

Knowledge, Attitude and Practice of Ergonomics and Musculoskeletal Disorders as an Occupational Hazard among Dental Professionals in Hyderabad – A Questionnaire Based Survey

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ABSTRACT

Dental ergonomics involves minimizing cognitive and physical stress, preventing occupational diseases, improving efficiency, quality, and comfort for both dentists and patients. Dental professionals frequently face various occupational hazards, including chemical, physical, biological, and ergonomic factors that can lead to musculoskeletal disorders. Therefore, the prevention of work-related strain is crucial for the long-term success of dentists in their practice. The primary goal of this survey was to evaluate the knowledge, attitude, and practices of dentists in Hyderabad regarding ergonomics and musculoskeletal disorders as occupational hazards. The survey was conducted using printed questionnaires and electronic media for distribution, data collection, analysis, and interpretation. A cross-sectional study was performed and it contained a total of 20 questions. The survey involved 300 dental professionals in Hyderabad. Statistical analysis was performed using the latest SPSS software. According to the results of this survey it is concluded that the knowledge and attitude of Dental Professionals is pretty appropriate as a maximum of the questions have been answered with suitable responses, however their clinical practice isn't as exceptional as expected.

INTRODUCTION

Ergonomics- derived from Greek language, when split in halves, “Ergo” means “work” and “Nomos” means “Natural laws or systems”. Thus ergonomics is a practical science that prioritizes the development of methods to enhance effectiveness and safety.¹ Instead of expecting individuals to adapt to tasks, ergonomics endeavors to tailor tasks to their specific requirements. Implementing proper ergonomic design is vital in preventing the occurrence of repetitive strain injuries, which can progressively accumulate and result in enduring disabilities. The principles of ergonomics influence the productivity and performance of individuals within their work environments.

Dentistry requires the operator's sound mental and physical health. A healthy dentist is a vital factor in establishing a prosperous dental practice and ensuring safety of the dentist.^{1,2}

Occupational health issues are widespread across various industries. One prominent and costly concern is musculoskeletal disorders, which pose a significant risk, due to the visual demands that necessitate staff to maintain fixed postures.⁶ This unique aspect of dental work is associated with tiresome and unfavourable effects. These disorders manifest as pain, stiffness, or dysfunction in the muscles, tendons, and soft tissues. They are often exacerbated or triggered by prolonged uncomfortable or forced body postures and repetitive motions.⁷ Globally, the ubiquitousness of MSDs in dentistry ranges from 63 to 93%.⁹

Ergonomics goes beyond simply preventing musculoskeletal problems resulting from improper practices; it is a

practice that guarantees heightened productivity, success rates, illness prevention, and increased satisfaction for both practitioners and workers. It aims to optimize individuals' efficiency within their specific working environment

According to a study done by Kupcinkas & Petrauskas et al in 2003, indicated that 88% of dentists reported satisfactory health, there is still evidence to suggest that dentists experience work-related physical illnesses³⁻⁵.

Gorter et al. in 2000, said that among ten dentists, one dentist exhibited poor general health, while three dentists experienced poor physical health¹. These health issues can significantly impact both the functioning of a dental practice and the overall well-being of the dentist.

Regularly assuming seated or standing positions, engaging in spinal twisting, and placing excessive strain on tissues all contribute to increased static loads, resulting in heightened muscle tension. Poor posture can cause pain in the neck, back, shoulders, elbows, and other areas. The limited workspace in dentistry requires practitioners to work in rigid positions. There have been reports of one-third of dentists report to having lower back pain.⁸ Due to the MSDs, dentists frequently have to restrict or even stop working, which negatively affects both their financial situation and/or their health. Murphy DC et al, in 1997 tested the regular cause of the dentists to retire prematurely, out of which 29.5% had to retire early because of the MSD.

The goal of incorporating ergonomics in dentistry is to prevent work-related injuries, enhance productivity, and improve the overall well-being of dental professionals. By optimizing the dental

workspace and adopting ergonomic practices, dentists can reduce the risk of MSD's, enhance patient care, and maintain long-term career sustainability.

Thus, the purpose of this survey was to assess the knowledge and attitude of dentists towards ergonomics and musculoskeletal disorders (MSDs), along with examining the measures they undertake in their practice to mitigate the risk of these occupational hazards⁵.

AIM

The aim of this study was to assess the knowledge, attitude and practice of ergonomics and musculoskeletal disorders as an occupational hazard among dentists in Hyderabad.

MATERIALS AND METHODS

A cross-sectional survey was distributed amongst 330 dentists of various specialties from December 2021 to March 2022, to which 310 practitioners responded. A self-administered, structure closed questionnaire written in English was distributed among all the participants.

It included questions primarily based on knowledge, attitude, and practice and were dispensed through means of communication such as questionnaire forms, social media, and emails, etc. The questionnaire held a complete 20 questions of which five questions were demographic based like age, gender, speciality, and years of experience and so on.

The next four questions were knowledge-based like were the dental professional familiar with the ergonomic posture, awareness of safe limits of tilting neck

while performing procedures, awareness of back straightening appliances, awareness of stretching exercises that can be done in clinical hours.

The next four questions were to test the attitude of the practitioners, like whether they try to follow the correct operating positions while working, do they try to explain ergonomic principles to their colleagues, do they consider ergonomic principles before purchasing work material tools or equipment, do they think information about ergonomics will be useful.

The next seven questions primarily based on their clinical practice, like how many clinical hours do they spend while working on a patient in a week, whether they work with or without an assistant, whether they feel numbness in fingers while working, whether they rest feet and back while working, whether they take short breaks between procedures, whether they feel any difficulties or muscular strain while working in someone else's clinic (as consultant), whether they follow any form of physical exercise like Yoga, Pilates, Stretching, etc., all the options were categorized into always, maybe and sometimes.

The questionnaires have been disbursed randomly to dental experts in Hyderabad and has been enclosed below.

QUESTIONNAIRE

Knowledge Attitude and Practice of Ergonomics and Musculoskeletal Disorders as an Occupational Hazard among Dental Professionals in India - A Questionnaire Based Survey

Dear doctor, a study is being conducted to evaluate the ergonomics among dentists. I request you to kindly spare your valuable time to answer the questionnaire. Thanks in advance. Regards.

DEMOGRAPHIC

- 1) Age
 - A) 20-25
 - B) 26-35
 - C) 36-45
 - D) 56-65
 - E) >65
- 2) Gender
 - A) Male
 - B) Female
- 3) Are you a
 - A) Full time practitioner
 - b) Part time practitioner
 - c) Full time academician
- 4) Specialty
 - A) Oral medicine and radiologist
 - B) Oral Surgeon
 - C) Prosthodontist
 - D) Periodontist
 - E) Endodontist
 - F) Orthodontist
 - G) Endodontist
 - H) Oral Pathologist
 - I) Public Health Dentist
- 5) Number of years of experience
 - A) 1-5
 - B) 6-10
 - C) 11-15
 - D) >15

KNOWLEDGE

- 6) Are you familiar with the ergonomic posture to perform clinical procedure in your dental practice?
 - A) Yes
 - B) No
- 7) Do you have knowledge about the safe limits for tilting the neck during the procedure?
 - A) Yes
 - B) No
- 8) Are you aware of back straightening appliances like posture corrector, back brace, etc.?
 - A) Yes
 - B) No
- 9) Do you have knowledge of stretching exercises that can be performed during clinical hours?
 - A) Yes
 - B) No

ATTITUDE

- 10) Do you make an effort to adhere to proper operating positions while working?
 - A) Always
 - b) Never
 - c) Sometimes
- 11) Do you make an effort to elucidate ergonomic principles to your colleagues?
 - A) Always
 - B) Never
 - C) Sometimes
- 12) How frequently do you take into account ergonomic principles when acquiring work materials, tools, or equipment?
 - A) Always
 - B) Never
 - c) Sometimes

13) Do you believe that receiving information and training on ergonomics would be beneficial?

- A) Yes
- B) No

PRACTICE

14) How many hours per week do you dedicate to clinical work on patients?

- A) < 20 hours
- b) 20-40 hours
- c) 40-60 hours
- d) > 60 hours

15) Do you work with an assistant?

- A) Always
- b) Never
- c) Sometimes

16) Do you experience numbness in your fingers during your work?

- A) Always
- b) Never
- c) Sometimes

17) Do you consciously ensure to give your feet and back some rest while working?

- A) Always
- b) Never
- C) Sometimes

18) Do you incorporate brief breaks between procedures?

- A) Always
- b) Never
- C) Sometimes

19) Do you experience any challenges or muscle strain while working in another clinic (as a consultant)?

- a) Always
- B) Never
- c) Sometimes

20) Do you follow any form of physical exercise like Yoga, Pilates, Stretching, etc.?

- A) Always
- B) Never
- C) Sometimes

STATISTICAL ANALYSIS

The survey facts were then accumulated collectively and analysed in the latest version of SPSS statistical software.

Kruskal-wallis and Spearman's correlation tests were done for the data analysis. The p-value of 0.05 or less was considered as statistically significant.

RESULTS

DEMOGRAPHIC DISTRIBUTION OF STUDY SUBJECTS

Among the total 310 participants majority belonged to the 25-35 age group females who were part-time oral surgeon practitioners with a work experience of 1-5 years, as shown in table 1.

MEAN COMPARISON OF KNOWLEDGE BASED ON DEMOGRAPHIC VARIABLES

Oral surgeons who are full-time practitioners belonging to the 36-45 age group males with an experience of 6-10 years are seen to have higher knowledge, as shown in table 5.

MEAN COMPARISON OF ATTITUDE BASED ON DEMOGRAPHIC VARIABLES

Oral Pathologists who are full-time practitioners belonging to the 36-45 age group females with an experience of 11-15 years are seen to have the best attitude, as shown in table 6.

MEAN COMPARISON OF PRACTICE BASED ON DEMOGRAPHIC VARIABLES

Oral surgeons who are full-time practitioners belonging to the 36-45 age group males with an experience of 11-15 years are seen to have the highest

implementation of the practice of ergonomics, as shown in table 7.

CORRELATION BETWEEN KNOWLEDGE, ATTITUDE, AND PRACTICE

There is an effective correlation between knowledge, attitude and practice of ergonomics and musculoskeletal disorders as occupational hazards amongst dental professionals. This means that with the increase of knowledge and imbining the proper attitude, will lead to an increase in the clinical practice of ergonomics and thereby successfully prevent musculoskeletal disorders amongst dental professionals, as shown in table 8.

Table-1: Demographic distribution of study subjects

Variables		N	%
Age	25-35	29	94.
		2	2
	36-45	8	2.6
	46-55	10	3.2
Gender	Male	76	24.5
	Female	23	75.5
Working as	Part time practitioner	19	62.9
	Full time practitioner	43	13.9
	Part time academician	72	23.2
Exp	1-5 years	28	92.

		8	9
	6-10 years	15	4.8
	11-15 years	7	2.3
Specialty	Oral Radiologists	30	9.7
	Oral Surgeons	61	19.7
	Prosthodontists	35	11.3
	Periodontists	35	11.3
	Endodontists	53	17.1
	Orthodontists	29	9.4
	Endodontists	25	8.1
	Oral Pathologists	9	2.9
	Public Health Dentists	33	10.6

Among the total 310 participants majority belonged to the 25-35 age group females who were part-time oral

Total sample	310	100
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Table-2: Distribution of subjects based on responses to knowledge items

Item	Yes		No	
	N	%	N	%
K1	237	76.5	73	23.5
K2	116	37.4	194	62.6
K3	114	36.8	196	63.2
K4	115	37.1	195	62.9

Table-3: Distribution of subjects based on responses to Attitude items

Item	Never		Sometime		Always	
	N	%	N	%	N	%
A1	59	19.0	156	50.3	95	30.6
A2	117	37.7	135	43.5	58	18.7
A3	132	42.6	114	38.4	59	19.0
A4	Yes		No		-	
	260	83.9	50	16.1		

Table-4: Distribution of subjects based on responses to Practice items

Items	N	%	N	%	N	%
P1	<20 hrs.		20-40 hrs.		40-60 hrs.	
	237	76.5	58	18.7	15	4.9
P2	Never		Sometimes		Always	
	149	48.1	110	35.5	51	16.5
P3	133	42.9	157	50.6	20	6.5
P4	101	32.6	157	50.6	52	16.8
P5	104	33.5	147	47.4	59	19.0
P6	107	34.5	160	51.6	43	13.9

P7	162	52.3	105	33.9	43	13.9
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Table-5: Mean comparison of knowledge based on variables

Variables		Mean	SD	Mean Rank	P value
Age	25-35	1.8630	1.38042	154.57	0.280
	36-45	2.6250	1.18773	203.44	
	46-55	1.7000	1.41814	144.25	
Gender	Male	2.1053	1.35232	170.55	0.097
	Female	1.8034	1.38191	150.61	
Working as	Part time practitioner	1.6051	1.29351	138.87	0.000*
	Full time practitioner	2.4186	1.27676	189.76	
	Part time academician	2.2917	1.47694	180.08	
Work experience	1-5 years	1.8194	1.36992	151.97	0.027*
	6-10 years	2.6667	1.04654	206.23	
	11-15 years	2.5714	1.81265	191.93	
Specialty	Oral Radiologist	1.7667	1.54659	145.88	0.000*
	Oral Surgeons	2.1967	1.51459	173.42	
	Prosthodontists	1.3429	1.21129	121.83	
	Periodontists	1.7429	1.29121	147.97	
	Endodontists	2.5660	1.23272	199.71	
	Orthodontists	1.6552	1.14255	145.33	
	Pedodontists	1.4000	1.22474	126.12	
	Oral Pathologists	1.0000	.86603	100.44	
	Public Health Dentist	1.7879	1.36376	150.03	

Kruskal Wallis test; $p < 0.05$ statistically significant

Oral surgeons who are full-time practitioners belonging to the 36-45 age group males with an experience of 6-10 years are seen to have higher knowledge.

Table-6: Mean comparison of attitude based on variables

Variables		Mean	SD	Mean Rank	P value
Age	25-35	3.5068	2.00771	154.80	0.481
	36-45	4.3750	1.50594	190.56	
	46-55	3.5000	2.17307	147.80	
Gender	Male	3.5263	1.87242	153.12	0.987
	Female	3.5299	2.04487	156.27	
Working as	Part time practitioner	3.0615	1.98092	135.80	0.000*
	Full time practitioner	4.4651	1.84325	194.19	
	Part time academician	4.2361	1.74818	185.74	
Work experience	1-5 years	3.4931	2.01388	154.16	0.411
	6-10 years	3.8000	1.61245	166.57	
	11-15 years	4.4286	2.22539	187.07	
Specialty	Oral Radiologists	3.3667	2.00832	148.25	0.086
	Oral Surgeons	3.5574	2.17964	156.75	
	Prosthodontists	2.6571	1.98439	118.57	
	Periodontists	3.4000	1.91281	150.49	
	Endodontists	4.0943	1.99291	180.44	
	Orthodontists	3.3448	1.95075	151.09	
	Pedodontists	3.8800	1.92180	169.78	
	Oral Pathologists	4.3333	1.50000	188.89	
	Public Health Dentist	3.4545	1.78695	148.17	

Kruskal Wallis test; $p < 0.05$ statistically significant

Oral Pathologists who are full-time practitioners belonging to the 36-45 age group females with an experience of 11-15 years are seen to have the best attitude.

Table-7: Mean comparison of practice based on variables

Variables		Mean	SD	Mean Rank	P value
Age	25-35	5.5548	1.86312	155.23	0.011*
	36-45	7.2500	2.60494	215.44	
	46-55	4.6000	1.26491	115.45	
Gender	Male	5.6316	2.03858	157.16	0.735
	Female	5.5470	1.84366	154.96	
Working as	Part time practitioner	5.1231	1.69755	133.32	0.000*
	Full time practitioner	5.9302	2.17557	172.71	
	Part time academician	6.5556	1.80679	205.28	
Work experience	1-5 years	5.5243	1.87579	153.56	0.051
	6-10 years	5.6000	1.72378	160.17	
	11-15 years	7.2857	2.28869	225.29	
Specialty	Oral Radiologists	5.4667	1.71672	150.38	0.012*
	Oral Surgeons	6.0656	2.12814	177.36	
	Prosthodontists	4.5714	1.06511	111.20	
	Periodontists	5.3429	2.20884	143.00	
	Endodontists	6.0943	2.01212	180.78	
	Orthodontists	5.4483	1.74410	149.05	
	Pedodontists	5.5200	1.41774	159.58	
	Oral Pathologists	5.4444	2.35112	143.89	
	Public Health Dentist	5.3636	1.63589	145.12	

Kruskal Wallis test; $p < 0.05$ statistically significant

Oral surgeons who are full-time practitioners belonging to the 36-45 age group males with an experience of 11-15 years are seen to have the highest implementation of the practice of ergonomics.

Table-8: Correlation between knowledge, attitude and practice

		Knowledge	Attitude	Practice
Knowledge	r value	-	0.571**	0.384**
	P value		0.000	0.000
Attitude	r value	0.571**	-	0.394**
	P value	0.000		0.000
Practice	r value	0.384**	0.394**	-
	P value	0.000	0.000	

R value- Correlation Coefficient

Spearman correlation test

p<0.05 considered statistically significant

There is an effective correlation between knowledge, attitude and practice of ergonomics and musculoskeletal disorders as occupational hazards amongst dental professionals.

DISCUSSION

Dental practitioners commonly experience hand and wrist problems, as well as back problems, which encompass conditions such as carpal tunnel syndrome, upper and lower back pain. Guyon's syndrome. Consequently, it becomes crucial to prioritize the proper implementation of ergonomic principles to ensure a long, pain-free and healthy career.

Among the participants, approximately 76.5% demonstrated awareness of the correct postures in their practice. However, Kanteshwari et al. (2011) discovered that less than 50% of the respondents exhibited awareness regarding ergonomics.¹⁰ These findings highlight the necessity of developing ergonomic protocols in order to ensure safe dental work practices among Indian dentists.

Approximately 37.4% of dentists possess knowledge regarding the safe limits for neck tilting, but only a few consistently adhere to these limits while working. It is evident that these dentists pause their work when experiencing pain or discomfort. This signifies that while their understanding of the subject is commendable, their actual practice and attitude towards implementing it are unsatisfactory.

The lack of attention to personal health during work may be the underlying cause of this issue.¹³ It is imperative to take measures to educate dentists about the gravity of the situation, as musculoskeletal disorders (MSDs) have long-term effects on an individual's life. Additionally, efforts should be made to introduce methods that minimize the occurrence of such illnesses.

Although pinpointing the direct aetiology of MSD development is challenging, it is acknowledged that the dental profession is linked to challenges in visualizing the working area, particularly during specific clinical tasks that require focus and precision³. This may lead to a reduction in function, range of movement, and tissue strength elasticity due to degenerative arthritic changes in the spine resulting from repetitive micro-trauma¹¹. Prolonged and static postures can lead to injuries in the lower back and neck¹². Hand and arm conditions are more frequently associated with repetition and force.

A major drawback of this research is that this study is questionnaire based, which may not be the most effective method for assessing knowledge and adherence to ergonomic practices. The answers provided may be influenced by social desirability bias, acquiescence bias, and obsequiousness.

A disparity exists between actual knowledge and perceived knowledge and practice. Hence, the obtained results may not accurately reflect the real-life clinical practice. Additionally, it is crucial to investigate the underlying reasons for the utilization of inadequately designed dental equipment and subpar dental practices in general.

KEY ASPECTS OF ERGONOMICS IN DENTISTRY:

❖ Dental Office Design:

The layout and design of a dental office should facilitate efficient workflow and minimize unnecessary movements. It should allow for proper spacing between equipment, ensure adequate lighting, and provide a comfortable working environment.

❖ **Dental Chair and Patient Positioning:**

Dental chairs should be adjustable to accommodate both the dentist and the patient in a comfortable position. Proper positioning of the patient's head, neck, and body is essential to minimize strain on the dentist's back, neck, and shoulders.

❖ **Operator Stool and Instrument Placement:**

The operator stool should be adjustable to support a neutral posture for the dentist and enable easy movement. Instruments and equipment should be placed within easy reach, reducing the need for excessive stretching or twisting during procedures.

❖ **Dental Loupes and Lighting:**

Dentists often use magnification loupes to improve vision and reduce strain on the eyes and neck. Adequate lighting is crucial to ensure clear visibility and reduce eye fatigue.

❖ **Instrument Design and Ergonomic Hand pieces:**

Dental instruments should be designed with ergonomics in mind. Lightweight, properly balanced, and ergonomically shaped instruments can reduce hand and wrist fatigue, improving the dentist's comfort and control.

❖ **Patient Education and Communication:**

Effective communication with patients is essential for their cooperation and comfort during dental procedures. Dentists should explain the treatment process, address concerns, and ensure patient comfort throughout the appointment.

❖ **Training and Education:**

Dental professionals should receive training on ergonomics and proper body mechanics to understand and implement best practices. Continuing education courses can provide updates on the latest ergonomic techniques and equipment.

CONCLUSION

Based on the consequences of this study it could be concluded that the knowledge and attitude of Dental Professionals towards ergonomics and musculoskeletal disorders is pretty appropriate as a maximum of the questions have been answered with suitable replies, however their clinical practice isn't as exceptional as expected.

The reasons may vary, emphasizing the need to impart additional emphasis on maintaining the correct posture during dental graduate and post-graduate programs. This ensures that practitioners inculcate this behaviour since their inception.

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