Indian Journal of Dental Education
Volume 5 Number 1, January - March 2012

Original article

Work-related musculoskeletal disorders among dental professionals: An evidence-based update

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ABSTRACT

Background: Numerous studies have reported prevalence rates for work-related musculoskeletal disorders (WRMSD) among dental professionals (DP).

Objective: The objective of this paper is to update the dental professionals, physical therapists, occupational therapists, epidemiologists and ergonomics specialists with the growing evidence on WRMSD in DP through a systematic literature search.

Materials and methods: Systematic review of studies in MEDLINE from 1972-2010 was conducted using search terms dental OR dentist AND work-related OR musculoskeletal IN title OR abstract for English articles. Consensus was obtained after independent blinded search and overall findings were summarized.

Main findings: Thirty-four included articles were heterogenous and studied all categories of DP which found one-year prevalence for MSK pain was from 24-100%. Neck and shoulder pain were the greatest prevalent MSK symptom. Most of the reported symptoms were chronic and recurrent.

Conclusion: There was an overall very high prevalence of MSK pain among DP. Among DP, dental hygienists and dental students were more affected with MSK symptoms. The risk factors highly predictive of developing MSK pain were biopsychosocial and further research on prevalence in Indian dental population is warranted before implementation of preventive educational programmes among dentists.

Key words: occupational disorders, prevalence, public health, dental education

INTRODUCTION

Oral healthcare providers (OHP) or dental professionals (DP) include dentists, dental assistants, dental hygienists, dental students, dental nurses, dental laboratory workers, dental technicians and dental office workers.[1] Work-related musculoskeletal disorders (WRMSD) are problems of the musculoskeletal system that significantly cost workplace problems thus affecting occupational health, productivity and career of the working population.[2] Like all other professionals, DP are exposed to occupational health hazards which predispose them to develop a multitude of health problems.

A study by Jacobsen et al[3] in their survey of dental laboratory technicians found biannual period prevalence of health problems to be 79%. Among those with health problems, musculoskeletal problems were among 68%; dermal (34%); respiratory (31%); neurological (26%); systemic (19%) and eyesight/hearing problems (15%). The study demonstrated the magnitude of musculoskeletal problems in comparison to other health problems among DP. Another study by Murtomaa[4] in a survey

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(Received on 31.07.2011, accepted on 26.08.2011)

of 68 dentists and 90 dental assistants found report of occupational disorders among 31% of dentists and 12% of dental assistants. Among them 31% of affected dentists and 10% of affected assistants reported having been of sick leave. Most common disorders were back and neck musculoskeletal disorders, stress and allergic rashes.

Though other authors reported risk factors and associated prevalence for non-musculoskeletal disorders[5-9] among DP, the magnitude and proportion of symptoms due to musculoskeletal disorders is so huge and has an enormous impact on the quality of life of DP.

Objectives of the review

The objective of this paper is to update the dental professionals, physical therapists, occupational therapists, epidemiologists and ergonomics specialists with the growing evidence on WRMSD in DP through a systematic literature search.

Methods of the review

Independent search was conducted by two testers independently using search terms dental OR dentist AND work-related OR musculoskeletal IN title in National Library of Medicine- MEDLINE (www.pubmed.com) website. The retrieved citations and articles were appraised and mutual consensus was obtained in presence of the third tester. The included articles were then grouped qualitatively under overall prevalence, region of involvement, risk factors, impact, and treatments taken for WRMSD among DP.

RESULTS

Our search yielded 55 citations from 1972 to 2010. Of the 55 articles, we excluded non-English articles (12 papers), letters to editor (4 papers) or commentary articles (5 papers). Thus final number of included articles was 34.

Main findings

Prevalence

There were twelve studies on prevalence of MSK symptoms among DP.

Dental professionals

Four studies evaluated the prevalence of musculoskeletal (MSK) pain in general, among dental professionals as a single group that comprised of two or more categories of professionals in dental healthcare.

Dajpratham et al[10] performed their survey on 164 dental personnel and surprisingly high number of 158 participants (96.3%) reported presence of musculoskeletal pain. Of those with pain, 32 (20.3%) were clinical instructors, 52 (32.9%) were post-graduate students and 74 (46.8%) were dental assistants. Hayes et al[11] in their review found an overall prevalence of musculoskeletal pain among dental professionals (dentists, dental hygienists and dental students) was 64-93%.

Sartorio et al[12] in their review found a prevalence of work-related musculoskeletal disorders ranging from 54-93% among dental professionals (dentists, dental hygienists, dental auxiliaries). Lalumandier et al[13] surveyed 5,000 dental personnel, dentists and dental auxiliaries and found prevalence of atleast one MSK symptom in the previous year among all the three groups.

Dental hygienists

Two studies evaluated prevalence among dental hygienists population. Anton et al[14] in their survey of 95 dental hygienists found that at least one MSD was reported by 93% of the studied sample. Prevalence of carpal tunnel syndrome symptoms was 42%. Osborn et al[15] found among 493 dental hygienists that 68% had MSK pain in eight bodily locations during previous year.

Dental students

Five studies evaluated prevalence among dental student population. de Carvalho et al[16] in their study on 227 Brazilian dental students found an overall prevalence of musculoskeletal pain during or after clinical work in 173 students thus amounting to 76.2%. Thornton et al[17] in their survey of 590 dental students reported one-year prevalence of musculoskeletal symptoms among 61% which they felt during their clinical work. Abou-Atme et al[18] found in their five-year follow-

up of dental students that temporomandibular joint (TMJ) pain, TMJ sounds, upper back pain and lower back pain had generally increasing trends from the first and second years to the third year and then a trend towards decrease until the fourth and fifth years.

Tezel et al[19] found prevalence of neuropathic symptoms co-existing with MSK pain among left- and right- handed dental students- weakness (42%, 40%), pins and needles (35%, 22%) and numbness (23%, 19%). Melis et al[20] in their survey on 392 dental students found greatest prevalence of headache followed by lower back pain versus a control comparison group of 114 psychology students.

Influence of Dental work category

One study compared the prevalence rates between different categories of dental professionals. Rice et al[21] found that among three categories of 45 dental workers (overall prevalence of 75.6%)- dentists, dental assistants and dental hygienists, the third group- dental hygienists had greater prevalence of MSK symptoms and was at greater risk for developing upper extremity symptoms, carpal tunnel syndrome (CTS) and back pain.

Region of musculoskeletal pain

Nine studies evaluated the prevalence of MSK symptoms according to region of involvement among DP. Dajpratham et al[10] found shoulder pain in 114 (72.2%), neck pain in 111 (70.3%) and low back pain in 80 (50.6%) of the total 158 participants.

Hayes et al[22] (2009a) found neck pain (64.29%), lower back pain (57.94%) and shoulder pain (48.41%) prevalence among Australian undergraduate dental hygiene students.

Hayes et al[11] in their review found most prevalent regions for pain in dentists to be back (36.3-60.1%) and neck (19.8-85%) and for dental hygienists, the wrist and hand pain was most prevalent at 60-69.5%.

Samotoi et al[23] found most commonly reported problems in previous year among 323 dental therapists. They found prevalence for neck (56.8%), lower back (54%) and shoulder (52.4%) among their study population. Thornton et al[17] found among those students who had musculoskeletal symptoms, neck represented 48%, shoulder 31%, back 44% and hands 20%. Tezel et al[19] found left- and right-handed students had shoulder pain (78%, 58%), neck pain (67%, 43%), back pain (56%, 43%) upper limb pain (46%, 43%) and headaches (34%, 22%) respectively.

Finsen et al[24] reported one-year prevalence of 65% for neck/shoulder pain and 59% for low back disorders among dentists. Augustson and Morken[25] found one-year overall prevalence of 81% for MSK symptoms among 329 dentists with shoulder (45%), neck (47%), low back pain (49%), hand/wrist (21%), upper back (20%), hip (18%), knee (14%), elbow (12%) and ankle (10%) complaints. Oberg and Oberg[26] (1993) found that 62% had neck complaints and 815 had one/both shoulder pain in the previous 12 months among 38 dental hygienists.

Neck and shoulder symptoms

Three studies specifically evaluated prevalence characteristics for neck/shoulder pain in DP. Morse et al[27] reviewed studies on prevalence for neck and shoulder disorders among dental practitioners (dentists, dental hygienists and dental assistants). Dentists reported 26-73% neck symptoms and 20-65% for shoulder symptoms on a one-year period prevalence. Dental hygienists reported higher rates 54-83% for neck and 35-76% for shoulder, and dental assistants at 38-62% and 27-62% respectively for neck and shoulder respectively. Morse et al[28] found that neck symptoms were reported by 37%, 43% and 72%; and shoulder symptoms by 11%, 20% and 35% respectively by students, students/ assistants and experienced dental hygienists. Akesson et al[29] found pain ratings and Nordic questionnaire were sensitive and specific for detecting work-related neck and shoulder complaints among 90 female dental personnel surveyed.

Risk factors

There were twelve studies finding association between physical, mental and social risk factors and reporting of MSK symptoms among DP. Eleven studies were on biological risk factors, five on psychological and eleven studies on social risk factors.

Biological- individual (physical)

Kihara[30] in a survey of dentists in private clinics found that prevalence of hand and arms, neck and shoulders and low back symptoms differed between three work postures commonly adopted by clinicians. Trunk lateral bending and rotation increased the low back extensor muscle EMG activity. Morse et al[27] reviewed and found static awkward postures involving isometric contractions of trapezius. Hayes et al[22] (2009a) found that lack of regular physical exercise was highly associated with lower back pain.

Valachi[31] reported higher risk of occupational injury and symptoms in women compared to their male counterparts. Yamalik[32] reported muscular imbalance, neuromuscular inhibition and previous pain are all risk factors towards development of future MSK symptoms in OHPs. Repeated unnatural, deviated or inadequate working postures and forceful hand movements were well identified risk factors.

Morse et al[28] found self-reported shoulder pain was strongly associated with working above shoulder height and neck symptoms with working positions involving a bent neck posture. Tezel et al[19] found no significant differences in MSK symptoms because of gender. The studied left-handed dental students however had significantly more MSK symptom prevalence than their right-handed counterparts. Oberg and Oberg[26] found that frequency of neck/shoulder symptoms was greater in the right side of dental hygienists.

Anton et al[14] found significant association of age and body mass index with carpal tunnel syndrome in dental hygienists. Ylipaa et al[33] found that dental hygienists under 42 years of age had more MSK disorder prevalence. Michalak-Turcotte (2000) risk factors for WRMSD among dental hygienists are repetitive motion, pinch-grasp force, vibration and prolonged awkward postures.

Akesson et al[34] high frequency of MSK disorders reflected the high demands of vision and fine precise hand movements and working with unsupported elevated arms during dental hygiene practice. The authors also found lack of association between MSK symptoms and blood levels of mercury and selenium, BMI and smoking habit. Moen and Bjorvatn[35] found that female dentists were more symptomatic than male in MSK disorders among 139 surveyed dental personnel (dentists, dental auxiliaries and office workers).

Psychological- cognitive affective (mental):

Locker et al[36] in their survey of 1000 Canadian dental assistants on self-perceived levels of work-related stress found 38.8% reporting moderately stressful and 14.5% reported extremely stressful. 43% of those reporting stress also reported their intention to change jobs to another profession. Warren[37] found strong association between psychosocial stress and musculoskeletal disorder causation among dental practitioners and dental hygienist students.

Ylipaa et al[33] found work-family overload and work relations were associated with more MSK disorders among dental hygienists. Ylipaa et al[38] found active leisure and psychosocial work factors (mastery of work) were associated with increased odds of good health and well-being among 575 surveyed dental hygienists. Augustson and Morken[25] found positive association between perceived workload and shoulder discomfort.

Social- environmental or ergonomic

Hayes et al[22] found that 16-20h of desk-based study by dental hygiene students was associated with neck pain and 6-10h on computer lead to greater predisposition to report shoulder pain and upper back pain. Samotoi et al[23] reported that less number of dental therapists working with dental assistants had shoulder symptoms. Those working with assistants however, reported higher prevalence of hip/thigh symptoms.

Thornton et al[17] showed among third and final year dental students that they reported significant relationship between occurrence of symptoms and equipment utilization, work efficiency and general health. Yamalik[32] reported inadequate equipment or workplace designs and inappropriate work patterns are particular risk factors for MSK symptoms.

Morse et al[28] reported higher supervisor support was associated with fewer dental hygienists reporting neck and/or shoulder symptoms. More et al[39] found that greater use of ultrasonic scalers and manual instruments to around 8.2 hrs per week and 10.1 hrs per week respectively was associated with symptoms of numbness in upper extremities compared to 2.8 hrs per week and 4.8 hrs week for students without numbness symptoms.

Anton et al[14] found that number of patients treated per day was a significant risk factor for greater prevalence of CTS symptoms among dental hygienists. Ylipaa et al[33] found that dental hygienists practising in Australia are more associated with MSK disorders than their Swedish counterparts. Thus the authors' findings reiterated the complex interdependent interaction between socio-demographic, occupational and cultural aspects influence a dental hygienist's work, health and well-being.

Ylipaa et al[38] found high clinical practice fraction, high management support increased the odds for good general health while work-family overload and high work efficiency decreased the odds. Increased work experience and scaling work duration per week was associated with finger disorders and upper body MSK disorders respectively. Ylipaa et al[40] found strainful ergonomics, solitary work, patient treatment hours and working hours were significant predictors for development of WRMSD and neck/shoulder pain among 364 dental hygienists. Those who worked in public dental health service experienced more symptoms than private practice.

Augustson and Morken[25] found sport activity participation was negatively associated with low back pain. Liss et al[41] found that days worked per week, time with trunk rotated postures and years of experience were significant predictors of reported shoulder pain.

Impact or consequence of musculoskeletal pain

Two studies evaluated the impact of MSK pain on health care system. Dajpratham et al[10] found usage of pain relieving medication (34.8%), seeking medical evaluation (32.3%), reduction in working hours (27.2%), difficulty sleeping (22.8%) and work absence (22.8%) among 158 participants with musculoskeletal symptoms. Osborn et al[15] found 34% of dental hygienists with MSK pain reported that pain had affected their clinical practice-forcing them to practise fewer days, decreasing their endurance, reducing speed and quality, and/or altering operating positions.

Treatments taken for relief of musculoskeletal pain

Two studies evaluated the reports of treatments taken by DP with MSK pain. Dajpratham et al[10] found Thai traditional massage (51.9%), medication (28.5%), physical therapy (15.8%), acupuncture (7.6%) and alternative medicine (4.4%) was taken for pain relief by their subjects. Augustson and Morken[25] found incorporating ergonomic equipment into dental practice alleviated shoulder discomfort.

Evidence for interventions

Ergonomic interventions

Two studies on ergonomic interventions, one by Michalak-Turcotte[42] outlined the components of ergonomic evaluation and intervention program and another by Sanders and Turcotte[43] who reported two cases of dental hygienists managed effectively.

DISCUSSION

This review found an overall prevalence estimate ranging from 23-100% in DP reporting previous year atleast one MSK pain in a body region which was mostly neck and/or shoulder or upper back pain.

The involvement of upper body- neck/shoulder among DP is understandable from a

biomechanical viewpoint. The work postures, use of equipment, work station and work demands necessitate a complex interplay of biopsychosocial variables which might have lead to increased reporting of symptoms.

These findings are of much wider range compared to the only other systematic review performed earlier by Hayes et al[11] which found a narrower range of prevalence rate (64-93%). The reasons could be attributable to the selection criteria (including both reviews and original articles; using comprehensive search terms and not using medical subject headings-MeSH) employed in this review and inclusion of studies on all categories of DP instead of only dentists and dental hygienists. The aim of this review was to provide a detailed and comprehensive data on the prevalence of MSK pain. Though such inclusion of all DP caused the inevitable heterogeneity, the estimates are far beyond expectations even when all groups combined and this indicates a huge public health issue.

Work place characteristics- the DP practise in a wide variety of settings- academic, hospital, private practice, community centers, research centers influence not only the predisposition to MSK pain but also maintains the symptoms leading to chronicity and work-related disability. The risk factors for MSK pain in DP found in this review include not only biological but psychological and social as well. This adds support to existing evidence for multidisciplinary biopsychosocial rehabilitation as a treatment of choice for neck and shoulder pain among working age adult population.[44]

One of few limitations of this review was the subjective nature of collecting information from DP in the reviewed studies, using verbal screening questions rather than clinical examination. Some of the studies used the well-validated Nordic questionnaire while most of them relied on self-reporting of symptoms. Reporting of symptoms can have aetiologies that range from non-organic to even serious pathologies. Multifactorial issues influence self-perceived and self-reporting of symptoms among DP such as their attitudes toward their profession,[45] work profile,[46] career choice,[47] career influences, levels of satisfaction with their work position, work stress,[48] salary, workplace preferences,[49] interest in community participation,[50] personal habits[51] etc. Other limitation noticed in the included studies was the interchangeable use of terms such as MSK disorders/ symptoms/ pain. As healthcare professionals, pain is only one of the symptoms of MSK dysfunction. Other symptoms can be stiffness, discomfort, clicks, fatigue etc which were often not reported in the earlier studies. Previous diagnosis of MSK disorders (specific and non-specific) by registered physicians was not observed in our reviewed studies as prevalence of MSK disorders.

Future studies can be on evaluating the prevalence of MSK pain among DP in India, which surprisingly had not been reported before till date. Our Indian dentists and dental professionals are also prone for all the reviewed risk factors and appropriate individualized and group ergonomic educational interventions might be indicated to ensure adequate prevention of MSK disorders. Outcome of such interventions could be evaluated using posture assessment instrument[52] validated for its use among dental operators.

CONCLUSION

There was an overall very high prevalence of MSK pain among DP. Among DP, dental hygienists and dental students were more affected with MSK symptoms. The risk factors highly predictive of developing MSK pain were biopsychosocial and further research on prevalence in Indian dental population is warranted before implementation of preventive educational programmes among dentists.

ACKNOWLEDGEMENTS

The authors wish to thank the authors of the reviewed studies for providing helpful comments and valuable suggestions during the manuscript preparation process.

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