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ORIGINAL RESEARCH

Ergonomics and Musculoskeletal Disorder: As an Occupational Hazard in Dentistry

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ABSTRACT

Objective: Musculoskeletal disorders (MSDs) are commonly experienced in dentistry. The objective of this study is to determine the prevalence of ergonomics and MSDs among dental professionals.

Materials and methods: A cross-sectional survey was conducted among 170 dentists of different specialties. The questionnaire gathered information regarding demographic details, MSDs, work duration, working status, awareness of ergonomics, etc. Data was analyzed using SPSS version 15.0. Student's t-test and analysis of variance (ANOVA) test was used for comparison in mean scores. Stepwise multiple linear regression analysis was used to assess the independent variables that significantly influenced the variance in the dependent variable (pain).

Results: It was found that 73.9% of the participants reported musculoskeletal pain and most common painful sites were neck and back. More than half of the participants, i.e. 232 (59.3%) were aware of correct ergonomic posture regarding dental. Almost percentage of pain increased significantly with increase in age and working time. Among all specialties, prosthodontics were found to have more prevalence of MSDs.

Clinical significance: The appearance of musculoskeletal symptoms among dental professionals was quite common. It suggested that ergonomics should be covered in the educational system to reduce risks to dental practitioners.

Keywords: Ergonomics, Musculoskeletal disorders, Dentistry.

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INTRODUCTION

Occupational health hazards are common in many sectors and are on the increase. Musculoskeletal disorder (MSD) is one obvious hazard and is significant and costly workplace problem. It is characterized by the presence of discomfort, disability or persistent pain in the joints, muscles, tendons and other soft parts, caused or aggravated by repeated movements and prolonged awkward or forced body postures. Dentistry, particularly is a high risk profession for the development of MSDs as it is characterized by high visual demands which result in the adaptation of fixed postures.[1]

The specific character of dental work is connected with and accompanied by onerous and harmful effects. As their work area is narrow, dental treatment is performed in a very inflexible posture. Standing or sitting positions which are frequently adopted and twisting of the spine, connected with excessive tightening of some tissues and the straining of others, generates high static loads (increased muscle tension) which are the sources of painful disorders and diseases of the musculoskeletal system and the peripheral nervous system.[2] Incorrect posture can cause pain in neck, back, shoulder, elbows, etc.

The percentage of dentists experiencing lower back pain was reported to range from one-third to one-half of the dental population.[3] Because of the MSDs, dentists often have to limit or even abandon their professional activities, and as a result, MSD has negative impact on either their finance and/or their healthy life. The overall prevalence of MSDs in dentistry differs from 63 to 93% worldwide.[4]

Since, dental work consists of precision tasks, involving a high degree of visual and manipulative elements, sometimes in combination with exertion of force. The concept of ergonomics was introduced into dentistry in order to improve the dental profession's working conditions.[5] In Greek, '*Ergo*' means work and '*Nomos*' means natural laws or systems. Ergonomics, therefore, is an applied science concerned with designing procedures for maximum efficiency and safety.[6] Ergonomics modifies tasks to meet the needs of people rather than forcing people to accommodate the task. Proper ergonomic design is necessary to prevent repetitive strain injuries, which can

develop overtime and can lead to long-term disability. Ergonomics is concerned with the efficiency of persons in their working environment. The musculoskeletal health of dental professionals has been the subject of numerous studies worldwide.[7] In this study, focus has been put on the pain experienced by the MSDs and its improvement by the implementation of proper ergonomics.

MATERIALS AND METHODS

An epidemiological survey was conducted among general dental practitioners and postgraduate students of different colleges during November 2012.

A self-administered, structured questionnaire written in English was used among all the participants. The questionnaire was pilot-tested in a sample of 20 subjects to ensure an acceptable level of validity and degree of repeatability (Cronbach' $\alpha = 0.80$).

The questionnaire covered information regarding presence of pain, awareness regarding correct posture, areas of body affected with pain, working with or without an assistant, duration of work, relieving factors.

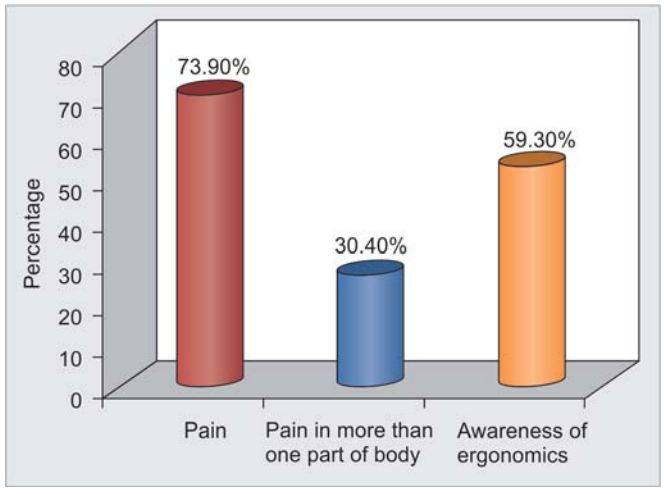
The proforma including the entire questionnaire was randomly mailed to general dental practitioners and postgraduate students (oral surgeons, prosthodontics, endodontics, periodontics) in different dental colleges. A total of 170 complete filled questionnaires were returned with response rate of 62.2%. The main reason to refuse contribution was lack of time. They were further categorized according to age, gender, specialty, etc.

STATISTICAL ANALYSIS

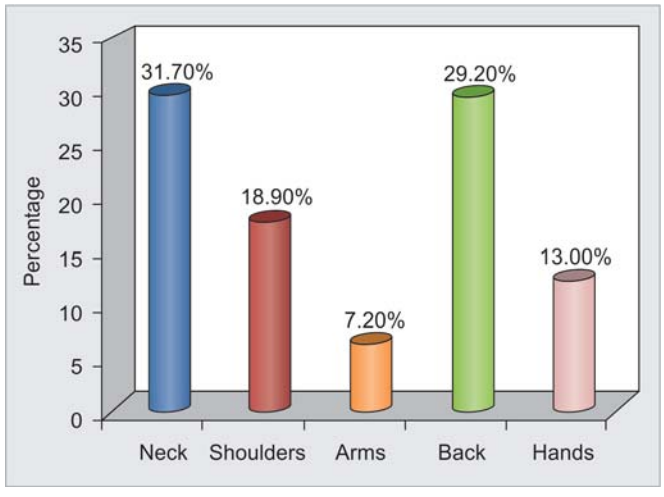
Data was analyzed using SPSS version 15.0. Descriptive statistics were obtained and frequency distribution, means, standard deviation were calculated. Student's t-test was used for comparison of mean scores for pain, pain in more than one part of body and awareness of ergonomics according to sex and working status. Analysis of variance (ANOVA) test was used for comparison in mean scores, according to age groups, different specialties and working duration. Stepwise multiple linear regression analysis was used to assess the independent variables that significantly influenced the variance in the dependent variable (pain). The p-value of 0.05 or less was considered as statistically significant.

RESULTS

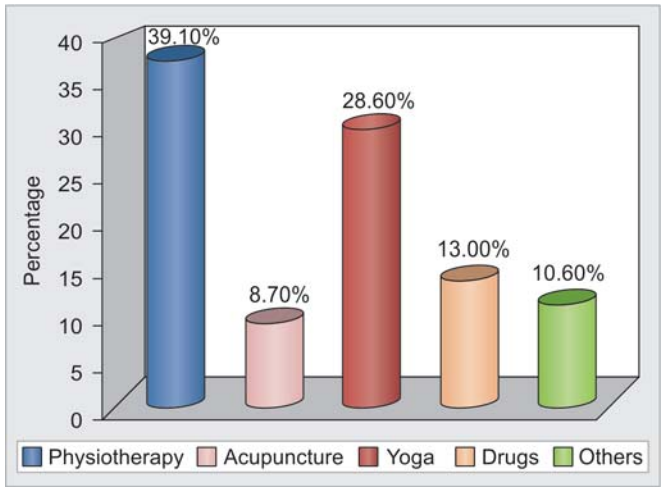
In the present study, 289 (73.9%) of the participants reported musculoskeletal pain and among them 119 (30.4%) experienced pain in more than one part of the body. More than half of the participants, i.e. 232 (59.3%) were aware of correct ergonomic posture regarding dental practice (Graph 1). Graph 2 revealed most common painful sites as neck followed by back, shoulders, hands and arms respectively. Participants had chosen physiotherapy (39.1%) and yoga (28.6%) as the most important factors to relieve their pain (Graph 3).



Graph 1: Frequency of pain, pain in more than one part of body and awareness of ergonomics



Graph 2: Frequency of MSDs in different body parts



Graph 3: Frequency of pain relieving factors

A significant difference found according to working status in which participants working with assistant experienced less pain and were having more awareness (p = 0.00). According to gender, males experienced more pain but frequency of pain in more than one site was more common among females (Table 1). Experience of pain according to different specialties showed that general dental practitioners are more affected followed by prosthodontics, oral surgeons, endodontics and periodontology. And the awareness of ergonomics was least among general dental practitioners (p = 0.00) (Table 2).

Almost percentage of pain in one and more than one site increased with increase in age, but the level of correct posture during practice decreased as the age prolongs (p = 0.00) (Table 3). Similarly frequency of pain increased with increase in working time among all participants (Table 4).

A stepwise multiple linear regression analysis in which the dependent variable was pain. The demographic independent variables were age, sex, specialty, working duration and working status (with or without assistant). The pain score showed significant association with all independent variables as working (with or without assistant), working duration and age in descending order (Table 5).

DISCUSSION

Dentistry is a high risk profession for the development of MSDs as it requires high visual demands which result in the adoption of fixed postures. The dentists were asked about the occurrence of pain due to MSDs and its improvement by the implementation of proper ergonomics. The investigation showed the frequency of pain among 73.9%

Table 1: Student's t-test for comparison in mean scores for pain, pain in more than one part of body and awareness of ergonomics according to sex and working status

Characteristics	*No.*	*Pain*		*Pain in more than one part of body*		*Awareness of ergonomics*	
Gender		*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Male	231	0.78	0.416	0.29	0.453	0.38	0.486
Female	160	0.68	0.467	0.33	0.472	0.45	0.499
p-value		0.000*		0.061**		0.012*	
Working status							
With assistant	320	0.31	0.372	0.24	0.467	0.70	0.475
Without assistant	71	0.83	0.466	0.32	0.430	0.34	0.460
p-value		0.000*		0.003*		0.118**	

*Significant; **Not significant

Table 2: ANOVA test for comparison in mean scores for pain, pain in more than one part of body and awareness of ergonomics according to different specialties

Characteristics	*No.*	*Pain*		*Pain in more than one part of body*		*Awareness of ergonomics*	
Specialties		*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Endodontics	55	0.66	0.476	0.000	0.000	0.37	0.488
Oral surgery	98	0.68	0.474	0.17	0.375	0.49	0.502
Prosthodontics	106	0.83	0.375	0.33	0.474	0.61	0.490
Periodontology	47	0.60	0.493	0.20	0.402	0.35	0.483
General practitioners	85	1.00	0.000	1.00	0.000	0.20	0.399
p-value		0.000*		0.000*		0.000*	

*Significant

Table 3: ANOVA test for comparison in mean scores for pain, pain in more than one part of body and awareness of ergonomics according to age groups

Characteristics	*No.*	*Pain*		*Pain in more than one part of body*		*Awareness of ergonomics*	
Age (years)		*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
25-34	151	0.67	0.472	0.02	0.140	0.56	0.498
35-44	184	0.73	0.446	0.37	0.484	0.38	0.487
45-54	53	0.98	0.137	0.91	0.295	0.08	0.267
≥55	3	0.67	0.577	0.00	0.00	0.33	0.577
p-value		0.000*		0.000*		0.000*	

*Significant

Table 4: ANOVA test for comparison in mean scores for pain, pain in more than one part of body and awareness of ergonomics according to working duration

Characteristics	No.	Pain		Pain in more than one part of body		Awareness of ergonomics	
Working duration a day (hours)	Mean	SD	Mean	SD	Mean	SD	
0-3	102	0.40	0.493	0.00	0.000	0.80	0.402
4-7	204	0.67	0.277	0.25	0.434	0.27	0.445
≥8	85	0.92	0.474	0.67	0.474	0.35	0.480
p-value		0.000*		0.000*		0.000*	

*Significant

Table 5: Stepwise multiple linear regression analysis with pain as a dependent variable

Model	R	R^2	F	p-value
1	0.460[a]	0.212	104.683	0.000[a]
2	0.555[b]	0.309	86.551	0.000[b]
3	0.571[c]	0.326	62.493	0.000[c]

[a]Predictors: (Constant), working (with or without assistant); [b]Predictors: (Constant), working (with or without assistant), working duration; [c]Predictors: (Constant), working (with or without assistant), working duration, age

participants. The results correspond with earlier investigations from different parts of the world.[8-10]

Neck and back were the common sites for MSDs as dentists do large of their work with their head bent forward and rotated and with their arms, especially the right one, held out from the body. This working posture leads to a considerable load on different structures in the neck, back and shoulders.[11] Similar painful sites were found in neck (43%) followed by back (38%), shoulder and wrist (25%) by Rabiei et al in their study (2008).[12] The present results were lower than that reported in Queensland Australia (57.5%), in Denmark (65%), in Saudi Arabia (65%), in Tehran, Iran (5.6%) and in Israel (38.3%).[4,12,13] Similarly, prevalence of back pain was lower than other studies in Yazd, Iran (33.3%), Tehran, Iran (32.3%), Birjand, Iran (48%), Queensland Australia (53%) and Australia (64%).[1,12,13] Hands and arms were less affected with MDSs and the results were similar to studies conducted by Newell and Kumar.[14]

Around 30% experienced pain in more than one part of the body and the results were lower than the study conducted by Abduljabbar.[15] The present study mentioned that males experienced more pain than females which was in contrast to other studies Abduljabbar.[15] This could be explained because males usually do more clinical work. But frequency of pain in more than one site was more common among females. The findings were similar to studies done by Rundcrantz and others[16] in which women experienced more pain; Niemi and others.[17]

This study showed that prevalence of pain according to different specialties showed that general dental practitioners are more affected followed by prosthodontics, oral surgeons, endodontics and periodontology. Whereas Rabiei et al found that endodontics had more experience of pain followed by prosthodontics, oral surgeons and periodontology.[12]

In the present study, age plays an important role in the occurrence of MSDs and similar results were obtained among Polish dentists.[18] However, younger and older dentists report the same symptoms, as confirmed in other studies.[19]

Awareness level of practitioners regarding the correctness of various postures was seen among 59.3% participants. However, Kanteshwari et al (2011) found that fewer than 50% of the respondents indicated awareness regarding ergonomics.[20] The results of our study demonstrate the need for developing ergonomic procedures and practice for safe stomatological work among Indian dentists.

CONCLUSION

MSDs are high among dentists and neck was the most common site. The symptoms of MSDs increase with increase in age and working duration. The prevention and reduction of MSDs among dentists should include their education in dental ergonomics and awareness regarding the importance of work-related risk factors. Musculoskeletal complaints may have connection with general health. One must pay attention with his/her nutrition and exercise.

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