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KNOWLEDGE OF THE WORKING OF THE DENTAL CHAIR AND THEIR ASSOCIATED EQUIPMENT AMONG INDIAN DENTAL STUDENTS

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Abstract

Objective: We aimed to evaluate the knowledge of the working principles of the dental equipment among South Indian dental students. ***Methods:*** We conducted an online multi-centric survey among dental students through Whatsapp-based study groups from various dental colleges in south India using a 20-itemed questionnaire. Dental students who were in clinical postings were eligible. ***Results:*** A total of 772 dental students participated in this survey, majority of them were females (n=601). Almost 40% of the dental students were in 3rd year. Only 1/3rd of the students (33%) knew that dental chair works on direct current. Also, almost 2/3rd (64.8%) have responded that dental compressor works on alternating current. More than 2/3rds of the students knew that the movement of the dental chair is regulated through hydraulic motors (68.3%). More than half of the students responded that the water flow in the scaler is regulated by the Water-relay valve and Solenoid (52.8%) and distilled water is the preferred source of water for dental chairs (57.8%). Only 1/5th of the students responded that online UPS was the best failsafe for power fluctuations (19.9%). There was no significant difference in the mean total knowledge score among the age groups, sex, and academic year. ***Conclusions:*** Our results showed that the dental student's overall knowledge was suboptimal irrespective of age, sex, or academic year.

Keywords: Knowledge, Dentistry, Dental Equipment, Dental Student.

INTRODUCTION

Dentistry deals with the diagnosis and management of oral conditions routinely done in a dental clinic or office using an array of equipment that includes a dental chair. It requires various competencies like communication, professionalism, administration, leadership, and management which are major components of practice management. Graduate programs across the world have emphasis on practice management. Regulatory bodies like Association for Dental Education (Europe) and the American Dental Association highlighted the need for practice management along with other clinical competencies.(1–3) Studies among dental students and dentists have shown that there is a need for comprehensive training in practice management.(4,5) Good knowledge about practice management was reported only among 1/3rd of the dental graduating students.(6) A review of existing literature showed that dental students

reported a lack of confidence in setting up independent dental practice (7) and were mostly inclined to be employed after graduation. (8)

There is minimal or no inclusion of working principles and maintenance of dental chairs and equipment in practice management. Major emphasis is on communication, professionalism, administration, leadership, management, conflict management, etc. There is a need for the dentist to understand the basic working principles of the dental chair and its associated equipment as it has multiple components with complex interactions between electrical, air, and water lines for optimal patient care. It also helps the dental personnel work in harmony keeping in view of ergonomics. Any discrepancy in these interactions can lead to a malfunction or breakdown affecting patient care, disruption in patient appointments, and can be stressful to the dental personnel.

Many support systems like warranty, guarantee, preventive maintenance, and annual maintenance are being offered by the manufacturers to mitigate unforeseen circumstances and reduce the burden among dental practitioners due to the breakdown of the equipment. Such support systems are sound but with multiple limitations like cost, turnaround time, availability of personnel, and availability of resources and most of them are time bound (initial few years of purchase). It can be quite challenging for dental personnel, especially in rural places to maintain the dental chair and associated equipment.

There is a general lack of information on the frequency of breakdown of dental chairs and associated equipment in the literature. There is no formal training on the working principles of dental chairs and associated equipment in the dentistry curriculum. Hence, dental personnel must know the working of the dental chair and its components. This will help in managing minor issues, communicating with authorized personnel in case of breakdown, and may also help in resolving the issue rapidly and efficiently. A review of the literature showed no such reported studies.

The dentistry graduate program in India consists of five years with four years of academic and clinical training followed by a one-year compulsory internship in various clinical specialties. In the four years, the first two years include preclinical training followed by two years of clinical training. A review of the Indian undergraduate curriculum showed a lack of information or emphasis on the training related to the basic working principles of the dental chair and its related equipment. Given this, we aimed to evaluate the knowledge and associated factors related to the working principles of the dental chair and its related equipment among South Indian dental students.

MATERIALS AND METHODS

We conducted an online multi-centric cross-sectional survey among dental students from various dental colleges in south India. Dental students who were in clinical postings in the graduate program were eligible to participate in this survey. Eligible dental students were invited through Whatsapp-based study groups. Informed consent was obtained from all the participants. The protocol of this study was approved by the institutional review committee (Ref:01/SSCDS/IRB/2022).

The survey questionnaire consisted of multiple questions related to the working of the dental chair and its associated equipment. In the initial phase, a list of relevant topics (dental chair movements, spittoon, suction, airotor, micromotor, dental light, scaler,

endomotor, dental compressor, power sources, and backup, water flow, and source) was finalized based on the inputs of dental practitioners and academicians. This was followed by the framing of multiple-choice questions relevant to the above topics. A total of 22 questions were developed which were shared with subject experts for their opinion for inclusion in the study.

Two questions were omitted as most of the subject experts rated them irrelevant. Minor modifications in the wording were also suggested. The final survey questionnaire consisted of 20 items along with information on age, sex, and academic year. These 20 questions have multiple options with only one right or appropriate answer. Two additional questions related to the background of the curriculum were also included. They are “Have you been taught or oriented about the working of the dental chair during undergraduation? (Yes/no/maybe)” and “Would you like to be taught about the basic principles of working of the dental chair? (Yes/no)” If yes, it should be taught in “3rd year/ final year/internship".

Data analysis

The survey form was designed using Microsoft Forms with all the questions being mandatory. Each right answer was awarded a score of "1" and a total knowledge score was created. All the analysis was done using SPSS version 20. A p-value of <0.05 was considered statistically significant. Comparison of mean total knowledge score with age, sex, and academic year of study was done using the Mann-Whitney U test or Kruskal Wallis ANOVA.

RESULTS

A total of 772 dental students participated in this survey out of which the majority of them were females (n=601). Almost 40% of the dental students were in 3rd year. More than 3/4th of the students reported that they were taught about the working principles of dental chairs (76.6%) and most of the students would like to be taught the same in the graduate program (94%). More than half of them responded that it should be taught in 3rd year (54%).

The distribution of the responses for each question were given in Table 1. Only 1/3rd of the students (33%) knew that dental chair works on direct current. Also, almost 2/3rd (64.8%) have responded that dental compressor works on alternating current. More than 2/3rds of the students knew that the movement of the dental chair is regulated through hydraulic motors (68.3%). Only 1/3rd of the students had responded that the water source for the spittoon is by main water supply.

The majority of the students knew the various types of suction available for dentistry (79.7%), the main factors which affect the quality of illumination (83.3%), the water source for the airotor (79.9%), and all the inbuilt functions of micromotor (78.5%). More than 1/3rd (37.5%) of the students knew the source of air for the three-way syringe. Almost 2/3rd of the students knew on how to focus the light (62.4%). More than 40% of the students knew all the applications of the solenoid and the working of airotor.

More than half of the students knew that scaler works on direct current and compressor. More than half of the students responded that the water flow in the scaler is regulated by the Water-relay valve and Solenoid (52.8%) and distilled water is the preferred source of water for dental chairs (57.8%). Only 1/5th of the students responded that online UPS was the best failsafe for power fluctuations (19.9%).

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Table 1: Item-wise responses for the questionnaire used in the study

Question	Responses	N	%
Dental chair works on	Alternating current	517	67.0%
	Direct current	255	33.0%
Dental compressor works on	**Alternating current**	500	64.8%
	Direct current	272	35.2%
Dental Chair movements are regulated by	Air compressor	245	31.7%
	Hydraulic motors	527	68.3%
Water for spittoon comes from	**Main water supply**	264	34.2%
	Reservoir	508	65.8%
What are the types of suction available in dentistry?	A. Motorised suction	54	7.0%
	B. Air whenge suction	88	11.4%
	Both A and B	615	79.7%
	None of the above	15	1.9%
Suction on the dental chair works on	A. Air compressor	354	45.9%
	B. Stand-alone motor	76	9.8%
	Both A or B	326	42.2%
	None of the above	16	2.1%
Source of air for three-way syringe	**Air compressor**	290	37.6%
	Condenser	37	4.8%
	Special air pump	54	7.0%
	All the above	391	50.6%
Main factors which affect the quality of illumination	Dirty cover	28	3.6%
	Reflector damage	38	4.9%
	Reflector focus	63	8.2%
	All the above	643	83.3%
How to assess whether the light is correctly focussed on a dental chair	A. Margins are blurred	50	6.5%
	B. A well-defined 2 X 3-inch square area	183	23.7%
	A and B	482	62.4%
	None of the above	57	7.4%
Solenoid is used in which aspect of dental chair?	Suction	125	16.2%
	Water dispenser	118	15.3%
	water to spittoon	83	10.8%
	All the above	446	57.8%
Water for airotor comes from	Main water supply	155	20.1%
	Reservoir	617	79.9%
Dental airotor hand piece works on	Alternating current	291	37.7%
	Compressed air	338	43.8%
	Direct current	143	18.5%
Dental scaler works on	A. Alternating current	171	22.2%
	B. Direct current	115	14.9%
	C. Compressed air	77	10.0%
	A and C	409	53.0%
Endomotor works on	Alternating current	374	48.4%
	Direct current	398	51.6%
Dental micromotor works on	Alternating current	329	42.6%
	Compressed air	102	13.2%
	Direct current	341	44.2%
What are the control functions of an inbuilt micromotor?	Direction of the rotation	28	3.6%
	Hand or foot control	78	10.1%
	Speed control	60	7.8%
	All the above	606	78.5%
Water flow in scaler is regulated by	A. Water relay valve	215	27.8%
	B. Solenoid	111	14.4%
	C. None of the above	38	4.9%
	A and B	408	52.8%

Most preferred water source for dental chair	Bore water	30	3.9%
	Distilled water	446	57.8%
	Tap water	180	23.3%
	Any of the above	116	15.0%
Water relay valve is related to which aspect of dental chair?	**Airotor**	184	23.8%
	Spitoon	102	13.2%
	Suction	110	14.2%
	All the above	376	48.7%
In Indian scenario, best failsafe for dental chair against power fluctuations	Inverter	209	27.1%
	Offline UPS	43	5.6%
	Online UPS	154	19.9%
	Stabilizer	366	47.4%

Bold face indicates correct or acceptable response

The mean total knowledge score was 10.69±3.5 (range: 2-20). There was no significant difference in the mean total knowledge score among the age groups, sex, and academic year (Table 2). Similarly, there were no significant differences in the mean total knowledge score among students who were taught or oriented about the working of dental chair during under-graduation and those who would like to be taught about the basic principles of working of the dental chair.

Table 2: Comparison mean knowledge scores with demographic variables

Variable	Total Knowledge score		P-value
	Mean	SD	
Age group [n (%)]			
20-23 [460(59.6%)]	10.66	3.63	0.404
24-26 [312 (40.4%)]	10.72	3.33	
Sex			
Male [171 (22.2%)]	10.57	3.19	0.975
Female [601 (77.8%)]	10.72	3.60	
Academic year			
3rd year [306 (39.6%)]	10.42	3.78	0.05
Final year [197 (25.5%)]	11.10	3.59	
Internship [269 (34.8%)]	10.68	3.08	
Have you been taught or oriented about the working of dental chair during under-graduation?			
No [133 (17.2%)]	10.10	3.31	0.281
Yes [591 (76.6%)]	10.82	3.62	
Maybe [48 (6.2%)]	10.69	2.40	
Would you like to be taught about the basic principles on working of the dental chair?			
No [47 (6.1%)]	10.30	3.48	0.585
Yes [725 (93.9%)]	10.71	3.51	

DISCUSSION

The basic knowledge of the working principles involved in the dental chair and associated equipment is essential for dental health care providers. There is no formal training on the various aspects of the same in the curriculum. Hence, we aimed to evaluate the knowledge of the working principles involved in the dental chair and associated equipment.

Our results showed that the dental student's overall knowledge was suboptimal and there is a need and scope for improvement. Further, poor knowledge among all dental students irrespective of age, sex, or academic year. Interestingly, there was no

significant difference in the knowledge among those who were taught and not taught about the same in graduate programs.

The right or appropriate answer for various questions ranged from 19.9% to 83.3%. Students had acceptable knowledge which was limited only to a few aspects related to the working of dental chairs. There is a general lack of comprehensive knowledge among the students as depicted by the overall knowledge score. Lack of knowledge in these domains coupled with poor support systems can lead to stress and frustration in dental practitioners. There exists an extensive support system for dental practitioners through practice management softwares and online resources.(9,10) However, they are limited to patients' appointment management, maintenance of patient records, reminders, inventory management, and health education. Online resources are available for office design, management of dental staff, finances, and risk management.

Basic knowledge of the working principles of dental chairs would help dental professionals to communicate effectively with the service providers and resolve problems at the earliest by reducing the turnaround time. This will be helpful to practitioners in rural and peri-urban areas as support systems are usually limited to the services rendered by the manufacturer which are limited to urban areas.

Information and training related to the dental chair and its associated working principles need to be incorporated into the graduate program preferably at the end preclinical years. Training programs should include real-time scenarios that can happen during dental practice. Students should observe in real-time whenever there are issues that are being resolved with existing dental equipment in the dental schools. Didactic lectures can be incorporated with topics like practice management for getting a comprehensive overview of the management of dental practice.

Competing interest: Nil

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Ethical Clearance: The protocol of this study was approved by the institutional review committee on ethical issues of Sri Sai College of Dental Surgery, Vikarabad, Telangana, India. (Ref:01/SSCDS/IRB/2022).

Data availability: Data can be made available upon request to the corresponding author.

Authors contribution:

Conceptualization: ANT, KCP, SS

Methodology: KCP, NKM, KKVSR, VK, RS

Software, formal analysis: KCP

Investigation: NKM, KKVSR, VK, RS

Resources: NKM, KKVSR, VK, RS

Data curation: KCP, ATN

Writing: KCP, NKM, KKVSR, VK, RS

Writing-review and editing: ANT, KCP

Supervision: NKM, KKVSR, VK, RS

Project administration: KCP, ATN

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