

Ergonomic Work Place Principles of Mysore District, Karnataka - A Questionnaire Survey

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Abstract

Introduction: Dynamic and static activities in dentistry, cause musculoskeletal disorders but dentists do not have enough awareness about effects of ergonomic factors on their health. Literature reviews world over have shown a high prevalence of musculoskeletal disorders among dental practitioners.

Aim: Correlation of the ergonomic factors and its association with age, gender, and work environment, musculoskeletal problems due to wrong postures and identify prophylactic measures used as self-management strategies for prevention.

Material and Methods: A cross sectional descriptive study was conducted between August 2012- December 2013 in which a self-administered questionnaire was used to assess the musculoskeletal symptoms among dental practitioners. The recorded data was analyzed with SPSS 13. P-value 0.05 was considered to statistically significant.

Results: One hundred and twenty dental practitioners participated in the study of which seventy-eight percent had a prevalence of at least one work related musculoskeletal disorder symptom (WMSD). The response rate was 56.07%. Most common areas affected by MSD in order of magnitude were neck (50%), low back (14.2%), shoulders (21.7%) and stiffness in fingers (21.7%). A significant association was observed between hours of practice, age, body posture and occurrence of WMSD.

Conclusions: In conclusion it was observed that limited ergonomics in the work environment resulted in WMSD among dentists.

Keywords: Ergonomics; GDP: General Dental Practitioners; WMSD: Work Related Musculoskeletal Disorders; CDE: Continued Dental Education

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Key message

The prevention and reduction of WMSDs among dentists should include their education in ergonomic principles as applied to dental practice and awareness regarding the importance of work related risk factors.

Occupational health hazards due to dental practice among dental professionals are on a continuous rise resulting in a significant negative impact on the overall quality of life. Dentists tend to assume stressful body positions due to work place restrictions, and to obtain better access and visibility to the operating site. This results in isometric contractions of large group of muscles involving head, neck and shoulders- the cumulative effect known

as Cumulative trauma disorders (CTD) [1]. (CTD) or repetitive strain injuries [2] (RSI) or occupational overuse syndromes [3] (OOS) of the musculoskeletal system or work-related musculoskeletal disorders [4] (WRMSDs) - Musculoskeletal Disorders has been defined by W.H.O [5,6] as "disorders of the muscles, tendons, peripheral nerves or vascular system not directly resulting from an acute trauma or instantaneous event". Two most common Cross sectional study causes for musculoskeletal disorders in the dental health profession are cumulative traumas & prolonged static postures. Studies reported prevalence of WRMSDs among nurses, [7] physical therapists, [8] physicians, [9] surgeons, [10] and dentists [11].

Literature suggests that the symptoms of pathological conditions which are prevalent in the upper body regions are more common among dentists than subjects working the different environment such as farmers, pharmacists and office employees [12]. Scientific research works by Rising et al. [13], Ayers et al. [14] and Al Wazzan [15] correlating ergonomics in dental procedures suggested that dental professional, whether they are dentists, dental hygienists or assistants, experienced more neck, shoulder and back pain than practitioners in other Profession. National differences were found to exist in work-related attitudes [16] which in turn influence work performance and WRMSD prevalence.

Several studies shows relationship between inadequate posture while doing clinical practice and appearance of pain in the various muscles of the body [17-19]. Unthank showed in his study that Lighting at the work place: the lack or excess of light can generate myopia and irreversible retinal lesions, among others [20].

Ergonomics is the Science that fits the job to a person's anatomical physiological and psychological characteristics in such a way that it enhances human efficiency and well-being (International ergonomic Association). It is the Science that designs tools, equipments, work stations that fits the job to the worker and not worker to the job. Physically challenging nature of work in dentistry combined with the risk factors such as prolonged static postures, repetitive movements, working in a confined space, challenges in positioning the practitioner or the patient and the limitations with the tools and equipments used results in poor ergonomics. These factors can initiate progress or worsen the musculoskeletal disorders. The present study is an attempt to understand the incidence and prevalence of musculoskeletal disorders among the general dental practitioners (GDP) in Mysore district, categorize them according to its type and severity, understand the risk factor involved and to utilize appropriate ergonomic principles to reduce the occurrence of WMSD.

Aim of this study

1. assess the awareness about ergonomically designed work station to reduce the effect of WMSD
2. to find the correlation of the ergonomic factors and its association with age, gender, musculoskeletal problems due to wrong postures
3. identify prophylactic measures used as self-management strategies for prevention so as to promote a healthy professional and personal life during the professional practice

Materials and Methods:

Study design: An epidemiologic survey was conducted to assess the awareness and practices of ergonomics among General dental practitioners of Mysore district- which was the inclusion criteria, the exclusion criteria was-subjects suffering from any kind of medical problems (arthritis, fracture etc).

A self-administered Questionnaire was designed to obtain information about the awareness of ergonomic practices, the possibility of postural risk factors affecting them and the nature of treatment they seek were also included in the study during the period of August 2012- December 2013.

Study population: A list of the dental practitioners with contact numbers was obtained from the IDA (Indian Dental Association) Mysore branch. Prior appointment was taken through telephone and a self-administered questionnaire was handed over to the dental practitioners at their respective clinics. Out of 260 General Practitioners 120 agreed to participate in the questionnaire in the study. Participation in the study was voluntary and informed consent was duly signed by the participants. The response rate was 56.07%. The method of sampling questionnaire in this study is depicted in (Table 1).

Questionnaire development and screening

validation: The method for answering the questionnaire was explained and the questionnaire was collected according to the convenience of the practitioners over a maximum period of one week. The screening questionnaire had a total 15 questions. Prior to the study, the questionnaire was tested for comprehensibility and relevance among ten dentists. The purpose of the questionnaire and how they should be answered was explained, and whenever necessary further information was provided.

Questionnaire description: The variables included in the questionnaire were information on the demographic details, respondent's individual characteristics, job history, years of experience and method of work, , and musculoskeletal complaints which were identified defined by the presence or absence of pain in each specific body region using standardized Nordic questionnaire [21-23]. This questionnaire records the prevalence of MSD in terms of musculoskeletal symptoms (ache, pain, discomfort) in the preceding 12 months. SNQ consists of structured, forced, binary, or multiple choice variants and prophylactic methods adopted in relation to musculoskeletal complaint. The SNQ includes a diagram of the human body viewed from the back, divided into nine anatomical areas. This helps the subjects in identifying the areas of the body to which the questions are directed. These areas have been shown to accumulate musculoskeletal symptoms and are distinguishable from each other by the responder [21]. The recording also included demographic variables such as age, gender, qualification, duration of practice, average patients seen per day, nature of practice, and whether the subjects were right handed or left handed.

Participation confidentiality: Each dentist was presented with a separate copy of the questionnaire personally by the investigators (M&R) and requested to answer the questions which was collected on the same day or the previous day. Written notification was received from the private dental practitioners

Table 1 Method of sampling questionnaires in this study.

	Total participants	Contacted	consented	Returned	included	Response rate
Frequency	335	290	214	120	120	120/214
Percent	100.0	86.57	63.9	35.8	35.8	56.07

confirming that the participation in the study was voluntary. Informed consent was duly signed by the participants included in the study.

Data analysis: Data gathered was statistically analyzed using SPSS software version 16 using chi-square test. The chi-square values were calculated. P-value of $p < 0.05$ was considered to be significant. The results were presented by a simple bar graph. A Chi-square test with 95% of probability and 0.5% margin error was done to establish differences when relating two qualitative variables and, to find out if there was statistical significance or were due to chance.

Results

In the present study the prevalence of various health hazards among general dentists practicing in Mysore district was interpreted. A total of 260 dentists who were members of IDA Mysore branch were surveyed out of which 120 general dentists agreed to participate in the study.

Gender: According to the study 40.8% samples corresponded to females and 59.2% samples were

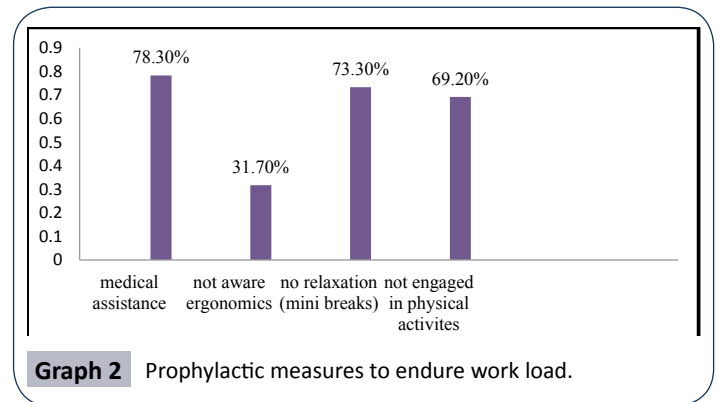
males who responded to the questionnaire.

Age: 108 dentists were between 31-50 years of age where as 12 were above 51 years of age.

Out of 120 dentists, 60 dentists had neck and shoulder pain, 17 dentists had low back pain, 17 dentists had elbow and wrist pain and 26 dentists had stiffness of fingers. Many of the dentists had two or more of the above mentioned physical limitations (**Graph 1**).

The number of hours they practice a day was also a crucial deciding factor. Of the sample of 120, incidence of WMSD was observed in 33.3% of GDP who practiced for less than 4 hours 58.6% GDP who practiced for 4-6 hours, and 70.2% of GDP who practiced for 6 hours and above. This clearly showed that the incidence of WMSD increased with hours of practice.

In the present study, GDP who had 5 years of experience, 73.1% practiced sitting dentistry, 26.9% practiced standing dentistry. GDP who had experience above 5 years of experience, 7.4% practiced sitting dentistry, 44.7% practiced standing dentistry,



Graph 2 Prophylactic measures to endure work load.

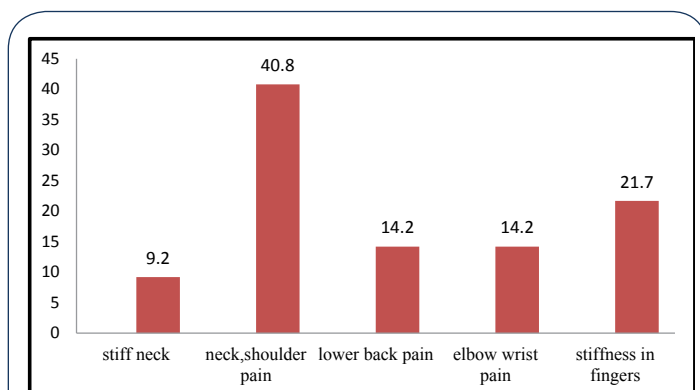
47.9% practiced both sitting and standing dentistry.

Awareness: In the present study 94 dentists (78.3%) have undertaken medical assistance/physiotherapy for experiencing musculoskeletal complaints. 31.7% were not aware of the term ergonomics and 68.3% were aware of the ergonomic principles. But, when questioned about utilization of ergonomically designed dental chair and equipment in their practice, 55.8% of the dentists were not following the usage (**Graph 2**).

Relaxation while working: Present study showed that around 73.3% of the practitioners do not relax by taking mini breaks and 26.7% take mini breaks while working, when questioned whether they perform any of the hand exercises after the dental procedure, only 37.5% perform some form of hand exercises such as all fingers spread. Around 69.2% of the dentists are not engaged in any form of physical activities/exercise as a prophylactic measure to endure the work load. Thus the results clearly demonstrate that the WMSD was directly related to the number of hours they practice and also sedentary life style and not involved in any form of physical activities.

Discussion

Published literature has shown a high prevalence of MSD among dentists [24-27]. The sedentary nature of work together with altered posture and lack of application of ergonomic principles can result in the imbalance of specific group of muscles. This Study was undertaken to determine the prevalence and distribution of WMSD among GDP of Mysore district. Musculoskeletal disorders are a diverse group of disorders with reference to pathophysiology. According to WHO WMSD is often accompanied by pain and impaired functioning related to musculoskeletal system or in relation to the cause such as joint disease/trauma [28]. The instrument used in this study is a self-administered Questionnaire and SNQ which records musculoskeletal symptoms and screens for musculoskeletal disorders in an ergonomic context [21]. It serves as a diagnostic tool for analyzing the work environment and identifying incompatibilities in the working environment [21]. The present study has revealed a prevalence of MSD 77.5% among GDP of Mysore district. This prevalence is higher than that reported in a study in Saudi Arabia (59.2%) but lower than the reports from Australia (87.2%), [29] Lithuania (86.5%) [30] and Turkey (94%) [31]. The prevalence of WMSD among GDP in the present study was higher than the prevalence observed in a cross-sectional study conducted by Bihari et al. in Delhi where the prevalence was 25% among General Indian Population.



Graph 1 Prevalence of WMSD based on body site.

The current study revealed no difference in prevalence of MSD between males and female general dental practitioners as compared to study done by Lindfors et al. in 2006 reported that the female group of dentists showed a higher incidence of muscular skeletal disorders.

Dentists predispose to pain/injury in different regions of the body depending on the type of work and position adopted. In the present study, the commonly affected areas were neck and shoulders which accounted for 40.8%, low back pain 14.2%, elbow and wrist 14.2%, stiffness in fingers 21.7% which were similar to the studies from Queensland [29] and New Zealand [32,33], Southern state of AP which showed high prevalence of MSD among GDP regardless of the qualification and specialty, the prevalent site affected was low back and neck. These results indicate that most of the practitioners adopt positions which frequently result in MSD of neck and low back regions. However, Szymanska [34] and Pureine et al. [35] have reported that most prevalent musculoskeletal complaint was MSD of low back which could be attributed to forward positioning of the operator to gain access to operating site.

When age of GDP and their practicing hours were associated, a significant association was observed (Contingency co-efficient $cc=.534$, $p=0.000$). It was found that those with in the age group of 31-50 years were more into practice between 4-6 hours and above 6 hours. However, in the case of GDP with more than 51 years, were into dental practice for less number of hours and very few of them were practicing for 4-6 hours and above 6 hours (Table 2).

A significant association was observed between practicing hours and WMSD where contingency co-efficient value .227 was found to be significant at .038 level. From the table it is clear that with increasing and age, incidence of WMSD also increased linearly and significantly (Table 3). The number of hours of practice play an important role in the occurrence of MSDs although both younger and older dentists report the same symptoms as confirmed in other studies [36]. In contrast to other studies done among GDP of Saudi Arabia and New South wales, where MSD decreased with age and duration of Practice [37-39] which could be attributed to older practitioners taking up less number of patients as a result of age /years of practice or having undertaken selective measures adjusting position while working, involved exercises and relaxation breaks for MSD. Our study is in agreement with the study conducted in AP which showed high prevalence of MSD

Table 2 Age and hours of practice- a significant association was observed (Contingency co-efficient $cc=.534$, $p=0.000$).

Age vs. Hours of Practice					
		AGE		Total	
		31-50 y	51+		
Hours of Practice	<4	Count	6	9	15
		% of participants	5.6%	75.0%	12.5%
	4-6	Count	57	1	58
		% of participants	52.8%	8.3%	48.3%
	6+	Count	45	2	47
		% of participants	41.7%	16.7%	39.2%
Total		Count	108	12	120

among GDP regardless of the qualification and specialty and the most prevalent site affected was low back and neck.

In the present study, 73.3% of GDP were not involved in any kind of rest breaks during their practice. The results were consistent with the studies by Szymanska [34] who discovered that more than 30% of dentists work without breaks.

A significant association was observed between years of experience and body posture ($cc=.559$; $P=0.000$). It was found that most of GDP with less experience were practicing sitting dentistry followed by standing. GDP with more than 5 years of experience were practicing alternative sitting and standing dentistry instead of sitting posture alone. GDP with 0-5 years of experience, 73.1% of them adopt sitting dentistry and GDP above 5 years of experience, 7.4% adopt sitting dentistry, 44.7% adopt sitting and standing /postural alterations. Ratzon et al. [40] conducted a study to determine the effect of work posture on musculoskeletal complaints. And concluded that those working in sitting position alone had more severe low back pain than those who alternated between sitting and standing positions (Table 4).

The inference we get through this study is that sedentary nature of work together with faulty posture –fewer repetitive motions, work place constrictions and lack of application of ergonomic principles can result in the imbalance of specific group of muscles. Operators strive to maintain a balance posture while 50% of their body's muscles are made to contract to hold the body motionless. The awkward posture retained for prolonged periods of time can cause irreversible damage to the muscles thus causing a threat to dentist's career. It is postulated that upper limb muscles and skeleton are more implicated during dental operation rather than other sites of the body. Åkesson et al. [41] assumed that the work posture of dentists plays an important role as a risk factor for the development of work-related disorders. A high frequency of MSDs among dentists was confirmed in numerous subsequent studies [42-44]. Maintaining poor posture for long periods of time, can result in chronic muscular fatigue, discomfort or pain, even if the soft tissues are not structurally altered. More

Table 3 A significant association was observed between practicing hours and WMSD where contingency co-efficient value .227 was found to be significant at .038 level.

Hours of practice vs. prevalence of WMSD

		WMSD		Total	
		+	-		
Hours of practice	<4	Count	5	9	15
		% of participant	33.3%	66.7%	100.0%
	4-6	Count	34	24	58
		% of participant	58.6%	41.4%	100.0%
	6+	Count	33	14	47
		% of participant	70.2%	29.8%	100.0%
Total		Count	72	48	120
		% of participant	100.0%	100.0%	100.0%

Table 4 Hours of dental practice vs. type of dental practice
A significant association was observed between years of experience and body posture ($\chi^2=5.59$; $P=0.000$).

Hours of dental practice vs. type of dental practice						
			Type of dental practice			Total
			sitting	stand	Both	
Years of experience	0-5	count	19	7	0	26
		% of participants	73.1%	26.9%	.0%	100.0%
	5+	Count	7	42	45	94
		% of participants	7.4%	44.7%	47.9%	100.0%
Total		Count	26	49	45	120
		% of participants	21.7%	40.8%	37.5%	100.0%

significantly, prolonged exposure to high static muscle and joint load may lead the soft tissues to adaptively change, and with time may lead to pathological effects and permanent disability [44-51]. Finsen et al. [45] presumed that an increased variation in work postures may reduce the risk of overloaded spine and lower and upper limbs. Newell and Kumar [42] confirmed that attention and awareness of MSDs in the dental profession has noticeably increased due to a rise in the number of reported MSDs. Some of the improper postures that detour the dentist to the route of ill health are working with neck in flexion, with shoulders elevated, or either flexed and abducted, side bending to left or right, forward bending or over reaching at waist, excessive twisting, elbows getting flexed greater than 90°, thumb hyperextension and wrists getting flexed in grasping [46]. Maintaining the same position for more than 40 minutes per patient can also be deleterious. Forceful pinching of the instruments during scaling is considered an important risk factor and the use of ergonomically designed instrument significantly helps reducing the musculoskeletal disorders that develop due to the former [47]. Similarly repetitive movements with low task variation had a higher incidence of RSI in dentists, rather than those who practice with varied type of movements [48,49].

Recommendations:

In a nut shell, it is indispensable to change poor work habits.

Some of the Parameters of the correct working postures: [42,50,52]

1. The sitting posture is upright and symmetrical
2. The shoulders hanging down relaxed with the upper arms beside the upper body
3. The minimal elevation of forearms.
4. The angle between lower and upper legs is approx. 105-110
5. The legs are slightly apart, making an angle of between 30-45°,
6. The position of the back of the patient chair
7. The patient's head is appropriately rotated in 3 directions
8. The light beam of the dental operating light is as parallel as possible to the viewing
9. The sitting location, between 09.00-12.00 o'clock (for left-handed people 03.00-12.00 o'clock position)
10. The patient's head is rotated and the sitting location adjusted
11. Instruments held in 3 supporting points

Limitations: Subjectivity of responses can be a limitation; practitioners with recent episodes of MSD will remember the events much better and can affect the response to questionnaire. Decreased sample size limits the generalizability of findings.

Conclusion

Dental surgeons must become more educated regarding the impact of their choices in seating in their work area. Improper adoption of ergonomics may cause untoward changes in our body leading to WMSD. The prevention and reduction of MSDs among dentists should include their education in dental ergonomics through regular CDE programmes and awareness regarding the importance of work-related risk factors.

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