

# Awareness and Implications of Proper Ergonomics among Dentists

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**Abstract:** Introduction: The incidence of work - related musculoskeletal pain is quite high in dental professionals. The most frequent musculoskeletal pain occurs in spine, back, shoulders, elbows and hands. Ergonomics is an applied science concerned with designing products and procedures for maximum efficiency and safety. The application of ergonomics in dentistry could not only provide safety benefits but a practitioner might also improve performance objectives through greater productivity. Appropriate ergonomic design is essential to avoid repetitive strain injuries, which can progress to long - term disability over time. Objective: The purpose of this study was to assess the awareness about proper ergonomic practices and its implications among the practicing dentists. Materials and methods: A cross sectional survey was conducted among all the 207 practicing dentists belonging to different fields including Post Graduate students. Non practicing dentists were excluded. Data collection was done by the means of structured questionnaire for ergonomic factors. The variables evaluated were gender, age, professional background [BDS or MDS], awareness, no of clinical hours, presence of pain, measures taken to prevent the injury or pain. Results: 88.9% of the dentist were aware about the ergonomic principles but only 29.5% of them followed the principles. It was observed that 67.7% dentists experienced neck pain, 52.2% experienced shoulder pain, 52.7% experienced upper back pain, 51.7% experienced lower back pain. Conclusion: Present study concludes that the majority of the dentists were aware about ergonomics, but somehow tend to overlook it. Implementation of ergonomic practices is important to prevent the risk of developing musculoskeletal disorders in future.

**Keywords:** ergonomics, musculoskeletal disorders, health hazards, dentist.

## 1. Introduction

The term ergonomics is derived from the Greek words ergon (work) and nomos (natural laws). Wojciech Jastrzębowski (1857) first used this word in his article "The Outline of Ergonomics, i. e. Science of Work, Based on the Truths Taken from the Natural Science". The International Ergonomics Association defines ergonomics as follows: Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well - being and overall system performance. [1]

The successful application of ergonomics assures high productivity and avoidance of illnesses and injuries. Failure to practice ergonomic principles, on the other hand, can lead to work related musculoskeletal disorders.

Dentists are at more risk of developing Musculoskeletal disorders (MSD) due to wrong postures and long working hours. Musculoskeletal disorder (MSD) can affect the body's muscle, joints, tendons, ligaments, and nerves. Developing these disorders would limit dentists ability to work efficiently. Such problems can be prevented by spreading awareness regarding different postures during different dental procedures. Further redesigning the workplace can also improve dentists productivity. Also, early detection of signs and symptoms and understanding mechanisms of progression of disease, MSDs can be prevented on a larger scale.

The purpose of this study was to assess the awareness about proper ergonomic practices and its implications among the practicing dentists.

## 2. Materials and Methods

A total of 207 practicing dentists residing in various parts of India participated in this survey. It was conducted via an online Google form link in December - January 2020. The online questionnaire was made in Google forms. It comprised of 21 multiple choice questions (Appendix 1) with sub - questions. The forms were circulated among the dentists through different social media platforms. The questionnaire included close ended questions based on the awareness about proper ergonomic practices and its implications among the practicing dentists.

### Inclusion Criteria -

- Dental practitioners who were willing to participate.
- Participants who filled the entire questionnaire.

### Exclusion criteria -

- Participants who did not fill the entire questionnaire.

### Statistical Analysis

Data obtained was compiled on a MS Office Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, Washington, United States) and was subjected to statistical analysis using Statistical package for social sciences (SPSS v 26.0, IBM). Normality of numerical data was checked using Shapiro - Wilk test & was found that the data followed a normal curve; hence parametric tests have been used for comparisons. Comparison of frequencies of categories of variables with groups was done using chi square test. For all the statistical tests,  $p < 0.05$  was considered to be statistically significant, keeping  $\alpha$  error at 5% and  $\beta$  error at 20%, thus giving a power to the study as 80%.

**3. Results**

Among all the dentist that participated in the study 64.7% were females, 75.8% from the age group of 20 - 30 years of age and 89.4% had experience from 0 - 10years. The demographic data of the participants is mentioned in table - 1.

**Table 1: Demographic Data of Participants**

		Frequency	Percentage
Gender	Female	134	64.7
	Male	73	35.3
Age	20 to 30 years	157	75.8
	31 to 40 years	38	18.4
	41 to 40 years	9	4.3
	50 years and above	3	1.4
Qualification	BDS	92	44.4
	Dental Student	18	8.7
	MDS	97	46.9
Experience	0 to 10 years	185	89.4
	11 to 20 years	17	8.2
	21 to 30 years	5	2.4

It was observed that 88.9% of the dentists who participated in the study were aware about ergonomics but only 29.5% followed the principles in their practise.55.6% dentists use both sitting and standing positions for treating patients.95.7% adjusted their dental chair prior to the procedure.

22.2% dentists have their head bent forward while working while 34.8% of them had their head bent forward and tilted.43% of them kept their head straight while working.

88.9% of dentist maintained their feet flat on the floor while working.6.8% of the dentists had their feet on the legs of dental stool while 4.3% had their toes touching the floor.

85.5% of them sit with their back erect while working while 14.5% of them had their back bent.

91.3% of the dentist worked in adequately lit working environment while 8.7% of them did not work in adequately lit environment.

54.1% dentist practised four handed dentistry while 45.9% did not.

66.7% dentist preferred direct vision over indirect vision.

92.8% of the dentists were aware about magnification aids however, only 37.7% used them.

77.3% dentists took break in between patients. Of these, 19.3% took break after 2 - 3hours, 15% took after an hour, 42% took break after every patient.

67.7% dentists experienced neck pain, 52.2% experienced shoulder pain, 52.7% experienced upper back pain, 51.7% experienced lower back pain.

68.6% were aware about the exercises to strengthen back, shoulders and hands. But, only 55.6% seemed to practise them.

The frequency tables of responses to each question has been mentioned in table – 2.

**Table 2: Frequency Tables of Responses to Each Question**

		Frequency	Percent
1. Are you aware of the term ‘Ergonomics’ and its implications in Dental Clinic?	No	23	11.1
	Yes	184	88.9
2. If yes, then are you following the principles of Ergonomics in your practice?	Nil	24	11.6
	Always	61	29.5
	Never	1	0.5
	Sometimes	121	58.5
3. What is your position while treating patients?	Both	115	55.6
	Sitting	87	42.0
	Standing	5	2.4
4. Do you adjust the operator chair prior to the beginning of a procedure?	No	9	4.3
	Yes	198	95.7
5. What is the position of your head while working?	Bent forward	46	22.2
	Bent forward and tilted	72	34.8
	Straight	89	43.0
6. What is the position of your feet while working?	Feet on the legs of the stool	14	6.8
	Flat on the floor	184	88.9
	Toes touching the floor	9	4.3
7. Do you sit with your back straight while doing patients?	No	30	14.5
	Yes	177	85.5
8. Do you bend your back during treatments?	No	89	43.0
	Yes	118	57.0
9. Is your workplace adequately lit?	No	18	8.7
	Yes	189	91.3
10. Do you practice four handed dentistry?	No	95	45.9
	Yes	112	54.1
11. Do you prefer direct vision over indirect vision?	No	69	33.3
	Yes	138	66.7
12. Are you aware of magnification and visualization aids	No	15	7.2

that may help you ergonomically?	Yes	192	92.8
13. If yes, do you use them?	No	17	8.2
	Yes	112	54.1
14. Do you normally take breaks in between patients?	No	78	37.7
	Yes	47	22.7
15. If yes, when do you take a break?		160	77.3
		49	23.7
	After 2 - 3 hours	40	19.3
	After an hour	31	15.0
16. Have you ever experienced neck pain/stiffness during treating patients?	After every patient	87	42.0
	No	67	32.4
17. Have you ever experienced shoulder pain/stiffness during treating patients?	Yes	140	67.6
	No	99	47.8
18. . Have you ever experienced upper back pain/stiffness during treating patients?	Yes	108	52.2
	No	98	47.3
19. Have you ever experienced lower back pain/stiffness during treating patients?	Yes	109	52.7
	No	100	48.3
20. Do you know about any exercises to strengthen your back, shoulders or hands?	Yes	107	51.7
	No	65	31.4
21. If yes, do you practice them?	Yes	142	68.6
		65	31.4
	No	27	13.0
	Yes	115	55.6

Table 3: Table with p values

	Age	Gender	Qualification	Experience
Are you aware of the term 'Ergonomics' and its implications in Dental Clinic?	0.304	0.328	0.008	0.215
If yes, then are you following the principles of Ergonomics in your practice?	0.000	0.093	0.132	0.017
What is the position of your head while working?	0.359	0.002	0.138	0.315
What is the position of your feet while working?	0.563	0.354	0.479	0.243
Do you sit with your back straight while doing patients?	0.721	0.139	0.651	0.355
Do you bend your back during treatments?	0.378	0.857	0.014	0.549
Do you practice four handed dentistry?	0.000	0.885	0.003	0.312
Do you prefer direct vision over indirect vision?	0.170	0.001	0.143	0.424
Are you aware of magnification and visualization aids that may help you ergonomically?	0.703	0.871	0.131	0.382
Do you normally take breaks in between patients?	0.034	0.053	0.004	0.027
Have you ever experienced neck pain/stiffness during treating patients?	0.517	0.461	0.279	0.904
Have you ever experienced shoulder pain/stiffness during treating patients?	0.083	0.008	0.148	0.333
Have you ever experienced upper back pain/stiffness during treating patients?	0.546	0.014	0.160	0.107
Have you ever experienced lower back pain/stiffness during treating patients?	0.925	0.510	0.386	0.866

#### 4. Discussion

Dental profession requires a lot of concentration and focus on minute level details. While achieving the precise details in dentistry the principles of ergonomics gets neglected. This neglect can backfire on dentist in the form of musculoskeletal disorder.

This survey provides an insight into the dentists' knowledge, awareness and precautionary measures taken on preventing the development of musculoskeletal disorder.

It was observed that 88.9% of the dentists who participated in the study were aware about ergonomics but only 29.5% followed the principles. In a study by Gopinandh et al (2013), the level of awareness regarding the correctness of various postures was 59.3% [2]The increase in awareness regarding ergonomic in recent years is due to increased prevalence of musculoskeletal disorder among dentists.

According to present study, 55.6% dentists used both sitting and standing positions for treating patients. A study by Bedi HS et al revealed that dentists who practiced sitting dentistry alone were at more risk of experiencing severe low back

pain than those who practiced both standing and sitting dentistry alternatively [3].

Adjusting the operator stool first and then adjusting the patient's chair can help in avoiding sitting posture problems. According to the present study it was seen that 95.7% adjusted their operator stool prior to the procedure.

Proper feet position while working is keeping the feet flat on the floor and thighs parallel to the floor

In the present study, 88.9% of dentist maintained their feet flat on the floor while working.

Adequately lit environment and use of magnification aids is important to minimize strain of eyes and to work efficiently. In the present study, 92.8% of the dentists were aware about magnification aids however, only 37.7% used them. To improve visibility dentist tend to bend their head forward in unbalanced position which leads to neck pain. So, the use of magnification aids is essential as it maintains proper ergonomic positions.

Only 54.1% dentist practised four handed dentistry while 45.9% did not. It is usually observed that those who do not practice four handed dentistry tend to twist their trunks to reach the instruments ultimately resulting in lower back pain in the long run.

Leaning forward and bent back for longer duration of time can cause abnormal curvature of spine. 67.7% of the dentists experienced neck pain, 52.2% experienced shoulder pain, 52.7% experienced upper back pain, 51.7% experienced lower back pain.

A survey conducted by the American Dental Association [4] showed that 9.2 percent of 2, 983 responding dentists had received diagnoses of upper - extremity musculoskeletal disorders; of these, approximately 20 percent required surgery and more than 40 percent reduced their work hours.

From the present study it was seen that most of the participants were aware of ergonomics, but while working in a confined area unknowingly, they tend to adjust their posture which leads to ill health effects. So, it is necessary to create awareness and conduct the timely workshops related to principles of ergonomics to avoid ill health effects and long - term safety for efficient practise. Use of ergonomically designed dental instruments, taking rests in between patients, practising proper postures of body and performing stretching exercises can reduce the risk of developing musculoskeletal disorder in future. It is also the need of the hour to include ergonomics in dental curriculum as a preventive measure for future dentists.

## 5. Limitations

There is limited generalizability of the study as we did not receive responses from all dentists. There was a lack of response from Dentists even though the questionnaire was sent to dentists almost all over the world, and hence, small sample size. Another limitation is that the dentists who decided to participate in the survey may be most likely to follow the ergonomic principles, therefore, this can be a source of bias.

## 6. Conclusion

Within the limitations of present study, it was seen that most of the dentists were aware about principles of ergonomics. But, unknowingly they tend to get into wrong body postures which predisposed them to MSDs. So, it is extremely important to be aware and practice the principles of ergonomics to improve productivity and stay healthy.

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