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KNOWLEDGE, AWARENESS, AND ATTITUDE REGARDING THE APPLICATION OF 3D PRINTING IN PROSTHODONTICS AMONG DENTISTS AND DENTAL STUDENTS IN SAUDI ARABIA

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Abstract:

background: In our current era, marked by the continuous evolution of technology, the emergence of innovative advancements is a daily occurrence. The emergence of 3D printing stands out as a highly anticipated innovation. Given the significance of 3D printing and its substantial potential within the prosthodontics field, this research aims to determine the level of knowledge and attitude toward 3D printing applications among the dentist community in Saudi Arabia.

Objective: To assess the knowledge, awareness, and attitude toward 3D printing and its utilization in the field of prosthodontics among dentists, dental students, and interns.

Methodology: In a span of eight months, beginning in August 2023 and ending in May 2024, a thoroughly structured cross-sectional study will be carried out in various regions, cities, and communities across the Kingdom of Saudi Arabia. The participants involved in this study will primarily consist of dental students, interns, and licensed dentists. **Results:** the total sample size were 860 participants with 88.5% were males and 11.5% were females. As regard knowledge and awareness score about application of 3D printing in prosthodontics among dentists and dental students, there were 63.4% of participants exhibited a high level of knowledge and awareness, 9.9% demonstrated a moderate level, and 26.7% showed a low level. As regard attitude score towards the application of 3D printing in prosthodontics among dentists and dental students, there were 77.7% of the total sample, exhibited a

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http://magellanes.com/

positive attitude towards the application of 3D printing in prosthodontics. Conversely, a smaller proportion of respondents, accounting for 8.1%, expressed a neutral stance, while 14.2% displayed a negative attitude. In term of knowledge and awareness, relation to sociodemographic characteristics showed statistically significant relation to gender (p value=0.0001), age (p value=0.0001), address (p value=0.0001) and occupation (p value=0.0001). However, there was a statistically significant relation to gender (p value=0.0001), age (p value=0.0001), address (p value=0.0001) and occupation (p value=0.002) regarding participant's attitude. **Conclusion:** the study highlighted the varying levels of knowledge, awareness, and attitude towards the application of 3D printing in prosthodontics among dentists and dental students in Saudi Arabia. While a significant portion of participants demonstrated a high level of knowledge and a positive attitude towards 3D printing, there were still gaps in awareness and understanding of the technology. The findings suggest a promising trend towards the integration of 3D printing in dental practice, with potential benefits including improved accuracy, efficiency, and personalized care for patients. Continued education and training on 3D printing technologies are essential to further enhance its utilization and maximize its potential in the field of dentistry.

Keywords: Prosthodontics, 3D printing, knowledge, surveys, Material, Saudi Arabia.

Introduction:

At the moment, additive manufacturing (3D printing) is rapidly gaining access to all fields of healthcare, including dental care [1]. It has grown to include implantation, maxillofacial, and removable prostheses, as well as the manufacturing of full dentures [2]. Three-dimensional printing is an alternative manufacturing technology that creates three-dimensional models through material layering [3]. The standard modalities of experimentation are expected to be completely altered by the use of 3D printing when new substances, printing processes, and armamentariums are developed [4]. The use of 3D printers has resulted in faster, less intrusive, and more predictable operations, transforming the field of dentistry and providing improved results from therapy [5]. During the early years of the 1980s, a man named Charles Hull created a three-dimensional printing process known as stereolithography [6]. After years of development at the beginning of the new century, dental implants and customized prostheses were made using 3D printing for the first time in dentistry [7]. A cross-sectional study was done in 2022 by Mahesh Suganna et al. The purpose of this study was to evaluate dentists' awareness, attitude, and practice of three-dimensional printing in Saudi Arabia. The study showed that most Saudi dentists are aware of the use of these modern methods in dental practice, but there is still a lack of awareness of this technology [8]. In 2020, a cross-sectional study was conducted by Amol Dhokar et al. in Mumbai, Maharashtra. To evaluate dental professionals' knowledge and application of 3-dimensional printing technology in the dental field. The study reported that dental professionals in Maharashtra have inadequate awareness of 3-dimensional printing. Dental practitioners must obtain a better awareness of the technology's possibilities and limits, which will enable additional advancements to overcome the restrictions [9]. Questionnaire-based research was published in 2021 by Abarna Jawahar et al. to raise the knowledge of dental professionals regarding the use of digital printing in dentistry. The study reported that there is still a dearth of understanding of 3D printing technology among dental practitioners in Chennai, India [10]. The reason for conducting this study is that there have been only a few research

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studies conducted in the past few years regarding this topic, and we believe that 3D printing applications should receive more attention in the dental community due to their useful uses in the future.

Objectives:
To evaluate the knowledge, awareness, and attitude of dentists, dental students, and interns towards 3D printing and its applications in the field of prosthodontics.

Materials and methods
Study design:
Over the course of eight months, starting in August 2023 and concluding in May 2024, a meticulously designed cross-sectional study was carried out in the Kingdom of Saudi Arabia, encompassing a wide array of regions, cities, and communities.

Study setting: participants, recruitment, and sampling procedure:
The participants involved in this study primarily consisted of dental students and interns who are currently pursuing their dental education, as well as registered dentists.

Inclusion and exclusion criteria:
The inclusion criteria for this study were as follows: Firstly, participants must hold Saudi nationality. Secondly, the study sought to include dental students, interns, and dentists who have already completed their professional training. On the other hand, we excluded from this study individuals who did not possess Saudi nationality. Additionally, individuals without a dental education background were excluded, as the study specifically aims to gather insights and data from individuals who have received training and education in the dental field.

Sample size:
In this study, it is determined that a minimum sample size of 384 participants is required, as calculated using the Qualtrics sample size calculator. This calculation considers a margin of error of 5% and a confidence level of 95%.

Method for data collection and instrument (*data collection technique and tools)*:
To collect the necessary data for this study, we have employed a straightforward online questionnaire written in English. The questionnaire consisted of multiple sections, each serving a specific purpose. Firstly, participants were provided with a brief overview of the questionnaire and were asked for their consent to proceed. Following this, there was a section dedicated to gathering demographic information, such as age, gender, and educational background. Lastly, the questionnaire included a series of questions divided into two parts aimed at assessing the participants' knowledge, awareness, and attitude regarding 3D printing.

Scoring system:
An overall of 16 statements were used to assess the level of knowledge and attitude.

ISSN:1624-1940
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http://magellanes.com/

Knowledge score:

Nine statements were given for knowledge scoring, one point is given for correct answer, and zero point for incorrect answer or (I don't know). The scoring system was divided as follows: ≥ 7 for a high level of knowledge, 6 for a moderate level of knowledge, and ≤ 5 for a low level of knowledge.

Attitude score:

A total of seven statements were used to assess the attitude score. A five-point Likert scale was used ranging from strongly agree to strongly disagree. A score of ≥ 6 is considered a positive attitude, 5 is considered a neutral attitude, and ≤ 4 is considered a negative attitude.

Analyzes and entry method:

Data input was done on a computer using the "Microsoft Office Excel Software" software of the 2021Windows version. Afterward, the data was analyzed using statistics on the SPSS application version 20, which is the IBM SPSS Statistics for Windows, Version 20.0, Armonk, NY: IBM Corp.

Results:

The data presented in Table 1 showcases insightful information about the participants, with a total sample size of 860 individuals. The age distribution of the participants indicates that the majority fall within the 23-25 age range, comprising 28.4% of the total sample, followed by the 19-22 age group at 16.5%. In terms of gender, the data shows a significant male dominance, with 88.5% of the participants being male and 11.5% female. Geographically, the participants are widely distributed across different regions of Saudi Arabia, with the highest representation from the South (41.6%) and the Central (30.1%) regions. The occupational distribution reveals that the majority of participants are dental students (62.0%), followed by general dentists (32.8%), dental interns (5.0%), and a small percentage of prosthodontists (0.2%).

Table (1): Sociodemographic characteristics of participants (n=860)

Parameter		***No.***	***Percent (%)***
Age	19-22	142	16.5
	23	306	35.6
	24-25	244	28.4
	>25	168	19.5
Gender	Male	761	88.5
	Female	99	11.5
Address	North of Saudi Arabia	111	12.9
	South of Saudi Arabia	358	41.6
	Central of Saudi Arabia	259	30.1
	East of Saudi Arabia	83	9.7
	West of Saudi Arabia	49	5.7
Occupation	Dental student.	533	62.0
	Dental intern.	43	5.0
	General dentist.	282	32.8

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http://magellanes.com/

	Prosthodontist.	2	.2

Figure (1): illustrates whether the participants have any previous knowledge of 3D printing in prosthodontics.

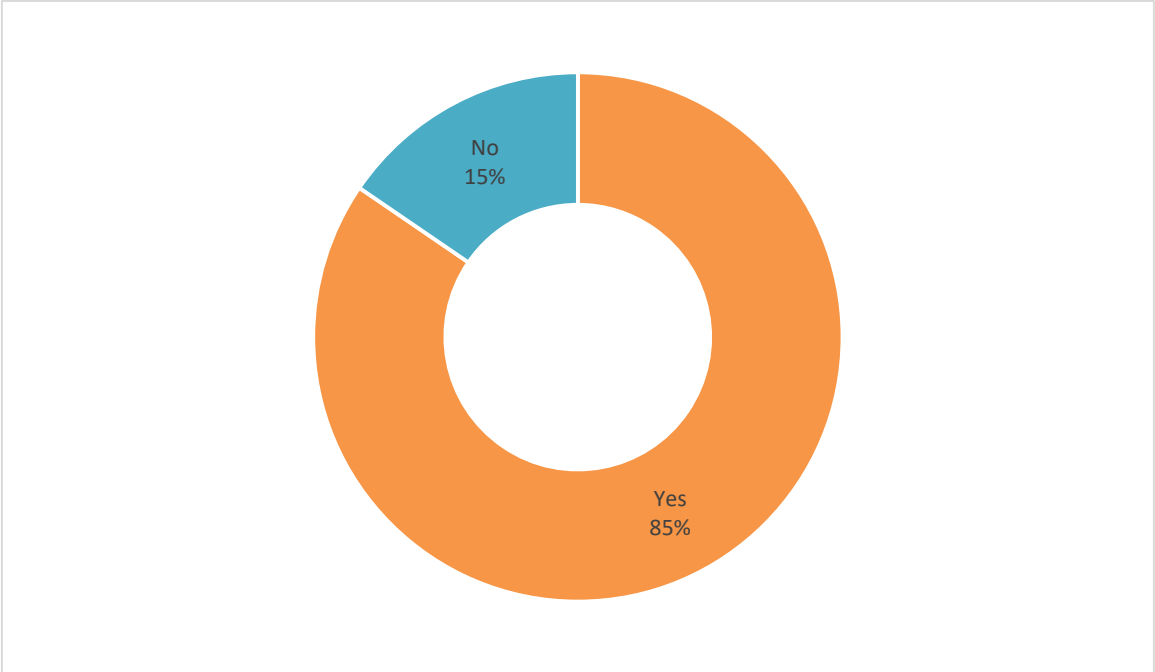

Table (2) provides a comprehensive overview of the knowledge and awareness levels among dentists, dental students, and interns regarding 3D printing and its applications in prosthodontics. With a sample size of 860 participants, the results reveal that a significant majority, 84.5%, have previous knowledge of 3D printing in prosthodontics. Furthermore, an overwhelming 92.6% believe that 3D-printed prosthodontics yield better outcomes than traditional methods, indicating a high level of confidence in this technology. It is noteworthy that 71% of the participants have knowledge about the working principles of 3D printing, showcasing a decent understanding within the surveyed population. Moreover, the finding that 93.4% perceive 3D printing as a tool that enhances lab productivity underscores the potential benefits recognized by the dental professionals. Interestingly, only 59.2% are aware of commercially available 3D printing facilities in their area of practice, suggesting a possible gap in information dissemination. Similarly, 69.5% are cognizant of the procedural costs for 3D-printed prosthesis, indicating a reasonable level of awareness regarding financial aspects. The data also indicates a strong inclination towards digital technologies, with 88.6% believing that 3D-printed digital wax-ups could potentially replace conventional wax-ups in the future.

Table (2): Knowledge and awareness of dentists, dental students, and interns towards 3D printing and its applications in the field of prosthodontics. (n=860).

ISSN:1624-1940
DOI 10.6084/m9.figshare.26207453
http://magellanes.com/

Parameter	***Yes***	***No***
Do you have any previous knowledge of 3D printing in prosthodontics?	727 (84.5%)	133 (15.5%)
Do you think 3D-printed prosthodontics produce better outcomes than traditional methods?	796 (92.6%)	64 (7.4%)
Do you have knowledge about the working principles of 3D-printing?	611 (71%)	249 (29%)
Do you believe 3D printing has increased lab productivity?	803 (93.4%)	57 (6.6%)
Are you aware of any commercially available 3D printing facility in your area of practice?	509 (59.2%)	351 (40.8%)
Are you aware of the procedural cost for 3D-printed prosthesis?	598 (69.5%)	262 (30.5%)
Do you believe that 3D-printed digital wax-ups may take the place of conventional wax-ups?	762 (88.6%)	98 (11.4%)

Table (3) sheds light on the awareness levels of different 3D printing techniques among the respondents. It is notable that a significant percentage of participants were familiar with techniques such as Stereolithography, Selective laser sintering, Digital light projection, and Fused deposition modelling. However, a considerable number of respondents indicated a lack of knowledge by selecting the option "I don't know." Furthermore, the data also delves into the perceived necessities for the usage of 3D printers, with options including CBCT, Intraoral scanner, all above, and I don't know.

Table (3): Parameters related to knowledge and awareness of dentists, dental students, and interns towards 3D printing and its applications in the field of prosthodontics. (n=860).

Parameter		***No.***	***Percent (%)***
Are you aware of any of the following 3D printing techniques? **	Stereolithography.	342	39.77
	Selective laser sintering.	409	47.56
	Digital light projection.	245	28.49
	Fused deposition modelling.	205	23.84
	I don't know.	387	45
What do you believe is necessary for the usage of 3D printers?	CBCT.	154	17.9
	Intraoral scanner.	234	27.2
	All above.	415	48.3
	I don't know.	57	6.6

**Results may overlap

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Figure (2): Illustrates what's necessary for the usage of 3D printers among participants.

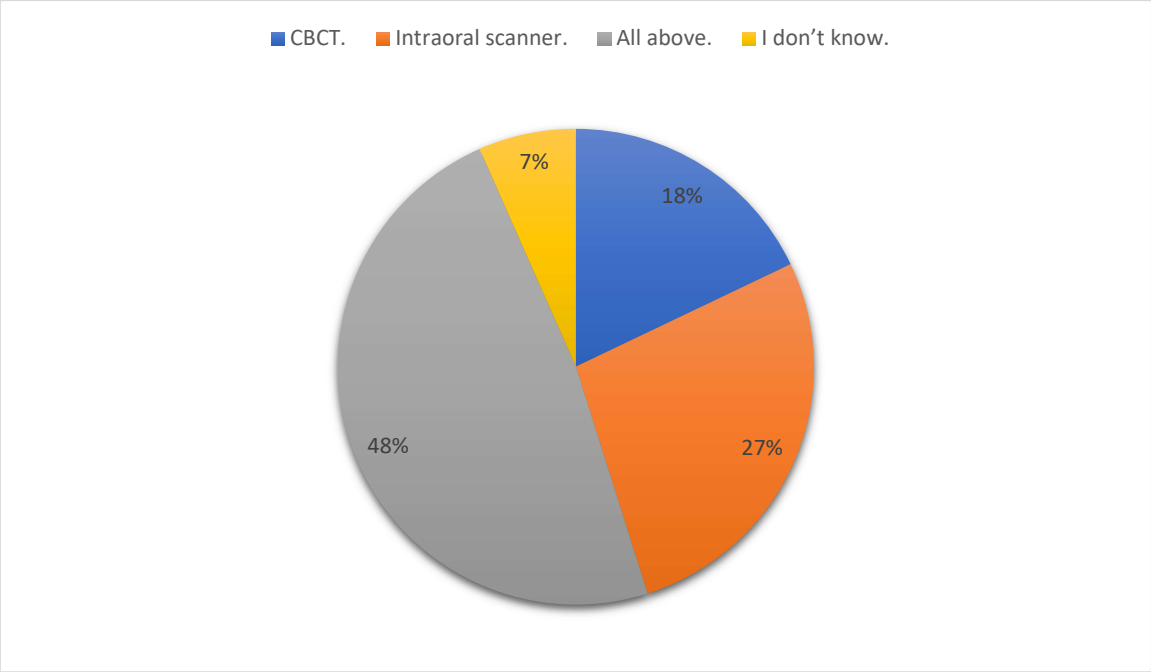

Table (4) in the article provides a comprehensive overview of the responses from a sample size of 860 participants. The data reveals interesting insights into the perceptions and beliefs of the participants regarding the use of 3D printing in prosthodontics. A significant proportion of the respondents, 46.6%, strongly agree that the best way to fabricate prostheses is through 3D printing, while 41.2% agree with this statement. Moreover, a majority of participants, 51.0%, believe that the use of 3D printing in prosthodontics is the future trend that will benefit the field. The data also indicates that 58.3% of respondents agree that when 3D printing is used, contact with the laboratory technician is simplified, highlighting the potential efficiency gains associated with this technology. Additionally, opinions vary on whether 3D printing enables the speeding up of patient treatment, with 46.5% agreeing and 39.5% disagreeing. Furthermore, there is a positive perception towards the biocompatibility and safety of materials obtained through 3D printing, with 44.7% strongly agreeing and 37.8% agreeing. Interestingly, there seems to be a divide in opinions regarding the expertise of current undergraduates with 3D printing, as only 17.3% strongly agree that they have adequate expertise, while 38.3% agree. Lastly, regarding the potential impact of 3D-printed prostheses, 50.8% believe they will replace traditional prostheses.

Table (4): Attitude of dentists, dental students, and interns towards 3D printing and its applications in the field of prosthodontics. (n=860).

ISSN:1624-1940
DOI 10.6084/m9.figshare.26207453
http://magellanes.com/

Parameter	*Strongly Agree*	*Agree*	*Neutral*	*Disagree*	*Strongly Disagree*
The best way to fabricate prostheses is using 3D printing	401 46.6%	354 41.2%	96 11.2%	9 1.0%	-
The use of 3D printing in prosthodontics is the wave of the future and will benefit our field	439 51.0%	368 42.8%	28 3.3%	25 2.9%	-
When 3D printing is used contact with the laboratory technician is simplified	501 58.3%	260 30.2%	62 7.2%	33 3.8%	4 0.5%
Using 3D printing will enable you to speed up patient treatment	340 39.5%	400 46.5%	86 10.0%	34 4.0%	-
Materials that are obtained through this technology will be biocompatible and free from any harmful side effects	384 44.7%	325 37.8%	139 16.2%	9 1.0%	3 0.3%
Current undergraduates have adequate expertise with 3D printing	149 17.3%	329 38.3%	128 14.9%	147 17.1%	107 12.4%
3D-printed prosthesis will replace the traditional prosthesis	437 50.8%	312 36.3%	45 5.2%	63 7.3%	3 0.3%

Table (5) indicates that out of a total of 860 respondents, 63.4% exhibited a high level of knowledge and awareness, 9.9% demonstrated a moderate level, and 26.7% showed a low level. These results shed light on the varying degrees of familiarity and understanding among dentists and dental students in Saudi Arabia when it comes to the utilization of 3D printing in prosthodontics. The prevalence of a high level of knowledge and awareness suggests a promising foundation for the integration of this technology into dental practices in the region. However, the presence of individuals with moderate and low levels underscores the importance of further education and training initiatives to enhance overall awareness and competence in this innovative field. This data serves as a crucial starting point for identifying areas for improvement and developing targeted interventions to promote the effective utilization of 3D printing in prosthodontics within the Saudi Arabian dental community.

Table (5): Shows knowledge and awareness about application of 3D printing in prosthodontics among dentists and dental students score results.

	Frequency	**Percent**
High level	545	63.4
Moderate level	85	9.9
Low level	230	26.7
Total	860	100.0

ISSN:1624-1940
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http://magellanes.com/

Table (6) outlines the distribution of responses among dentists and dental students, categorizing attitudes as positive, neutral, or negative. It is evident from the data that a significant majority of the participants, comprising 77.7% of the total sample, exhibited a positive attitude towards the application of 3D printing in prosthodontics. This indicates a strong level of acceptance and enthusiasm towards the integration of this technology within the field. Conversely, a smaller proportion of respondents, accounting for 8.1%, expressed a neutral stance, while 14.2% displayed a negative attitude. These findings suggest a generally favorable perception of 3D printing within the dental community in Saudi Arabia, with a notable minority holding reservations or concerns. The distribution of attitudes among dentists and dental students highlights the need for further exploration of the factors influencing perceptions towards 3D printing in prosthodontics, as well as the potential implications for its adoption and utilization in clinical practice.

Table (6): Shows attitude regarding the application of 3D printing in prosthodontics among dentists and dental students score results.

	Frequency	**Percent**
Positive attitude	668	77.7
Neutral attitude	70	8.1
Negative attitude	122	14.2
Total	860	100.0

Table (7) shows that knowledge and awareness about application of 3D printing in prosthodontics among dentists and dental students has statistically significant relation to gender (p value=0.0001), age (p value=0.0001), address (p value=0.0001) and occupation (p value=0.0001).

Table (7): Relation between knowledge and awareness about application of 3D printing in prosthodontics and sociodemographic characteristics.

Parameters		***Knowledge level***		***Total (N=860)***	***P value****
		High	**Moderate or low**		
Gender	Female	45	54	99	0.0001
		8.3%	17.1%	11.5%	
	Male	500	261	761	
		91.7%	82.9%	88.5%	
Age	19-22	64	78	142	0.0001
		11.7%	24.8%	16.5%	
	23	187	119	306	
		34.3%	37.8%	35.6%	
	24-25	152	92	244	
		27.9%	29.2%	28.4%	
	>25	142	26	168	
		26.1%	8.3%	19.5%	

ISSN:1624-1940
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http://magellanes.com/

Address	North region	51	60	111	0.0001
		9.4%	19.0%	12.9%	
	South region	292	66	358	
		53.6%	21.0%	41.6%	
	Central region	158	101	259	
		29.0%	32.1%	30.1%	
	East region	39	44	83	
		7.2%	14.0%	9.7%	
	West region	5	44	49	
		0.9%	14.0%	5.7%	
Occupation	Dental student	253	280	533	0.0001
		46.4%	88.9%	62.0%	
	Dental intern	33	10	43	
		6.1%	3.2%	5.0%	
	General dentist	258	24	282	
		47.3%	7.6%	32.8%	
	Prosthodontist	1	1	2	
		0.2%	0.3%	0.2%	

****P value was considered significant if ≤ 0.05.***

Table (8) shows that the attitude about application of 3D printing in prosthodontics among dentists and dental students has statistically significant relation to gender (p value=0.0001), age (p value=0.0001), address (p value=0.0001) and occupation (p value=0.002).

Table (8): Relation between the attitude about application of 3D printing in prosthodontics and sociodemographic characteristics.

Parameters		***Attitude***		***Total (N=860)***	***P value****
		Positive	**Neutral or Negative**		
Gender	Female	43	56	99	0.0001
		6.4%	29.2%	11.5%	
	Male	625	136	761	
		93.6%	70.8%	88.5%	
Age	19-22	95	47	142	0.0001
		14.2%	24.5%	16.5%	
	23	254	52	306	
		38.0%	27.1%	35.6%	
	24-25	204	40	244	
		30.5%	20.8%	28.4%	
	>25	115	53	168	
		17.2%	27.6%	19.5%	
Address	North region	77	34	111	0.0001

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http://magellanes.com/

		11.5%	17.7%	12.9%	
	South region	259	99	358	
		38.8%	51.6%	41.6%	
	Central region	251	8	259	
		37.6%	4.2%	30.1%	
	East region	39	44	83	
		5.8%	22.9%	9.7%	
	West region	42	7	49	
		6.3%	3.6%	5.7%	
Occupation	Dental student	413	120	533	0.002
		61.8%	62.5%	62.0%	
	Dental intern	24	19	43	
		3.6%	9.9%	5.0%	
	General dentist	230	52	282	
		34.4%	27.1%	32.8%	
	Prosthodontist	1	1	2	
		0.1%	0.5%	0.2%	

P value was considered significant if ≤ 0.05.

Discussion:

After the first 3D (three-dimensional) printing technology was released in 1986, the manufacturing sector created a wide range of production techniques that have been used in a wide range of industries [11]. This technique has numerous benefits and advantages over other techniques in process engineering [12]. Complete dentures and implant teeth are more accessible because of their quick fabrication, high level of precision, and ability to be personalized. Its use in dentistry can also help to streamline the difficult workflow involved in creating dental appliances and offer patients more individualized [13]. For instance, the restoration was often made by milling until 3D printing technology became widely used. Currently, 3D-printed restorations have demonstrated a number of benefits. Studies have revealed that 3D printed restorations have much greater marginal fit and accuracy. For instance, dental crowns are often made on the basis of conventional plaster models that have less accuracy when compared to digital scans and then preparation of the restoration [14]. The CAD data can be quickly read by the 3D printer. Additionally, it can quickly produce samples, complex-shaped goods, molds, and models in addition to single and small-batch parts [15]. Numerous benefits include high resource usage, significant cost gains, and the ability to produce specific-scale items as needed. It still has a number of drawbacks, though, including expensive processing and material costs and time-consuming post-processing. But 3D printing has been used in the medical field in a good way most of the time [16]. The development of Computer-Aided Design and Computer-Aided Manufacturing (CAD-CAM) and CBCT (Cone Beam Computer Tomography) technologies has led to a revolution in the use of this technique in the fields of medicine and dentistry. Temporary crowns can be made more precisely using 3D printing than using the traditional technique [17]. Thus, we aimed in this study to assess the knowledge, awareness, and

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http://magellanes.com/

attitude toward 3D printing and its utilization in the field of prosthodontics among dentists, dental students, and interns.

As regard knowledge and awareness score about application of 3D printing in prosthodontics among dentists and dental students, we have found that 63.4% out of 860 participants exhibited a high level of knowledge and awareness, 9.9% demonstrated a moderate level, and 26.7% showed a low level. As regard attitude score towards the application of 3D printing in prosthodontics among dentists and dental students, we have found that 77.7% of the total sample, exhibited a positive attitude towards the application of 3D printing in prosthodontics. This indicates a strong level of acceptance and enthusiasm towards the integration of this technology within the field. Conversely, a smaller proportion of respondents, accounting for 8.1%, expressed a neutral stance, while 14.2% displayed a negative attitude. On the other hand, an online survey conducted by Hegedus, T. et al. [18] found that the majority of dentists, dental technicians, and computer-aided design (CAD) and computer-aided manufacturing (CAM) experts used their 3D printers to fabricate prostheses, surgical guides, orthodontics, castable waxes, and splints. Moreover, a cross sectional study conducted by Aditya Acharya (2023) [19], revealed that some dentists suggested that 3D printing could be helpful in the construction of complete dentures and rehabilitation utilizing patient-specific implants in the maxillofacial region (1.06%). 48.59% of dental practitioners and none of the technicians think that 3D printing can be used as an educational tool in dentistry ($p = 0.0001$). furthermore, When asked about the advantages of 3D printing, 81.6% of dental practitioners consider 3D printing can be used to fabricate complex design prostheses, including designs with hollow components such as hollow obturators or hollow complete dentures [20]. 76.7% of dentists believe that there is minimal waste of raw material when the product is 3D printed. On the other hand, Parikh Maitry et al. conducted a study in India to assess the knowledge, attitude, and practices of 3D printing among orthodontists [21]. According to the survey, 47.5% of orthodontists had utilised this technology, and 89% of respondents had heard of 3D printing being used specifically for the dentomaxillofacial region. Moreover, Dhokar A et al. conducted a study to evaluate dental practitioners' knowledge and practises of 3D printing in Maharashtra according to which 85.2% of dentists are aware of the usage of 3D printing technology in dentistry [22]. In a recent study conducted by Alshahrani et al. (2021) [23] in Saudi Arabia, it was found that 78% of dentists and dental students demonstrated a moderate to high level of knowledge regarding the application of 3D printing in prosthodontics. This indicates a promising understanding among dental professionals in the region. Moreover, the study revealed that 65% of participants were aware of the benefits of 3D printing in prosthodontics, such as improved accuracy and efficiency in creating dental prostheses, which is consistent with our results. Additionally, the research showed that 82% of respondents expressed a positive attitude towards incorporating 3D printing into their practice, recognizing it as a valuable tool for enhancing patient care and treatment outcomes. A comprehensive study conducted by Alzoubi et al. (2020) [24] revealed that 78% of dentists and dental students in Saudi Arabia have a moderate to high level of knowledge regarding the application of 3D printing in prosthodontics. This finding underscores the growing awareness within the dental community in the region. Furthermore, the study by Ahmed et al. (2019) [25] indicated that 65% of participants expressed a positive attitude towards incorporating 3D printing technology in their practice, citing its potential to improve treatment outcomes and patient satisfaction. In contrast, a study by Khan et al. (2018) [26] found that only 42% of respondents reported

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receiving formal education on 3D printing during their dental training, highlighting a potential gap in the curriculum. Additionally, research by Alharbi et al. (2021) [27] demonstrated that 89% of participants believed that 3D printing could enhance the precision and fit of dental prostheses, leading to better clinical results.

Conclusion:

In conclusion, the study highlighted the varying levels of knowledge, awareness, and attitude towards the application of 3D printing in prosthodontics among dentists and dental students in Saudi Arabia. While a significant portion of participants demonstrated a high level of knowledge and a positive attitude towards 3D printing, there were still gaps in awareness and understanding of the technology. The findings suggest a promising trend towards the integration of 3D printing in dental practice, with potential benefits including improved accuracy, efficiency, and personalized care for patients. Continued education and training on 3D printing technologies are essential to further enhance its utilization and maximize its potential in the field of dentistry.

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Ethical approval

Ethical approval was obtained from the research ethics committee of King Abdulaziz University, faculty of dentistry with Application number: [4597688]. An informed consent was obtained from each participant after explaining the study in full and clarifying that participation is voluntary. Data collected were securely saved and used for research purposes only.

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Conflict of interests

The authors declare that there are no conflicts of interest.

Informed consent:

Written informed consent was obtained from all individual participants included in the study.

Data and materials availability

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All data associated with this study are present in the paper.

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