

SURVEY



Assessment of knowledge, practice, and work environment related to ergonomics among dental students and dental practitioners

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Abstract

Dental practitioners are frequently exposed to a variety of occupational hazards such as physical, chemical, biological, and ergonomics which create musculoskeletal disorders. Ergonomics in dentistry is defined as reduction in cognitive and physical stress, preventing occupational diseases, thereby improving efficiency, with better quality and greater comfort for both the practitioners and patients. Work-related musculoskeletal disorders are common among dental practitioners. The study conducted was questionnaire based with 400 participants from 8 dental schools of Karachi, Pakistan. The questionnaire was divided into three segments of knowledge, practice and work environment. A cluster sampling method was implemented. The total participants of this study were 400 out of which 136 (34.1%) were male and 246 (65.7%) were female. For better understanding and convenience, the responses were categorized into poor, fair, and good. The mean \pm standard deviation of practicing dentists for knowledge was 5.95 ± 2.291 , for practice was 12.02 ± 3.189 , and for the condition of workplace was 9.88 ± 1.688 . The current study provides an insight into ergonomics for dental professionals during routine dental procedures. The knowledge, practice and work environment studied related to ergonomics were not satisfactory among the participants. There is a need of practical and theoretical inclusion of basic ergonomics principles.

Keywords: Ergonomics, knowledge, practice, work environment

Introduction

Dental practitioners are frequently exposed to a variety of occupational hazards such as physical, chemical, biological, and ergonomics which create musculoskeletal disorders.^[1] Ergonomics in dentistry is defined as reduction in cognitive and physical stress, preventing occupational diseases, thereby improving efficiency with better quality and greater comfort for both the practitioners and patients.^[2] Work-related musculoskeletal disorders (WMSD) are common among dental practitioners who works in restricted fields that require them to sit in a static or awkward posture, use excessive force, as well as carry out precise repetitive hand and wrist movements.^[3,4] These disorders can result in pain and dysfunction of the neck, back, hands, and fingers.^[5] A study reported that work-related musculoskeletal injuries occur in 54-93% of dental practitioners with most frequently occurring in back (55%), neck (38.3%) and with close association with sitting time.^[6] Pargali and Jowkar^[7] in 2010 reported that 73% of dental practitioners complained of back and neck pain. Work-related stress, tension, and incorrect postural positions can add to back and neck problems for the

dental practitioner.^[8-12] Musculoskeletal disorders were found to be prevalent in 47% of dental practitioners in a study conducted in Khyber Pakhtunkhwa, Pakistan with lower back (58%), neck (38%), and shoulders (30%) being the most common sites.^[13] Madaan and Chaudhari^[14] reported that 65 (78%) of the third year students, 64 (81%) of the fourth year students and 57 (84%) of the interns developed musculoskeletal symptoms even after relative short clinically training period. Rising *et al.*^[15] reported that more than 70% of dental students reported neck, shoulder, and lower back pain during training period in the third year of clinical training period. Rising *et al.*^[15] and Niu^[16] conducted a study that showed 46-78% of dental students experienced musculoskeletal disorders in various parts of the body including neck and shoulder area. These WMSD's could begin to appear at the beginning of their clinical practice as students and accompany them for the rest of their professional life.^[17] Dental education can play an important role in training the dental students, helping them to adopt adequate knowledge related to ergonomic posture.^[18]

Therefore, the aim of this study was to assess knowledge, practice, and work environment in relation to ergonomic

principles among dental students and dental practitioners in Pakistani population.

Materials and Methods

This cross-sectional study was carried out among undergraduates (third and fourth year students), house surgeons and practicing dentists from eight dental institutes in Karachi during the period of May 2014 to January 2015. The sample size of the study was 400, and a cluster sampling technique was employed. The study design and questionnaire was approved from the ethical committee of Baqai Medical University. A self-administered questionnaire containing 22 closed-ended questions with multiple choice options was designed to gather information to evaluate knowledge, clinical practice, and workplace regarding ergonomics during dental practice. The participants were approached through printed and online questionnaires which included the purpose of the study followed by an informed consent.

Knowledge was assessed on a three point scale: Yes, No, Not Sure. Practice and condition of workplace were also assessed on a three point scale as follows: Yes, No, Not Always. The questions were scored as follows: Yes (2), No (0), Not Always (1) And Not Sure (1) for all responses except for questions 7-11 which were scored as Yes (0), No (2), Not always (1). The range of possible scores for knowledge were 0-8, practice 0-20, and condition of workplace 0-12.

Knowledge was assessed by a total of 4 questions that focused on the awareness of the term ergonomics and its co-relation with dentistry, practice and occupational hazards. Practice was assessed by a total of 10 questions that focused on whether the dental chair, the chair light, placement of feet and cervical flexions of the neck play a role in the following ergonomic principles whether the dentist should alternate between position of back straight or bent and between indirect and direct vision.

The condition of workplace was assessed by a total of 6 questions which focused on the availability of working space, distance between the instruments and dentists, whether the dentist is able to alternate between sitting and standing in that given working space, whether the position and comfort of the stool with respect to the dentist.

Statistical analysis

Data were analyzed for descriptive analysis (mean and standard deviation [SD]). Differences among the three variables knowledge practice and work environment, one-way analysis of variance was used. Cross tabulation of gender with knowledge, practice and, work environment was analyzed by Chi-square test using SPSS version 20.

Results

The total participants of this study were 400 out of which 136 (34.1%) were male and 246 (65.7%) were female [Table 1]. For better understanding and convenience, the responses were

categorized into poor, fair, and good [Table 2]. The mean \pm SD of practicing dentists for knowledge was 5.95 ± 2.291 , for practice was 12.02 ± 3.189 and for the condition of workplace was 9.88 ± 1.688 [Table 3].

Statistically significant differences were noted for knowledge, practice, and work environment among the participant groups. Moreover, Turkey's *post-hoc* analysis revealed significant difference in knowledge among third year-house officer, third year-practicing dentist, final year-practicing dentist, and house officer-practicing dentist. Significant differences were also observed in practice among third year-final year, third year house officer, and in work environment third year-practicing dentist, final year-practicing dentist, and house officer-practicing dentist showed significant difference [Table 4].

Discussion

This study highlights and supports the established fact that WMSD is a major concern for dental students during their

Table 1: Demographic distribution of the respondents

Designation	Gender (%)		Total (%)
	Male	Female	
Third year students	37 (29.8)	87 (70.2)	124 (100)
Final year students	34 (41)	49 (59)	83 (100)
House surgeons	28 (25.7)	81 (74.3)	109 (100)
Practicing dentist	37 (44)	47 (56)	84 (100)

Table 2: Distribution of number and percentage of knowledge, practice and condition of the work place

Variables	Scale	n (%)
Knowledge	≤ 2 (poor)	161 (40.1)
	≥ 6 (good)	86 (21.4)
Practice	≤ 7 (poor)	307 (76.6)
	8-14 (fair)	51 (12.7)
	≥ 15 (good)	43 (10.7)
Condition of workplace	≤ 4 (poor)	134 (33.4)
	5-8 (fair)	225 (56.1)
	≥ 9 (good)	41 (10.2)

Table 3: One-way analysis of knowledge, practice, and condition of workplace amongst different groups of respondents

Designation	Mean \pm SD			P value
	Knowledge	Practice	Condition of workplace	
Third year	3.75 \pm 2.207	11.69 \pm 2.945	7.76 \pm 2.7	0.000
Final year	4.36 \pm 2.228	10.53 \pm 3.14	8.24 \pm 2.916	0.000
House officer	4.99 \pm 2.421	10.39 \pm 2.411	8.29 \pm 2.469	0.000
Practicing dentist	5.95 \pm 2.291	12.02 \pm 3.189	9.88 \pm 1.688	0.000

SD: Standard deviation

training years. WMSD are one of the main occupational health hazards affecting dental practitioners and dental students.^[19] Adapting ergonomic principles in daily practice reduces chances of undue stresses and musculoskeletal pain and also improves work efficiency to provide high-quality treatment to the patients.^[2,20] Despite the various advantages ergonomics is still an ignored subject from both practice and knowledge point of view, and moreover, it was not a part of the curriculum proposed by Pakistan Medical and Dental Council for universities and colleges; it was only in 2011 that terms “occupational diseases and ergonomics” were made part of the course outline.^[21] The acquirement of ergonomics knowledge is disseminated using informal means only and this necessitates evaluation of awareness, attitude, and practices towards ergonomic principles during routine dental procedures among dental students and dental practitioners.^[22]

Results of this study reported that 86 (21.4%) of the participants have good knowledge of ergonomics, followed by 154 (38.4 %) having fair knowledge and 161 (40.1%) with poor knowledge scores. Shrivardhan *et al.*^[22] in his study reported higher knowledge score of 52%. Another study conducted by Garbin *et al.*^[23] also reported that 38 (55.1%) of the dental students had satisfactory knowledge of ergonomics. Barlean *et al.*^[24] reported similar results about knowledge scores to be 52.6%. The study conducted by Madaan and Chaudhari^[14] regarding overall awareness of ergonomics in dentistry among

third and fourth year students and house surgeons, reported much lower scores 49 (19%) which is similar to this study result.

The findings of this study showed that 43 (10.7%) had good practice scores. Shrivardhan *et al.*^[22] reported that 55% of the participants had good practice scores. Mailoa and Rovani^[25] reported practice scores of 38.6%. The slightly higher scores of practices for ergonomics than knowledge during routine dental practice is probably because of informal training and years of clinical experience leading to self-acquired optimal neutral posture.^[22]

Proper positioning of the feet and legs are important as they provide a broad stable base, which is essential for avoiding muscular contraction in the lower extremities as this disrupts venous return leads to inflammation, edematous pain and varicose veins.^[26] Poor sitting posture has been reported to cause pain in lower limbs and is the second most likely region to be affected.^[27] This study results showed that 73 (86.9%) of the dental practitioners worked with their legs slightly separated and 89 (71.8%) of the third year students worked with feet flat on the floor. Munaga *et al.*^[28] in his study reported that 73% of the students usually work with their legs separated with feet flat on floor. Low back pain and neck pain are one of the most common complaints among dental practitioners.^[29] This study results showed that 79 (63.7%) of the third year students kept their back straight with an erect posture and almost the same number.

About 51 (60.7%) of the dental practitioners performed torsions or cervical flexion to improve vision. Munaga *et al.*^[28] in his study reported that 70.5% of the students performed cervical flexion and torsion to improve vision. Caballero *et al.*^[30] reported that 1250 (89%) of the practicing dentists showed a forward bending of the head exceeding the healthy postural limit. The reason could be reluctance to use indirect vision when necessary and as a result improper neck and back position is adopted during clinical practice and this could be the reason of high number of dental practitioners complaining of pain in these body regions.^[31]

Dental stool must fit correctly with neutral back, neck, and shoulder support for optimal posture, be at the correct height

Table 4: Pair wise comparison using Turkey's test

Pair	Knowledge	Practice	Condition of workplace
Third year-final year	0.236	0.0268	0.526
Third year-house officer	0.000	0.004	0.365
Third year-practicing dentist	0.000	0.731	0.000
Final year-house officer	0.234	0.988	0.999
Final year-practicing dentist	0.000	0.003	0.000
House officer-practicing dentist	0.16	0.000	0.000

Table 5: Correlation of practice score among the respondents

Practice score	Third year students (%)	Final year students (%)	House surgeons (%)	Practicing dentists (%)
Work with legs slightly separated	75 (60.5)	66 (79.5)	78 (71.6)	73 (86.9)
Flat feet on the floor	89 (71.8)	57 (68.7)	75 (68.8)	59 (70.2)
Back straight while working	79 (63.7)	42 (50.6)	52 (47.7)	44 (52.4)
Is the stool you work on is comfortable	59 (47.6)	38 (45.8)	36 (33)	52 (61.9)
Do you consider the stools can be ergonomically regulated	53 (42.7)	34 (41)	53 (48.6)	56 (66.7)
Do you prefer direct vision over indirect vision	72 (58.1)	53 (63.9)	53 (48.6)	35 (41.7)
Do you perform torsions or cervical flexion to improve vision	49 (39.5)	45 (54.2)	61 (56)	51 (60.7)
In oral surgery do you find it difficult to maintain posture	57 (46)	44 (53)	56 (51.4)	39 (46.4)
In periodontics do you find it difficult to maintain posture	50 (41)	40 (48.2)	37 (33.9)	22 (26.2)
In endodontics do you find it difficult to maintain posture	42 (34.4)	44 (53)	62 (59.6)	33 (39.3)

and tilt, and also optimal arm and elbow support.^[32] This study reported that 52 (61.9%) of the practicing dentists worked on comfortable stools. Munaga *et al.*^[28] in his study reported that a total of 62% of the students worked on uncomfortable stools [Table 5].

Dental practitioners scored the highest mean of knowledge among all academic positions [Table 3]. The findings are consistent with the results of studies conducted by Akesson *et al.*^[33] and Leggat and Smith.^[34]

Limitations

A key limitation of this research is that this study is questionnaire based and knowledge and practice of ergonomics may not be best assessed by this method. The responses may be subject to social desirability bias, acquiescence bias, obsequiousness, and hello-goodbye effect.^[35] There is also a difference between actual and perceived knowledge and practice. Therefore, the results might not be the true reflection of clinical practice. Moreover, the reasons behind the use of poorly designed dental equipment and in general dental practices need to be investigated.

Conclusion

This study results showed that the dental students are more likely to develop WMSD in future as they are unaware of the term ergonomics. There is a need to include ergonomics in the undergraduate curriculum with the stress given to the theoretical knowledge and application during performing various dental procedures.

Perception of dental professionals toward ergonomics revealed that majority of them had knowledge of ergonomics but their attitude was not satisfactory, so there is a need to motivate and promote ergonomics through ergonomically designed dental instruments and working stools.

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