly complete coverage of licensed dentists in Nebraska found 29 percent responded positively to the question: "Do you have a past or present history of any altered sensation in your upper extremities (hand or hands, forearm, arm, cervical area/neck)?" When asked to characterize the altered sensation, the most frequent response was pain followed by numbness and tingling. The symptoms suggest peripheral neuropathy and the prevalence is high enough to suggest the possibility of an occupational component to the etiologic factors in this particular group.

The initial questions asked

Dr. Stockstill is associate professor, Adult Restorative Dentistry, University of Nebraska Medical Center, College of Dentistry, 40th and Holdrege, Lincoln, Neb., 68583-0740. Address reprint requests to Dr. Stockstill.

Dr. Strickland is assistant professor, Department of Societal and Preventive Medicine, University of Nebraska Medical Center.

of all respondents were designed to address concerns such as association of age or years of practice with a greater proportion of symptoms. We found that only the dominant hand factor differed by symptomatic status.

When only symptomatic subjects are analyzed, the number of symptoms is associated with age. This is open to a number of interpretations, ranging from more reporting of complaints in older subjects to a more advanced condition resulting from years of exposure to some hazard, presumably occupational. When asked "Which procedure might you be performing when altered sensations are noticed?", subjects responded "crown and bridge" significantly more often. This response suggests that future investigations should examine components of dental procedures and their frequency to assess the possible contribution to occupational symptoms.

While the question of nonoccupational exposures was not addressed directly, the large proportion who reported symptoms resulting from specific aspects of dental practice suggests that most develop symptoms as a result of occupational exposures. Future research, however, should assess external factors as well.

Finally, the issue of subjective reporting vs. objective testing should be addressed. While an earlier study investigated the relationship between subjective reporting and vibrometry testing in hygienists,[9] our survey focused primarily on the number of dentists reporting some symptom or symptoms of peripheral neuropathy. Data collected from this study are being used as the foundation for a clinical study investigating the relationship between subjective symptom reporting and nerve conduction studies in symptomatic dentists vs. asymptomatic controls. The validity and reliability of survey responses vs. actual nerve conduction change will be studied.

## CONCLUSION

In a descriptive study of occupational upper-body symptoms in Nebraska dentists, 29 percent reported some altered sensation. This suggests the possibility of a high prevalence of conditions that may affect ability to perform dental techniques. This study provides estimates of exposures and outcomes necessary for the design of more detailed studies aimed at relating self-reported symptoms to objective measurements of peripheral neuropathy. ■

The authors thank Mrs. Terry Shipshock for technical assistance in development of this research project.

1. Lawrence J. Disc degeneration, its frequency and relationship to symptoms. Ann Rheum Dis 1969;28:121-5.
2. Cornblath D. Peripheral neuropathy. In: Tollison C, ed. Handbook of chronic pain management. Baltimore: Williams & Wilkins; 1989:424-9.
3. Kelsey JL, et al. The impact of musculoskeletal disorders on the population of the United States. J Bone Joint Surg 1977; 61A(10):959-63.
4. Szabo R, Gelberman R. The pathophysiology of nerve entrapment syndromes. J Hand Surg 1987;12(5, part 2):880-4.
5. Conway S, Jones H. Entrapment and compression neuropathies. In: Tollison C, ed. Handbook of chronic pain management. Baltimore: Williams & Wilkins; 1989: 440-3.
6. Pratt N. Neurovascular entrapment in the regions of the shoulder and posterior triangle of the neck. Phys Ther 1986;66(12):1894-9.
7. Gordon R. Non-articular rheumatism—miscellaneous nonarticular syndromes. In: Katz W, ed. Rheumatic and granulomatous diseases. In: Rose L, Kaye D, eds. Internal medicine for dentistry; Section 3, 32:84-6, 2nd ed. St. Louis: Mosby; 1990.
8. Stevens J, Sun S, Beard C, O'Fallon W, Jurland L. Carpal tunnel syndrome in Rochester, Minn., 1961 to 1980. Neurology 1988;38:134-8.
9. Conrad J, Osborn J, Conrad K, Jetzer T. Peripheral nerve dysfunction in practicing dental hygienists. J Dent Hyg 1990;64(8):382-7.
10. Osborn J, Newell K, Rudney J, Stoltenberg, J. Carpal tunnel syndrome among Minnesota dental hygienists. J Dent Hyg 1990;64(2):79-85.
11. Hall C. The carpal tunnel syndrome. Occup Probl Med Pract 1986;1:1-6.
12. Silverstein B, Fine L, Armstrong T. Occupational factors and carpal tunnel syndrome. Am J Ind Med 1987;11(3):343-58.
13. Macdonald G, Robertson M, Erickson J. Carpal tunnel syndrome among California dental hygienists. J Dent Hyg 1988;62:322-8.
14. Bauer M. Carpal tunnel syndrome: an occupational risk to the dental hygienist. J Dent Hyg 1985;59:218-21.
15. Armstrong T, Foulke J, Joseph B. Investigation of cumulative trauma disorders in a poultry processing plant. Am Ind Hyg Assoc J 1982;43(2):103-16.
16. Morse L. Repetitive motion musculoskeletal problems in the microelectronics industry. State of the art reviews. Occup Med 1986;1:167-74.
17. Lehto T, Helenius H, Alaranta H. Musculoskeletal symptoms of dentists assessed by a multidisciplinary approach. Community Dent Oral Epidemiol 1991;19:38-44.
18. Shugars D, Miller D, Williams D, Fishburne C, Strickland D. Musculoskeletal pain among general dentists. Gen Dent 1987;35(4):272-6.

Dr. Harn is associate professor, Department of Oral Biology, University of Nebraska Medical Center, College of Dentistry.

Mr. Hruska is director, Department of Physical Therapy, St. Elizabeth's Hospital, Lincoln, Neb.