

Dental practitioners' knowledge, attitudes, and practices of ergonomics – a cross-sectional web-based survey

Anusha Galla¹, Anusuya Chowdhry¹, Aayushi Bagga², Lohan Moradia³, Abhinav-Nitin Tadikonda⁴, Kalyana-Chakravarthy Pentapati¹, Nanditha-Kumar Mysore⁵

¹Department of Public Health Dentistry, Manipal College of Dental Sciences, Manipal, Manipal Academy of Higher Education, Manipal, Karnataka, India; ²Melbourne School of Population and Global Health, The University of Melbourne, Australia; ³Department of Epidemiology and Biostatistics, School of Public Health, Texas A and M Health Science Centre, College station, Texas, USA; ⁴Department of Public Health Dentistry, Sri Sai College of Dental Surgery, Vikarabad, Telangana, India; ⁵Department of Prosthodontics, JSS Dental College and Hospital, JSS Academy of Higher Education and Research, Mysuru, Karnataka, India.

Abstract. *Background and aim:* Dentistry is a profession known to have many occupational hazards, including biomechanical, ergonomic, and work factors. We aimed to evaluate dental practitioners' knowledge, attitudes, and practices of ergonomics and to evaluate the significant differences with age, sex, educational qualification and clinical experience. *Methods:* We conducted a cross-sectional multi-centric web-based survey among dental practitioners of south India. Dentists who were involved in clinical practice in India with a minimum of 1-year experience were invited to participate in this study. Information on demographics (age, sex, education) and years of practice of the dental practitioners was collected. Knowledge attitude and practice questionnaire was adapted from El Salamy et al. *Results:* The mean age of the participants was 30.57 (SD=6.95). More than half of the respondents were female (60.1%). Dental practitioners who were less than 28 years old (OR: 0.57), graduates (OR: -0.47), and clinical experience less than three years (OR: -0.53) had a higher probability of having poor or fair knowledge scores. Dental practitioners who were more than 28 years old had a significantly higher probability of positive attitudes (OR: 0.6) and good practices (OR: 0.54). Practitioners with a master's degree had a higher probability of good practices (OR: 1.92). Practitioners with more than three years of clinical experience had a higher likelihood of good practices (OR: 1.72; 95% CI: 1.03 – 2.9). *Conclusions:* Overall, we could conclude that dental professionals had predominantly fair to good knowledge, positive attitudes and a high proportion of bad practices. (www.actabiomedica.it)

Key words: Knowledge, attitude, practice, dentistry, ergonomics

Introduction

“The International Ergonomics Association defines ergonomics 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.” Dentistry is a profession known to have

many occupational hazards, including biomechanical, ergonomic, and work related factors. Such conditions need thorough assessment in terms of physical conditions, equipment design, and postures from the view of ergonomics.(1)

The dentistry profession can cause musculoskeletal pains and discomfort in many areas of the body, which are often slow to develop and become chronic problems when ignored. A dentist's working area

involves a restricted area with limited visibility and high reliance on artificial illumination that may require continuous adjustments, frequently contaminated with saliva and irrigants, and the activity of tongue and cheeks. The musculoskeletal disorders (MSD) are mainly due to inappropriate working postures coupled with long working hours and inadequate rest between patients and lack of awareness over the concepts of ergonomics. Due to the uniqueness and complex working environment, MSD are common among dental practitioners. Previous studies showed the prevalence of musculoskeletal pain as high as 100% among dental professionals. Hence, it is essential to maintain an appropriate work posture and to maintain the same while working with various instruments during various clinical procedures.(2)

Studies have reported the relationship between inadequate postures and the appearance of MSD among dentists. A significant association was seen between pain and specific postures and extended working time. (3) Literature exists on various aspects related to prevalence of work-related MSD (4–8), risk factors for MSD; postural habits adopted,(9) interventional programs on ergonomics among dental students and dental practitioners(10,11). Literature is scant concerning knowledge, attitude, and practices towards various ergonomic principles among dentists (2,12–17) and dental students (18–24) in developing countries.

The high prevalence of MSD could be due to insufficient knowledge, lack of awareness, negative attitudes, and bad practices towards ergonomics. In developing countries like India, these deficiencies are attributed to lack of emphasis on various concepts of ergonomics during the training years. The knowledge during the undergraduate training is mainly limited to operator chair positions. There is substantial variation in the training like standing dentistry or sitting dentistry, with or without four-handed dentistry. There are no uniform guidelines in the curriculum about the same (25). Due to this ambiguity in training in the undergraduate curriculum, there is a general deficiency of knowledge and awareness towards the various ergonomics concepts relevant to clinical dental practice. Due to the ongoing COVID-19 pandemic, there is increased use of personal protective equipment, which can compromise the accessibility and visibility of the

oral cavity. Coupled with a deficient knowledge of ergonomics and inaccessibility, poor visibility due to personal protective equipment during dental clinical procedures can lead to increased MSD among dental professionals.

There is an urgent need to improve the dentists' knowledge and attitudes towards ergonomics by continuing dental education programs. Structured programs can be developed when there is data on the existing knowledge and attitudes to increase acceptance and enrolment into such programs.

Aim: We aimed to evaluate dental practitioners' knowledge, attitudes, and practices of ergonomics. We also aimed to compare the dental practitioners' knowledge, attitudes, and practices of ergonomics with age, sex, educational status and clinical experience.

Materials and methods

Study design and sample

We conducted a cross-sectional multi-centric web-based survey among dental practitioners of south India. Invites were sent through Emails and Whatsapp through based practice networks. Dentists who were involved in clinical practice in India with a minimum of 1-year experience were invited to participate in this study. Dentists who were not involved in the treatment of patients were excluded.

Ethics approval

The protocol was approved by the Kasturba hospital and Kasturba Medical College institutional ethics committee (IEC: 263/2021). Informed consent was sought from all the participants.

Questionnaire

A self-administered questionnaire in English was prepared, which had two parts. The first part consisted of information on demographics (age, sex, education) and years of clinical practice of the dental practitioners. The second part included a knowledge, attitude and practice questionnaire adapted

from El Salamy et al. (18) It included the 16 items on knowledge (For ex: “Do you know what is meant by ergonomics? Yes / to some extent / no”), five items on attitude (For ex: “Do you think ergonomics should be a part of the dental curriculum? definitely yes/ yes/ neutral / no / definitely no”) and six items relevant to practice (For ex: “How frequent do you work with your legs separated and your feet flat on the floor? always / very often / often / rarely / never”) towards ergonomics. The questionnaire was pilot tested for feasibility among a group of 20 dental practitioners.

Statistical analysis

Analysis was done using SPSS version 20 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). A p-value of <0.05 was considered statistically significant. “Knowledge scores (range: 0-32) were categorized as good (≥ 24), fair (16-23) and poor (<16), attitude scores (range: 0-20) as negative (<15) and positive (≥ 15) and practices scores (range: 0-24) as good (≥ 18) and bad (<18).” A Chi-square test was done to compare the knowledge, attitude, and practice scores with age, sex, education, and clinical experience. Ordinal regression was used to evaluate the association of knowledge levels (good, fair, poor), and binary logistic regression was used to assess the association of attitude (positive and negative) and practices (good and bad) with age, sex, education and clinical experience.

Results

Almost half of the dental practitioners (49.3%) were less than or equal to 28 years old. The mean age of the participants was 30.57 (SD=6.95). More than half of the respondents were female (60.1%), had a master’s degree (57.4%), and had less than three years of clinical experience (51.9%).

The majority of the respondents knew the meaning of “ergonomics” (97.7%), “health hazards” (99.4%), “benefits of ergonomic application” (93%), “popular operating posture that may cause MSD” (91.8%), “best posture of the dentist sitting” (96.8%), “the best level of the dentist shoulders and site of the elbow and upper

arms” (94.8%), and best “site for forearms and operating fingers of the dentist” (90.4%). Only half of the respondents knew “points on the body, including fingertips and feet, that come in contact with patients and objects for stable control and sightings of the operating points (50.5%) and orbit range around the patients’ head” (52.2%). Almost 2/3rd of the respondents knew “the degree of the sight-line and the light-line” (63%), “specifics for designing and equipping the treatment room” (68.2%), “human supports and material objects that account for body space, paths of motion of body parts, and location of instrument supports” (62.1%), “ergonomic head rest and its benefits (70.5%), “the ideal distance from the floor to the position” (65.3%), “moving, exercise, and stretch exercise between patient’s appointments” (66.7%), and “how to maintain a comfortable environment, light, and temperature in the treatment room” (67.6%) (Table 1).

Most of the respondents opined that “ergonomics should be a part of the dental curriculum” (96.8%), “should follow ergonomic principles in routine dental practice” (95.6%), “dental chair and instruments play any role in following ergonomic principles in routine dental practice” (94.8%), “dentist should alternate between sitting and standing between patient appointments” (76.7%) and “various dental institutions should conduct continuing dental education” (87.5%) (Table 2).

Most of the participants reported, “working with legs separated and feet flat on the floor” (97.1%), “work in the upright position and spine resting on the back of the stool” (87.5%), “orient the operating field to the elbow level of the working hand” (92.2%), “make an effort to maintain neutral posture while working” (85.2%) and “orient beam of light perpendicular to the observational direction” (87.4%). “Most of the practitioners don’t use the dental loupes for magnification (72.7%) (Table 3).

Dental practitioners who were less than 28 years old (OR: 0.57), graduates (OR: -0.47), and clinical experience less than three years (OR: -0.53) had a higher probability of having poor or fair knowledge scores. No significant difference was seen between sex and distribution of knowledge scores (OR: 0.3) (Table 4).

Dental practitioners who were more than 28 years old had a significantly higher probability of positive

Table 1. Distribution of responses with respect knowledge of the dental practitioners towards ergonomics

	No N(%)	To some extent N(%)	Yes N(%)
1. Do you know what is meant by ergonomics?	8(2.3)	76(22.2)	259(75.5)
2. Do you know what are the health hazards	2(0.6)	68(19.8)	273(79.6)
3. Do you know the benefits of ergonomic application?	24(7)	114(33.2)	205(59.8)
4. Do you know the popular operating posture that may cause MSD?	28(8.2)	128(37.3)	187(54.5)
5. Do you know the best posture of the dentist sitting?	11(3.2)	80(23.3)	252(73.5)
6. Do you know the best level of the dentist shoulders and site of elbow and upper arms?	18(5.2)	97(28.3)	228(66.5)
7. Do you know the best site for forearms and operating fingers of the dentist?	33(9.6)	140(40.8)	170(49.6)
8. Do you know the degree of the sight line and the light-line?	127(37)	142(41.4)	74(21.6)
9. Do you know the points on the body, including fingertips and feet, that come in contact with patients and objects for stable control and sightings of the operating points?	170(49.6)	112(32.7)	61(17.8)
10. Do you know, when designing and equipping the treatment room, what specifics should dentists be looking for?	109(31.8)	130(37.9)	104(30.3)
11. Do you know human supports and material objects that account for body space, paths of motion of body parts, and location of instrument supports?	130(37.9)	106(30.9)	107(31.2)
12. Do you know the orbit range around the patients' head?	164(47.8)	107(31.2)	72(21)
13. Do you know the ergonomic headrest and its benefits?	101(29.4)	129(37.6)	113(32.9)
14. Do you know the ideal distance from the floor to the position?	119(34.7)	102(29.7)	122(35.6)
15. Do you know the moving, exercise, and stretch exercise between patient's appointments?	114(33.2)	113(32.9)	116(33.8)
16. Do you know how to maintain a comfortable environment, light, and temperature in the treatment room?	111(32.4)	103(30)	129(37.6)

Table 2. Distribution of responses with respect Attitude of the dental practitioners towards ergonomics

	Definitely no N(%)	No N(%)	Neutral N(%)	Yes N(%)	Definitely yes N(%)
1. Do you think ergonomics should be a part of the dental curriculum?	0(0)	0(0)	11(3.2)	58(16.9)	274(79.9)
2. Do you think dentists should follow ergonomic principles in routine dental practice?	0(0)	1(0.3)	14(4.1)	82(23.9)	246(71.7)
3. Do you think the dental chair and instruments play any role in following ergonomic principles in routine dental practice?	0(0)	0(0)	18(5.2)	134(39.1)	191(55.7)
4. Do you think the dentist should alternate between sitting and standing between patient appointments?	1(0.3)	9(2.6)	70(20.4)	139(40.5)	124(36.2)
5. Do you think various dental institutions should conduct continuing dental education?	1(0.3)	9(2.6)	33(9.6)	176(51.3)	124(36.2)

attitudes (OR: 0.6) and good practices (OR: 0.54). No significant difference was seen between sex and distribution of attitudes (OR: 1) and practice (OR: 0.7) scores. No significant difference was seen between practitioners with graduate and masters concerning

the attitude scores. Practitioners with a master's degree had a higher probability of good practices (OR: 1.92). Practitioners with more than three years of clinical experience had a higher likelihood of good practices (OR: 1.72; 95% CI: 1.03 – 2.9) (Table 4).

Table 3. Distribution of responses with respect practices of the dental practitioners towards ergonomics

	Never N(%)	Rarely N(%)	Often N(%)	Very often N(%)	Always N(%)
1. How frequent do you work with your legs separated and your feet flat on the floor?	1(0.3)	9(2.6)	73(21.3)	143(41.7)	117(34.1)
2. How frequent do you work in the upright position and your spine resting on the back of the stool?	2(0.6)	41(12)	147(42.9)	119(34.7)	34(9.9)
3. How frequent do you orient the Operating field to the elbow level of your working hand?	1(0.3)	26(7.6)	131(38.2)	99(28.9)	86(25.1)
4. How frequently do you made an effort to maintain neutral posture while working?	6(1.7)	45(13.1)	132(38.5)	110(32.1)	50(14.6)
5. How frequent do you orient beam of light perpendicular to the observational direction?	5(1.5)	38(11.1)	127(37)	95(27.7)	78(22.7)
6. How frequently do you use dental loupes for magnification purposes?	143(41.7)	103(30)	52(15.2)	34(9.9)	11(3.2)

Table 4. Association of Knowledge, attitude and practices with age, sex, educational qualification and clinical experience

		Knowledge N(%)			Attitude N(%)		Practice N(%)	
		Poor	Fair	Good	Negative	Positive	Bad	Good
Age (in years)	≤28	59 (56.2)	75 (53.2)	35(36.1)	50 (58.8)	119(46.1)	141(52.6)	28(37.3)
	>28	46 (43.8)	66(46.8)	62(63.9)	35(41.2)	139(53.9)	127(47.4)	47(62.7)
	P-value [†]	0.008			0.042		0.019	
	OR	-0.57 [-0.96 – (-0.71)]			0.6 [0.37 – 0.99]		0.54 [0.32 – 0.91]	
Sex	Male	42(40)	49(34.8)	46(47.4)	34(40)	103(39.9)	102(38.1)	35(46.7)
	Female	63(60)	92(65.2)	51(52.6)	51(60)	155(60.1)	166(61.9)	40(53.3)
	P-value [†]	0.146			0.99		0.179	
	OR	0.30 [-0.19 – 0.61]			1 [0.6 – 1.67]		0.7 [0.42 – 1.18]	
Educational qualification	Graduate	48(45.7)	70(49.6)	28(28.9)	44(51.8)	102(39.5)	123(45.9)	23(30.7)
	Masters	57(54.3)	71(50.4)	69(71.1)	41(48.2)	156(60.5)	145(54.1)	52(69.3)
	P-value [†]	0.005			0.048		0.018	
	OR	-0.47 [-0.87 – (-0.07)]			1.64 [1 – 2.69]		1.92 [1.11 – 3.31]	
Clinical experience (in years)	0-3	60(57.1)	81(57.4)	37(38.1)	47(55.3)	131(50.8)	147(54.9)	31(41.3)
	>3	45(42.9)	60(42.6)	60(61.9)	38(44.7)	127(49.2)	121(45.1)	44(58.7)
	P-value [†]	0.006			0.47		0.038	
	OR	-0.53 [-0.93 – (0.14)]			1.2 [0.73 – 1.96]		1.72 [1.03 – 2.9]	
Total		105(30.6)	141(41.1)	97(28.3)	85(24.8)	258(75.2)	268(78.1)	75(21.9)

[†] Chi-square test; OR: Odds ratio

Discussion

Ergonomics plays an essential role in clinical dental practice, and it is required to practice it right from the inception of the career. Ergonomics in the dentistry curriculum is not emphasized, which results in a lack

of knowledge, attitude, and practices during clinical work. Along with these factors, previous studies report a high prevalence of MSD among dental health care providers. Hence, our study aimed to evaluate private dental practitioners' knowledge attitude and practices of ergonomics.

Our study found that over 75% of participating dental practitioners in the study were aware of the term ergonomics and its health hazards. However, only 30% knew the ergonomic design requirements in dental practice. These results corresponded to those reflected in the studies by Garbin et al., Diaz-Caballero et al. (1,20). Less than 5% of dental practitioners utilize magnification tools such as dental loupes in their daily practice. These results were akin to the previous studies (9,18). Despite understanding the benefits of assistive devices and suitable ergonomic procedures, dental professionals fail to implement them in clinical practice.

The majority of the dentists (41.1%) had fair knowledge, and more than $\frac{3}{4}$ th of them (75.2%) had positive attitudes, which was similar to previous research (2,12,14–17,20,24). Only $\frac{1}{5}$ th of them had good practices (21.9%) identical to an earlier study on dental students and practitioners (24). However, contrary findings were also reported (2,12). Younger dentists were likely to have poor or fair knowledge, negative attitudes, and bad practices similar to that reported by Kalghatgi et al. (2). However, no significant association was reported in previous studies concerning age and knowledge, attitude and practices in dental students and dentists (12,18). No significant differences were seen in knowledge, attitudes, and practices regarding gender, similar to previous studies on dental students (2,18). However, contrary findings were seen in previous research (12,26). Dentists with specialization had significantly better knowledge, attitudes, and practices, similar to the previous studies (2,13). Despite displaying a positive attitude and considerable knowledge towards Ergonomics, this study highlighted poor practices of dental ergonomics in their daily routine of work similar to that reported by El-Sallamy et al., 2017. (18)

Conclusion

Overall, we could conclude that dental professionals had predominantly fair to good knowledge and positive attitudes. A high proportion of dental professionals self-report bad practices. Hence, there is an urgent need to incorporate the principles of ergonomics into the dentistry curriculum. Regular training programs to improve knowledge, attitude, and

practices and frequent comprehensive musculoskeletal examinations are required for dental professionals. Individuals and organizations should monitor the adoption of ergonomics during clinical practice with regular evaluation for musculoskeletal problems. The questionnaire included in this study has comprehensive coverage of all the ergonomic aspects needed for clinical practice. Limitations include the lack of an appropriate sampling method, self-reported nature, and social desirability bias. This study included a comprehensive evaluation of dental professionals' knowledge, attitude, and practices with representation from various parts of India.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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Correspondence:

Received: 15 February 2022

Accepted: 1 April 2022

Dr Kalyana-Chakravarthy Pentapati
Department of Public Health Dentistry,
Manipal College of Dental Sciences, Manipal,Manipal Academy of Higher Education,
Manipal-576104

Karnataka, India.

Phone: +91-9916036303

E-mail: drkalyan81@gmail.com

ORCID: <https://orcid.org/0000-0002-5462-5677>