

Knowledge, Attitude, and Practice of Ergonomics among Dental Students in a College in North Bengaluru.

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ABSTRACT

Background: Ergonomics plays an important role in dentistry by promoting proper posture, reducing physical and mental strain, and preventing work-related musculoskeletal disorders. Dental students are exposed to prolonged clinical procedures, repetitive movements, and awkward working postures from an early stage of training. Assessing their knowledge, attitude, and practice (KAP) is therefore essential for identifying gaps and strengthening ergonomic education.

Aim: To assess the knowledge, attitude, and practice of ergonomics among undergraduate and postgraduate dental students.

Materials and Methods: A descriptive cross-sectional questionnaire-based study was conducted among 300 dental students at Krishnadevaraya College of Dental Sciences, Bengaluru. The study included 150 undergraduate and 150 postgraduate students involved in clinical practice. Participants were selected using convenience sampling. Data were collected using a previously validated questionnaire. Responses were collected through Google Forms and analysed using SPSS Statistics version 26.0. Descriptive and inferential statistics were used, with statistical significance set at $p < 0.05$.

Results: Postgraduate students demonstrated significantly better knowledge of several ergonomic principles compared with undergraduate students, including awareness of ergonomic concepts, occupational hazards, appropriate posture, body positioning, and ergonomic equipment. Significant differences were observed for most knowledge-related parameters ($p < 0.001$). Both undergraduate and postgraduate students demonstrated a generally positive attitude towards ergonomics and supported its inclusion in the dental curriculum. However, a gap was observed between knowledge and actual clinical practice, with several recommended ergonomic practices being inconsistently followed. Postgraduate students generally demonstrated better implementation of ergonomic practices than undergraduate students.

Conclusion: The study highlights important gaps in ergonomic knowledge and clinical practice among dental students, particularly at the undergraduate level. Although attitudes towards

ergonomics were generally favourable, knowledge did not consistently translate into practice. Incorporating structured ergonomic education, practical demonstrations, posture training, periodic workshops, and continuous monitoring into dental education may promote safer clinical practices and help prevent future musculoskeletal problems.

Keywords: Ergonomics, Dental Students, Knowledge, Attitude, Practice, Musculoskeletal Disorders.

INTRODUCTION

The term “ergonomics” is derived from the Greek words ‘Ergo’ meaning work and ‘Nomos’ meaning natural laws or systems. It refers to the application of scientific principles to optimize human well-being and overall system performance. Ergonomics involves the study of work, including tasks, technology, and the environment, in relation to human capabilities, with the aim of improving productivity, reducing injuries, and enhancing worker satisfaction¹. Its fundamental goal is to design work environments that fit the worker rather than forcing adaptation to unsuitable conditions.

In healthcare, ergonomics is essential for ensuring safety, efficiency, and quality of care. Dental practitioners are particularly vulnerable to occupational hazards due to the nature of their work, which involves precision, repetitive movements, sustained concentration, and prolonged static postures. These factors increase the risk of musculoskeletal disorders (MSDs). The importance of ergonomics in dentistry has been recognized for decades, including its incorporation into dental education at the University of British Columbia since the early 1980s². However, musculoskeletal problems continue to be widely reported among dental professionals.

Musculoskeletal disorders are among the most common occupational health issues affecting dentists. Clinical dental practice often requires maintaining fixed and awkward postures for extended periods while working within the confined oral cavity³. This includes forward bending of the neck, shoulder rounding, trunk twisting, and arm elevation. Over time, such repetitive strain can lead to chronic pain and functional limitations.

Work-related musculoskeletal disorders (WMSDs) commonly affect the neck, shoulders, lower back, wrists, and hands. These arise from static postures, restricted working spaces, forceful exertions, and repetitive fine motor movements⁴. The cumulative effect may result in muscle fatigue, ligament strain, nerve compression, and joint degeneration, ultimately affecting clinical performance and efficiency.

Ergonomics in dentistry aims to minimize physical and cognitive strain, prevent occupational diseases, and improve efficiency while ensuring comfort for both practitioners and patients⁴. It includes proper operator posture, optimal patient positioning, appropriate instrument handling, adequate lighting, and ergonomically designed equipment. Additional strategies such as four-handed dentistry, micro-breaks, and stretching exercises further help in reducing occupational risks.

Ergonomics also addresses cognitive well-being. Dentistry requires sustained attention and fine motor coordination, making practitioners susceptible to stress and fatigue, which may compromise clinical outcomes⁵. Therefore, ergonomic principles also focus on improving workflow and reducing unnecessary physical and mental strain.

The risk of musculoskeletal problems begins early during dental training. Students are often introduced to clinical procedures without adequate awareness of correct posture and body mechanics, leading to the

adoption of improper positions. Long clinical hours and repetitive tasks further increase the likelihood of early musculoskeletal discomfort, which may persist into professional practice.

Incorporating ergonomic principles into dental education is crucial for prevention. Training in proper posture, neutral spine alignment, patient positioning, and instrument handling can significantly reduce strain. The use of magnification loupes and four-handed dentistry enhances posture and efficiency. Educational institutions play a key role through structured training, workshops, and monitoring of clinical practices.

Despite its importance, studies indicate that many dental students and practitioners have inadequate knowledge and inconsistent application of ergonomic principles. A positive attitude does not always translate into proper practice, highlighting the need to assess knowledge, attitude, and practice (KAP) regarding ergonomics.

With increasing student enrolment and clinical workload, limited data are available on ergonomic awareness in this region. Given the high prevalence of musculoskeletal disorders globally, it is important to evaluate whether students are adequately prepared to prevent such occupational hazards.

Understanding the knowledge, attitude, and practice of ergonomics among dental students will help identify gaps in training and guide the implementation of structured ergonomic programs. Early intervention during undergraduate training can significantly reduce future occupational health problems.

Hence, the present study “Knowledge, Attitude, and Practice of Ergonomics among Dental Students in a College in North Bengaluru – A Questionnaire Study” was conducted to assess the level of awareness, perceptions, and implementation of ergonomic principles among dental students.

AIMS AND OBJECTIVES

AIM: To assess the Knowledge, Attitude, and Practice of Ergonomics among Dental students.

MATERIALS AND METHOD

Source of Data

The present study comprised undergraduate and postgraduate students of Krishnadevaraya College of Dental Sciences, Bengaluru. Participants were enrolled based on predefined inclusion and exclusion criteria.

Method of Data Collection

Study Design

The present study was designed as a descriptive cross-sectional questionnaire-based study aimed at assessing the knowledge, attitude, and practice related to ergonomics among dental students.

Study Setting

The study was conducted at Krishnadevaraya College of Dental Sciences, Bengaluru.

Study Population

The study population included undergraduate students (third year, final year, and interns) and postgraduate students who were actively involved in clinical practice.

Sampling Technique

A convenience sampling technique was adopted for the selection of study participants.

Sample Size

The present study comprised a total of 300 dental students.

SAMPLE SIZE ESTIMATION

$$N = Z^2(1-\alpha/2) p(1-p)$$

δ^2

$$Z(1-\alpha/2) = 1.96 \text{ (For 95\% Confidence Interval)}$$

$P = 0.15$ [Based on the previous literature by A Vinita Mary et al, 2023, that 15% students implemented ergonomics in their daily clinical practice]

$$\delta \text{ (Margin of Error)} = 0.05$$

$N = 272.13$, which will be rounded off to 300.

The present study comprises of 300 dental students.

Reference: Mary AV, Kesavan R, Vaishnavi V, Jessica V, Vadllamudi Y, Tabasum MF. Knowledge, attitude and practice of ergonomics among dental students: A cross-sectional pilot study. International Journal of Applied Dental Sciences. 2023;9(4):294-298.

Inclusion Criteria

- Dental students (Undergraduate and Postgraduate)
- Students willing to participate in the study
- Students involved in clinical practice (3rd years, final years, interns, and postgraduates)

Exclusion Criteria

- Students not involved in clinical practice (1st and 2nd year students)

STUDY PROCEDURE.

A previously validated questionnaire was used for data collection. The questionnaire was structured to assess three main domains: Knowledge, Attitude, and Practice (KAP) related to ergonomics in dentistry. The questionnaire consisted of a total of 27 items.

- Participants were informed about the purpose and objectives of the study prior to data collection.
- The questionnaire was created using Google Forms.
- The link to the questionnaire was circulated through social media platforms to eligible participants.
- Participants were requested to complete the questionnaire within the stipulated time.
- Responses were collected and compiled electronically for further statistical analysis.

Structure of the Questionnaire

Sociodemographic Details:

Additional questions were included to collect demographic information such as age, gender, academic year, and methods practiced (two-handed or four-handed dentistry).

Knowledge Domain:

Knowledge was assessed using 16 questions related to ergonomic principles in routine dental procedures.

Attitude Domain:

Attitude was assessed using 5 questions with responses measured on a 5-point Likert scale

Practice Domain:

Practice was assessed using 6 questions with responses measured on a 5-point Likert scale

RESULTS

A cross-sectional questionnaire-based study was conducted among 300 dental students (150 undergraduate and 150 postgraduate students) to assess their knowledge, attitude, and practice regarding ergonomics in dentistry. Data collection was carried out using a convenience sampling technique. Information regarding

sociodemographic characteristics and knowledge, attitude, and practice related to ergonomics was collected using a structured, validated questionnaire. The questionnaire consisted of 16 knowledge-based questions, 5 attitude-based questions, and 6 practice-based questions. Responses were recorded using Google Forms. Descriptive statistics were used to summarize the findings, while inferential statistical tests were used to assess the association between knowledge, attitude, practice, and selected sociodemographic variables. Statistical analysis was performed using SPSS Statistics version 26.0, and a p-value of <0.05 was considered statistically significant.

DESCRIPTIVE STATISTICS

Distribution of Study Participants

A total of 300 dental students participated in the study. Of these, 150 were undergraduate (UG) students (50%) and 150 were postgraduate (PG) students (50%). The gender distribution showed a predominance of female participants (n=195) over male participants (n=105).

Table 1: Demographic Distribution of Study Participants

Variable	Category	N	%
Gender	Female	195	65%
	Male	105	35%
Year of Study	UG	150	50%
	PG	150	50%
Total		300	100%

KNOWLEDGE DOMAIN

Knowledge was assessed on ergonomic principles in routine dental procedures.

Table 2: Knowledge of meaning of ergonomics

Response	PG (n=150)	UG (n=150)	χ^2		p-value
	n	%	N	%	
Yes	131	87.3%	38	25.2%	<0.001
To some extent	16	10.7%	24	16.6%	
No	3	2.0%	88	58.3%	

A statistically significant difference was observed between UG and PG students ($\chi^2=132.547$, $p<0.001$). Among PG students, 87.3% were aware of the meaning of ergonomics, whereas only 25.2% of UG students responded "Yes", with 58.3% responding "No".

Table 3: Knowledge of health hazards without ergonomics

Response	PG (n=150)		UG (n=150)		p-value
	n	%	N	%	
Yes	100	66.7%	42	27.8%	<0.001
To some extent	31	20.7%	46	30.5%	
No	19	12.7%	62	41.7%	

The difference was statistically significant ($\chi^2=50.219$, $p<0.001$). PG students (66.7%) were more aware of health hazards compared to UG students (27.8%). A substantial proportion of UG students (41.7%) had no knowledge of occupational health risks.

Table 4: Knowledge of benefits of ergonomic application

Response	PG (n=150)		UG (n=150)		p-value
	n	%	N	%	
Yes	99	66.0%	38	25.2%	<0.001
To some extent	48	32.0%	24	16 %	
No	3	2.0%	88	58.3%	

A significant difference was found ($\chi^2=113.801$, $p<0.001$). PG students demonstrated greater awareness of ergonomic benefits (66.0% "Yes") compared to UG students, where 58.3% responded "No".

Table 5: Knowledge of postures causing MSD

Response	PG (n=150)		UG (n=150)		p-value
	n	%	N	%	
Yes	87	58.0%	20	13.2%	<0.001
To some extent	47	31.3%	105	70.2%	
No	16	10.7%	25	16.6%	

A statistically significant difference was observed ($\chi^2=66.678$, $p<0.001$). While 58.0% of PG students said "Yes", only 13.2% of UG students confirmed knowledge. The majority of UG students (70.2%) selected "To some extent".

Table 6: Knowledge of best sitting posture

Response	PG (n=150)		UG (n=150)		p-value
	n	%	N	%	
Yes	126	83.4%	61	40.7%	<0.001
To some extent	24	16.6%	89	59.3%	
No	0	0.0%	0	0.0 %	

PG students showed significantly better knowledge of the ideal sitting posture (83.4% "Yes") compared to UG students (40.7% "Yes") ($\chi^2=56.717$, $p<0.001$).

Table 7: Knowledge of shoulder/elbow/upper arm positioning

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Yes	106	70.7%	67	44.4%	<0.001
To some extent	18	12.0%	83	55.6%	
No	26	17.3%	0	0.0%	

The result was statistically significant ($\chi^2=77.495$, $p<0.001$). UG students (70.7% "Yes") showed better awareness than PG students, though PG students predominantly selected "To some extent" (55.6%), suggesting partial knowledge of optimal shoulder and elbow positioning.

Table 8: Knowledge of forearm and finger positioning

Response	UG (n=150)		PG (n=150)		p-value
	N	%	N	%	
Yes	69	46.0%	84	55.6%	<0.001
To some extent	43	28.7%	66	44.4%	
No	38	25.3%	0	0.0%	

A significant difference was found ($\chi^2=44.704$, $p<0.001$). PG students had better knowledge (55.6% "Yes") than UG students. Notably, 25.3% of UG students had no knowledge, while all PG students had at least partial awareness ("To some extent": 44.4%).

Table 9: Knowledge of sight-line and light-line degree

Response	UG (n=150)		PG (n=150)		p-value
	N	%	N	%	
Yes	27	18.0%	42	27.8%	<0.001
To some extent	66	44.0%	85	57.0%	
No	57	38.0%	23	15.2%	

The difference was statistically significant ($\chi^2=20.339$, $p<0.001$). Knowledge was low in both groups, but PG students had slightly better awareness (27.8% "Yes" vs 18.0% in UG). A large proportion of UG students (38.0%) had no knowledge of sight-line and light-line degrees.

Table 10: Knowledge of body contact points

Response	UG (n=150)		PG (n=150)		p-value
	N	%	N	%	
Yes	43	28.7%	103	68.2%	<0.001
To some extent	66	44.0%	47	31.8%	
No	41	27.3%	0	0.0%	

PG students showed markedly superior knowledge (68.2% "Yes") compared to UG students (28.7% "Yes") ($\chi^2=68.497$, $p<0.001$). Importantly, no PG student responded "No", indicating greater clinical exposure to ergonomic positioning.

Table 11: Knowledge of treatment room design specifics

Response	UG (n=150)		PG (n=150)		p-value
	N	%	N	%	
Yes	23	15.3%	74	49.3%	0.21
To some extent	109	72.7%	60	40.4%	
No	18	12.0%	16	10.6%	

No significant difference was observed ($\chi^2=1.382$, $p=0.21$). Most UG students (72.7%) selected "To some extent", while PG students were more polarised, with 10.6% responding "No".

Table 12: Knowledge of human supports and material objects

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Yes	23	15.3%	24	15.9%	<0.001
To some extent	126	84.0%	102	68.2%	
No	1	0.7%	24	15.9%	

The difference was statistically significant ($\chi^2=23.488$, $p<0.001$). A very large proportion of UG students (84.0%) responded "To some extent", while 15.9% of PG students had no knowledge. Both groups had similar "Yes" rates (~15%).

Table 13: Knowledge of orbit range around patient's head

Response	PG (n=150)		UG (n=150)		p-value
	N	%	N	%	
Yes	23	15.3%	24	15.9%	<0.001
To some extent	93	62.0%	62	41.7%	
No	34	22.7%	64	42.4%	

The result was statistically significant ($\chi^2=14.971$, $p<0.001$). Knowledge was limited in both groups.

Table 14: Knowledge of ergonomic headrest

Response	PG (n=150)		UG (n=150)		p-value
	N	%	N	%	
Yes	48	32.0%	18	11.9%	<0.001
To some extent	41	27.3%	20	13.9%	
No	61	40.7%	112	74.2%	

A significant difference was observed ($\chi^2=35.120$, $p<0.001$). A majority of UG students (74.2%) had no knowledge of ergonomic headrests, compared to 40.7% of PG students. PG students had better awareness (32.0% "Yes" vs 11.9% in UG).

Table 15: Knowledge of ideal floor-to-position distance

Response	PG (n=150)		UG (n=150)		p-value
	N	%	N	%	
Yes	76	50.7%	41	27.8%	<0.001
To some extent	57	38.0%	60	39.7%	
No	17	11.3%	49	32.5%	

The result was statistically significant ($\chi^2=25.386$, $p<0.001$). PG students had considerably better knowledge (50.7% "Yes") compared to UG students (27.8% "Yes"). About 32.5% of UG students had no knowledge, compared to only 11.3% of PG students.

Table 16: Knowledge of inter-appointment exercises

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Yes	25	16.7%	24	15.9%	0.391
To some extent	28	18.7%	38	25.2%	
No	97	64.7%	88	58.9%	

No statistically significant difference was observed between UG and PG students ($\chi^2=1.876$, $p=0.391$). Both groups had poor knowledge of inter-appointment stretching exercises -approximately 64.7% of UG and 58.9% of PG students responded "No".

Table 17: Knowledge of comfortable environment maintenance

Response	PG (n=150)		UG (n=150)		p-value
	n	%	N	%	
Yes	67	44.7%	42	28.5%	<0.001
To some extent	65	43.3%	62	41.1%	
No	18	12.0%	46	30.5%	

A statistically significant difference was found ($\chi^2=17.554$, $p<0.001$). PG students showed better awareness (44.7% "Yes") than UG students (28.5% "Yes"). About 30.5% of UG students had no knowledge, compared to 12.0% in PG students.

ATTITUDE DOMAIN

Table 18: Attitude towards ergonomics in dental curriculum

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Definitely yes	63	42.0%	42	27.8%	<0.001
Yes	71	47.3%	108	72.2%	
Neutral	0	0.0%	0	0.0%	
No	16	10.7%	0	0.0%	

The result was statistically significant ($\chi^2=28.219$, $p<0.001$). The majority in both groups supported inclusion of ergonomics in the curriculum. PG students responded with "Yes" more uniformly (72.2%), while UG students were more strongly positive ("Definitely yes": 42.0%). Notably, 10.7% of UG students responded "No", while no PG student did.

Table 19: Attitude towards following ergonomic principles

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Definitely yes	48	32.0%	42	28.5%	<0.001
Yes	100	66.7%	60	39.7%	
Neutral	2	1.3%	48	31.8%	
No	0	0.0%	0	0.0%	

A significant difference was found ($\chi^2=52.592$, $p<0.001$). The majority of UG students responded "Yes" (66.7%) while a notable 31.8% of PG students were "Neutral".

Table 20: Attitude towards role of dental equipment in ergonomics

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Definitely yes	76	50.7%	108	71.5%	<0.001
Yes	58	38.7%	42	28.5%	
Neutral	0	0.0%	0	0.0%	
No	16	10.7%	0	0.0%	

The difference was statistically significant ($\chi^2=23.790$, $p<0.001$). PG students more strongly agreed that dental equipment impacts ergonomics ("Definitely yes": 71.5%) compared to UG students (50.7%).

Table 21: Attitude towards alternating sitting and standing

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Definitely yes	26	17.3%	72	48.3%	<0.001
Yes	54	36.0%	38	25.2%	
Neutral	28	18.7%	40	26.5%	
No	42	28.0%	0	0.0%	

The difference was significant ($\chi^2=69.211$, $p<0.001$). PG students strongly supported alternating postures (48.3% "Definitely yes"), while UG students were divided -28.0% responded "No" and 18.7% were "Neutral".

Table 22: Attitude towards institutional CDE programs

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Definitely yes	66	44.0%	84	55.6%	<0.001
Yes	68	45.3%	66	44.4%	
Neutral	0	0.0%	0	0.0%	
No	16	10.7%	0	0.0%	

A statistically significant difference was found ($\chi^2=18.164$, $p<0.001$). PG students more strongly endorsed CDE programs (55.6% "Definitely yes" vs 44.0% in UG).

PRACTICE DOMAIN

Table 23: Practice of legs separated / feet flat posture

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Always	27	18.0%	42	27.8%	<0.001
Very often	33	22.0%	66	44.4%	
Often	49	32.7%	42	27.8%	
Rarely	41	27.3%	0	0.0%	
Never	0	0.0%	0	0.0%	

A significant difference was observed ($\chi^2=56.357$, $p<0.001$). PG students practiced proper leg positioning more consistently — 27.8% "Always" and 44.4% "Very often", with no "Rarely" responses. In contrast, 27.3% of UG students rarely maintained this posture.

Table 24: Practice of upright spine posture

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Always	38	25.3%	25	16.6%	<0.001
Very often	69	46.0%	55	36.4%	
Often	18	12.0%	70	47.0%	
Rarely	25	16.7%	0	0.0%	
Never	0	0.0%	0	0.0%	

The difference was statistically significant ($\chi^2=60.822$, $p<0.001$). UG students more frequently practiced upright posture ("Always": 25.3%; "Very often": 46.0%), while PG students more commonly responded "Often" (47.0%).

Table 25: Practice of operating field orientation to elbow level

Response	UG (n=150)		PG (n=150)		p-value
	N	%	N	%	
Always	16	10.7%	25	16.6%	<0.001
Very often	92	61.3%	59	39.1%	
Often	17	11.3%	66	44.4%	
Rarely	25	16.7%	0	0.0%	
Never	0	0.0%	0	0.0%	

A statistically significant difference was found ($\chi^2=63.947$, $p<0.001$). UG students more often positioned the operating field at elbow level ("Very often": 61.3%), while PG students predominantly responded "Often" (44.4%).

Table 26: Practice of maintaining neutral posture

Response	UG (n=150)		PG (n=150)		χ^2	p-value
	N	%	N	%		
Always	40	26.7%	25	16.6%	66.240	<0.001

Very often	30	20.0%	77	51.0%		
Often	39	26.0%	48	32.5%		
Rarely	41	27.3%	0	0.0%		
Never	0	0.0%	0	0.0%		

The difference was significant ($\chi^2=66.240$, $p<0.001$). PG students more consistently maintained neutral posture - 51.0% "Very often" and no "Rarely" responses. Among UG students, the responses were distributed across all categories with 27.3% rarely maintaining neutral posture.

Table 27: Practice of light beam orientation

Response	UG (n=150)		PG (n=150)		p-value
	n	%	N	%	
Always	38	25.3%	25	16.6%	0.003
Very often	54	36.0%	76	51.0%	
Often	16	10.7%	25	16.6%	
Rarely	42	28.0%	24	15.9%	
Never	0	0.0%	0	0.0%	

The difference was statistically significant ($\chi^2=13.602$, $p=0.003$). PG students more frequently oriented the light beam correctly ("Very often": 51.0%), while UG students had more inconsistent practices, with 28.0% rarely doing so. Both groups lacked full compliance.

Table 28: Practice of using dental loupes

Response	UG (n=150)		PG (n=150)		p-value
	N	%	N	%	
Always	1	0.7%	24	16%	0.45
Very often	3	2 %	20	13.3%	
Often	41	27%	65	43.0%	
Rarely	71	47.3%	1	0.6%	
Never	34	22.7%	41	27.3%	

The difference was not statistically significant for loupe use ($\chi^2=1.86$). PG students predominantly used loupes "Often" (43.0%) or "Always" (16%), while UG students rarely (47.3%) or never (22.7%) used dental loupes. Only 0.7% of UG students always used loupes.

DISCUSSION

The present study assessed the knowledge, attitude, and practices regarding ergonomics among undergraduate and postgraduate dental students. Ergonomics is essential in dentistry to prevent musculoskeletal disorders and maintain professional efficiency. The findings revealed significant differences between the groups, with postgraduate students demonstrating better knowledge, attitudes, and practices. Increased clinical exposure and advanced training may contribute to greater ergonomic awareness and implementation.^{13, 14}

The present study revealed that postgraduate students possessed significantly better knowledge regarding ergonomics compared with undergraduate students. Greater awareness was observed among PG students regarding the meaning of ergonomics, health hazards associated with poor posture, benefits of ergonomic application, treatment room design, ideal operating distance, and environmental factors. The higher knowledge levels among postgraduate students may be attributed to increased clinical exposure and practical experience. Similar improvement in ergonomic awareness with increasing academic level has also been reported among dental students.¹¹

These findings are consistent with the study conducted by Tysiąc-Miśta et al.¹⁰, which reported significantly better ergonomic knowledge among fifth-year dental students than fourth-year students, suggesting that knowledge improves with advancing academic level. Similarly, Bârlean et al.⁵ found that dentists with greater professional experience demonstrated better understanding and appreciation of ergonomics. Raja Rajeswari et al.¹² also assessed ergonomic knowledge among interns and postgraduate dental students and highlighted the importance of awareness regarding equipment ergonomics during dental training.

The findings also agree with those of Irshad et al.⁸, who reported that more than half of university students possessed good ergonomic knowledge and that knowledge was positively associated with attitude and practice. Likewise, Sarfaraz et al.⁹ observed that dental graduates had fair knowledge regarding ergonomic principles. Mohan Kumar et al.¹¹ similarly assessed knowledge, attitude, and practice related to ergonomics among students from three dental schools in India, supporting the importance of ergonomic education during dental training.

However, the present study identified deficiencies among undergraduate students in understanding basic ergonomic concepts. Similar observations were reported by Siddiqui et al.⁴, who found unsatisfactory knowledge scores among dental practitioners in Pakistan and emphasized the need for improved ergonomic education. Comparable findings were obtained by Munaga et al.⁶, who concluded that ergonomic awareness among dental students was inadequate and required further attention. Solanki et al.¹⁵ also reported gaps in awareness and application of dental ergonomics among dental students and professionals, further supporting the need for structured ergonomic education.

Furthermore, El-Sallamy et al.⁷ reported that only one-quarter of dental students demonstrated good knowledge, while nearly half had fair knowledge. These findings support the present study and indicate that ergonomic knowledge among dental students remains incomplete and requires reinforcement through structured educational programs.

The present study demonstrated an overall positive attitude toward ergonomics among both undergraduate and postgraduate students. Most participants agreed that ergonomics should be included in the dental curriculum and recognized its importance in routine clinical practice. Postgraduate students exhibited greater support for continuing dental education programs and alternating between sitting and standing positions.

These findings are in agreement with those of El-Sallamy et al.⁷, who observed that approximately 84.8% of students had positive attitudes toward ergonomics. Similarly, Sarfaraz et al.⁹ reported that 77% of dental graduates demonstrated favorable attitudes regarding ergonomic implementation. Tysiąc-Miśta et al.¹⁰ found that 76.1% of students considered ergonomics an important component of the dental curriculum, while 72.3% regarded its practical application as highly important.

The findings are also comparable with those of Irshad et al.⁸, who reported positive attitudes among 64.1% of participants and identified significant correlations between knowledge and attitude. In addition, Bârlean et al.⁵ demonstrated that a majority of dentists considered postgraduate ergonomic courses essential for improving professional practice. These observations support the present findings and indicate widespread recognition of the importance of ergonomics.

Although attitudes were generally positive, some undergraduate students expressed uncertainty regarding certain ergonomic practices. This suggests that awareness alone may not guarantee complete acceptance or application of ergonomic concepts, highlighting the need for continuous reinforcement through workshops and clinical demonstrations.

With respect to ergonomic practices, postgraduate students showed better compliance with recommended practices, including maintaining proper posture, leg positioning, light orientation, and use of dental loupes. Their superior performance may be attributed to increased clinical workload and experience. Garbin et al.¹⁷ demonstrated the importance of knowledge regarding ergonomic postural requirements and their application during clinical care, emphasizing the need for students to translate theoretical knowledge into appropriate clinical behaviour.

Despite these advantages, the present study demonstrated that actual implementation of ergonomic principles remained inconsistent, thereby revealing a gap between knowledge and practice. This finding is consistent with the study by El-Sallamy et al.⁷, which reported that although students exhibited positive attitudes, 95.4% showed poor ergonomic practices and only 5% actively applied ergonomic principles.

Similarly, Sarfaraz et al.⁹ observed that although most dental graduates possessed fair knowledge and positive attitudes, nearly 73.6% demonstrated poor ergonomic practices. A weak but significant relationship between knowledge and practice was also identified. Comparable findings were reported by Tysiąc-Miśta et al.¹⁰, who found that nearly 79.3% of students failed to consistently follow ergonomic principles despite possessing adequate knowledge. These results strongly support the findings of the present study and indicate that theoretical understanding does not necessarily translate into appropriate clinical behavior.

Likewise, Mary et al.¹ reported that although 47% of students were aware of ergonomics, only 22.9% regularly implemented ergonomic principles. The authors further reported musculoskeletal pain among 34.9% of participants, emphasizing the consequences of poor ergonomic practice. Munaga et al.⁶ similarly observed that approximately 70% of students performed body torsion and cervical flexion to improve visibility during treatment, indicating poor posture habits and inadequate workplace ergonomics. Their findings correspond with the present study, which demonstrated inconsistent adherence to recommended ergonomic practices.

The findings also corroborate those of Siddiqui et al.⁴, who reported unsatisfactory practice scores among dental practitioners and advocated the incorporation of ergonomic training into dental curricula. Kumar et al.¹⁶, in a recent questionnaire survey among dental students in India, further highlighted the continuing importance of assessing dental ergonomics during student training.

The risk of musculoskeletal problems begins early during dental education. Khan and Yee Chew¹³ reported an association between working characteristics, ergonomic training, and musculoskeletal disorders among dental students. Similarly, Kamal et al.¹⁴ assessed preclinical dental students and highlighted the potential for musculoskeletal problems during dental training. These findings emphasize the importance of introducing ergonomic principles at an early stage of dental education rather than waiting until students enter professional practice.

One of the most important findings of the present study was the discrepancy between knowledge and practice. Although both undergraduate and postgraduate students generally exhibited moderate-to-good knowledge and positive attitudes, the practical implementation of ergonomic principles remained inconsistent. The persistence of this knowledge–practice gap suggests that theoretical teaching alone is insufficient. Practical demonstrations, continuous monitoring, periodic workshops, and incorporation of ergonomics into clinical postings may be necessary to ensure proper implementation and reduce the risk of musculoskeletal disorders.

Overall, the findings of the present study indicate that postgraduate students possess better ergonomic knowledge, more favourable attitudes, and superior practices than undergraduate students. The findings also highlight the need for structured ergonomic education, practical demonstrations, posture training, and continuous reinforcement throughout undergraduate and postgraduate dental education.

STRENGTHS AND LIMITATIONS OF THE STUDY

Strengths

- The study included an equal number of undergraduate and postgraduate dental students, allowing comparison between the two groups.
- Knowledge, attitude, and practice regarding ergonomics were assessed comprehensively.
- The study identified important gaps in ergonomic knowledge and practices among dental students.

Limitations

- The study was conducted in a single dental institution, limiting the generalizability of the findings.

Recommendations

- Similar studies should be conducted in multiple dental institutions with larger sample sizes.

CONCLUSION

The present study assessed the knowledge, attitude, and practice regarding ergonomics among undergraduate and postgraduate dental students. The findings revealed gaps in ergonomic knowledge and practices among the students. Although the students demonstrated a generally positive attitude towards ergonomics, appropriate practices were not consistently followed. Postgraduate students showed better awareness in certain aspects, possibly due to greater clinical exposure. The findings highlight the need for greater emphasis on ergonomics in dental education. Incorporating practical ergonomic training and posture correction sessions may help promote healthier and safer clinical practices among dental students.

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