European Journal of Clinical Pharmacy
Print ISSN: 2385-409X, **Online ISSN**: 3105-0409
Website: https://farmclin.com/

"EVALUATION OF KNOWLEDGE AND PERCEPTION OF UNDERGRADUATE DENTAL STUDENTS IN COIMBATORE DISTRICT ON VIRTUAL REALITY(VR)TECHNOLOGY IN DENTISTRY -A QUESTIONNAIRE STUDY."

Article History:

Name of Author:
Dr Nivethitha M[1]*, Dr Reemitha P[2] , Dr Sumathy K[3] , Dr Deepshika Saravanan[4], Dr Vijay V K[5]

Affiliation: *[1,2,3]MDS (Periodontology)., RVS Dental College and Hospital, Coimbatore, India*
[4]MDS., Professor, Head of the Department (Periodontology) RVS Dental College and Hospital, Coimbatore, India
[5]MDS., MBA (H.M)., FADI, Professor, PRINCIPAL cum DIRECTOR, RVS Dental College and Hospital, Coimbatore, India

Corresponding Author:
Dr Nivethitha M:
nivethithamohankumar111@gmail.com

Received*:* 12-04-2026
Revised*:* 19-04-2026
Accepted*:* 06-05-2026
Published*:* 25-05-2026

Abstract: Background: The preclinical training-clinical practice transition is a critical and sometimes challenging phase in the undergraduate dental student, especially in dealing with real patients. Despite gaining experience in the process of working on simulation models, many students lack confidence in the performance of treatments and planning their performance due to the lack of clinical experience. VR is transforming the field of dentistry by enhancing patient care and training and educating dental students. These limitations can be well overcome with integration of virtual reality. The current research was meant to assess the knowledge and perception of dental students towards virtual reality technology.**Materials & Methods:**A questionnaire-based cross-sectional study was conducted targeting undergraduate dental students in dental colleges in the Coimbatore district in the second, third, and final years and during their internship. Twenty validated questions were created and circulated to 800 students through Google Forms, and the responses were statistically analyzed using percentage analysis and the chi-square test.**Results:**Most participants self-assessed their knowledge as being at a good level, agreed that VR could be useful for their education, and wanted to incorporate it into dental practice.**Conclusion:**Only half of the dental students were aware of VR being used in dentistry Integrating virtual reality effectively improves the skills and confidence, leading to better clinical practice.
Keywords: Virtual Reality (VR) Dentistry Dental Education Undergraduate Dental Students

INTRODUCTION

The concept of virtual reality (VR) technology in dentistry is a new twist in the clinical practice and dental education. It combines computer-generated, immersive, three-dimensional, environments that enable users to interact with simulated dental situations in real time. It is possible to provide dental practitioners and dental students with a realistic experience of performing dental procedures, such as tooth restoration, surgery, etc., without having to work on a real patient.

This technology can improve the learning process by providing a repetitive practice in a risk-free environment in which the effects of errors are not actual in the real world. In the case of practitioners, VR may be employed to plan a complex treatment, see anatomical structures in detail, and enhance communication with the patient through virtual demonstrations of the proposed treatment. It is also instrumental in helping to lessen patient anxiety through providing a pre-treatment simulation or distraction therapy during dental procedures.

With the further development of VR tools, their uses in dentistry are getting more sophisticated, merging the elements of realism, accuracy, and interactivity. This combination of technology and clinical know-how is transforming the way future dentists are educated and how they administer patient care in the future in a way that promotes higher standards of accuracy, safety and confidence to the field.

Virtual reality is transforming dentistry as it enhances patient care, education and training to the dental students. Virtual reality (VR) is also providing an engaging and immersive experience that is changing the face of dentistry. This technology can transform the dental experience to one that is more enjoyable, efficient and effective. VR can be greatly used in future shaping, starting with the anxiety-reducing simulations, all the way to the precise treatment planning. This study evaluated dental students' knowledge regarding the use of virtual reality in dentistry.

Material And Methods

Study design: This was a descriptive cross-sectional questionnaire-based study. The study was conducted in the dental colleges in the Coimbatore district.

Inclusion criteria: Only undergraduate dental students studying in the second , third , final year, and internship were selected for this study.

Exclusion criteria:
Students in the first year were excluded from this study, as they were new to the dental curriculum, and their response would misguide the data collected for this study.

Study setting:
A total of 20 validated questions related to demographic data (4 questions) and questions evaluating general knowledge on VR (4 questions) and its application in dentistry (12 questions) were created and circulated to 800 undergraduate dental students in dental colleges in the Coimbatore district through Google Forms to analyze the knowledge and perception of virtual reality technology.
The sample size was 465, using Slovin's formula.

Result:

Of 800 dental students, 467 responded. With the response collected from the undergraduate dental students, statistical analysis was done using percentage analysis and the chi-square test. Results from the chi-square test revealed that gender and knowledge p (0.020), gender and usage p (0.000), and gender and training received on VR technology p (0.035) were significantly related. Gender and awareness of VR technology being used in industry (p-1.427); gender and usage of VR technology for educational purposes p (0.101); and gender and incorporating VR technology in dental programs p (0.588) were not significantly related.

Chi-Square Test no: 1

Gender * Usage of VR Technology Crosstabulation				
		Usage of VR Technology		
		Yes	No	Total
Gender	Male	67	63	130
	Female	97	241	338
Total		164	304	468

NULL HYPOTHESIS (H_0): There is no significant relationship between gender and usage of VR Technology. ALTERNATE HYPOTHESIS (H_1): There is a significant relationship between gender and usage of VR Technology.

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	21.517[a]	1	0.000		
Continuity Correction[b]	20.526	1	.000		
Likelihood Ratio	20.949	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	21.471	1	.000		
N. of Valid Cases[b]	468				

Chi-square value= 21.517
p value = 0.000
Degrees of freedom = 1
Level of significance = 5%
Here the. p-value (0.000) is less than 0.05.
H_0 is rejected, and H_1 is accepted.

Hence, we conclude that gender and usage of VR Technology is significantly related.

Chi-Square Test no: 2

Gender * Usage of VR Technology for Educational Purposes Crosstabulation				
		Usage of VR Technology for Educational Purposes		
		Yes	No	Total
Gender	Male	37	93	130
	Female	72	266	338
Total		109	359	468

NULL HYPOTHESIS (H_0): There. is no significant relationship between gender and usage of VR Technology for educational purposes.
ALTERNATE HYPOTHESIS (H_1): .There is a significant relationship between gender and usage of VR Technology for educational purposes.

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.694[a]	1	0.101		
Continuity Correction[b]	2.308	1	.129		
Likelihood Ratio	2.620	1	.105		
Fisher's Exact Test				.113	.066
Linear-by-Linear Association	2.688	1	.101		
N. of Valid Cases[b]	468				

Chi-square value= 2.694
p value = 0.101
Degrees of freedom = 1
Level of significance = 5%
Here the p-value (0.101) is more than 0.05.
H_0 is accepted and H_1 is rejected.

Hence we conclude that gender and usage of VR Technology for educational purposes is not significantly related.
Chi-Square Test no: 3

Gender * Awareness of VR being used in Dentistry Crosstabulation				
Awareness of VR being used in Dentistry				
		Yes	No	Total
Gender	Male	69	61	130
	Female	200	138	338
Total		269	199	468

NULL HYPOTHESIS (H_0): There is no significant relationship between gender and awareness of VR Technology being used in industry.
ALTERNATE HYPOTHESIS (H_1): There is a significant relationship between gender and awareness of VR Technology being used in industry.

Chi-Square Tests					
	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	1.427[a]	1	0.232		
Continuity Correction[b]	1.188	1	.276		
Likelihood Ratio	1.421	1	.233		
Fisher's Exact Test				.252	.138
Linear-by-Linear Association	1.424	1	.233		
N. of Valid Cases[b]	468				

CHI-SQUARE VALUE = 1.427
P VALUE = 0.232
Degrees of freedom = 1
Level of significance = 5%
Here the p-value (1.427) is more than 0.05.
H_0 is accepted and H_1 is rejected.

Hence, we conclude that gender and awareness of VR Technology being used in industry is not significantly related.
Chi-Square Test no: 4

Gender * Knowledge of VR Technology in Dentistry Crosstabulation						
Knowledge of VR Technology in Dentistry						
		Very Good	Good	Fair	Poor	Total
Gender	Male	32	58	23	17	130
	Female	64	116	93	65	338
Total		96	174	116	82	468

NULL HYPOTHESIS (H_0): There is no significant relationship between gender and knowledge of VR Technology in industry.
ALTERNATE HYPOTHESIS (H_1): There is a significant relationship between gender and knowledge of VR Technology in industry.

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.838[a]	3	0.020
Likelihood Ratio	10.072	3	.018

Linear-by-Linear Association	7.251	1	.007
N of Valid Cases	468		

Chi-square value = 9.838
p value = 0.020
Degrees of freedom = 3
Level of significance = 5%
Here, the p-value (0.020) is less than 0.05.
H_0 is rejected and H_1 is accepted.

Hence, we conclude that gender and knowledge of VR Technology in industry is significantly related.

Chi-Square Test no: 5

Gender * Received training on VR Technology Crosstabulation				
		Received training on VR Technology		
		Yes	No	Total
Gender	Male	38	92	130
	Female	68	270	338
Total		106	362	468

NULL HYPOTHESIS (H_0): There is no significant relationship between gender and training received on VR technology.
ALTERNATE HYPOTHESIS (H_1): There is a significant relationship between gender and training received on VR technology.

Chi-Square Tests					
	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	**4.450[a]**	**1**	**0.035**		
Continuity Correction[b]	3.945	1	.047		
Likelihood Ratio	4.295	1	.038		
Fisher's Exact Test				.048	.025
Linear-by-Linear Association	4.440	1	.035		
N. of Valid Cases[b]	468				

Chi-square value = 4.450
p value = 0.035
Degrees of freedom = 1
Level of significance = 5%
Here, the p-value (0.035) is less than 0.05.
H_0 is rejected, and H_1 is accepted.

Hence, we conclude that gender and training received on VR technology is significantly related.
Chi-Square Test no: 6

Gender * Incorporate VR Technology in Dental Program Crosstabulation				
Incorporate VR Technology in Dental Program				
		Yes	No	Total
Gender	Male	111	19	130
	Female	295	43	338
Total		406	62	468

NULL HYPOTHESIS (H_0): There is no significant relationship between gender and incorporating VR Technology in dental program.

ALTERNATE HYPOTHESIS (H_1): There is a significant relationship between gender and incorporating VR Technology in dental program.

Chi-Square Tests					
	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	0.293[a]	1	0.588		
Continuity Correction[b]	.151	1	.697		
Likelihood Ratio	.288	1	.592		
Fisher's Exact Test				.648	.344
Linear-by-Linear Association	.292	1	.589		
N. of Valid Cases[b]	468				

Chi-square value = 0.293

p value = 0.588

Degrees of freedom = 1

Level of significance = 5%

Here, the p-value (0.588) is more than 0.05.

H_0 accepted, and H_1 is rejected.

Hence, we conclude that gender and incorporating VR Technology in dental program is not significantly related.

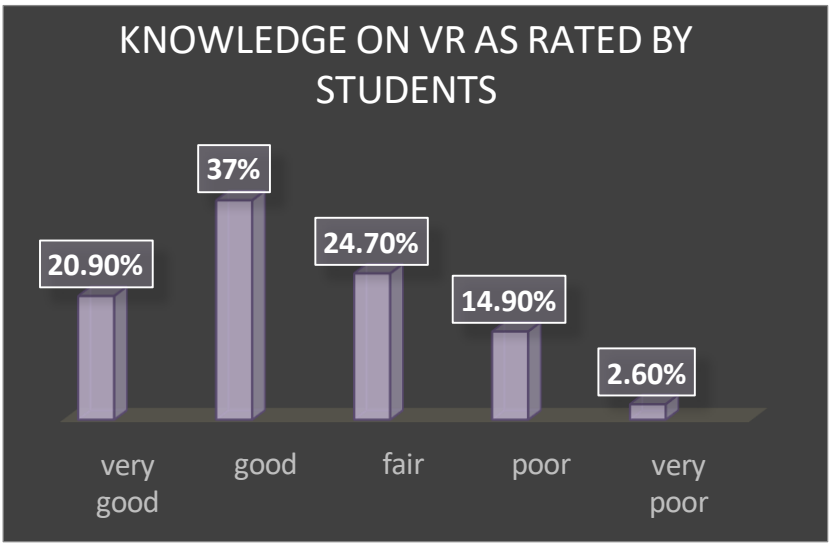
PERCENTAGE ANALYSIS

TABLE 1:

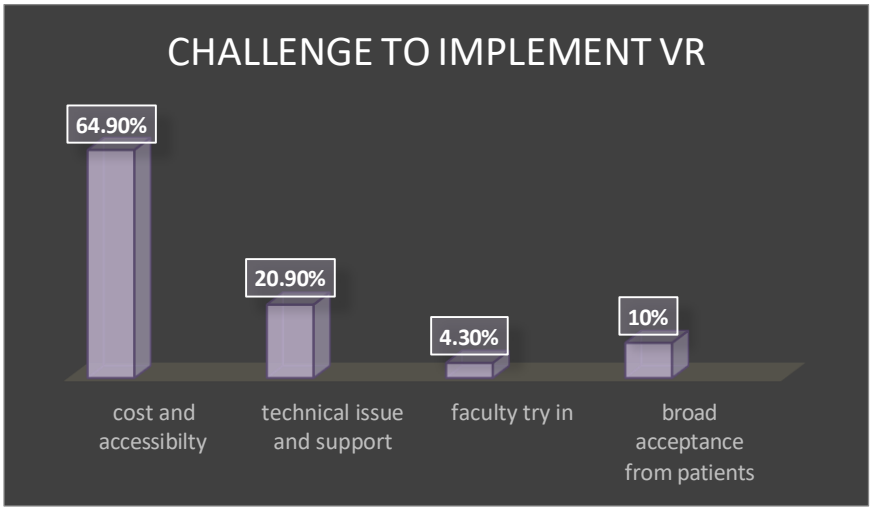
QUESTIONS	**YES**	**NO**	**MAYBE**
Have you ever used VR technology?	35.3%	64.7%	-
If yes, Have you enjoyed using VR technology?	43.1%	56.9%	-
Have you ever used VR for educational purposes?	23.6%	76.4%	-
Have you heard of VR being used in dentistry?	57.7%	42.3%	-
Have you ever received education or training on VR technology in dentistry in your dental program?	23%	77%	--
Do you want to incorporate VR technology in your dental program?	86.8%	13.2%	
Will you invest in VR technology for your clinical practice?	37.7%	6.2%	56.2%
Do you think VR will become a standard tool in dental education in upcoming era?	48.1%	5.1%	46.8%

PERCEPTION AND KNOWLEDGE OF STUDENTS

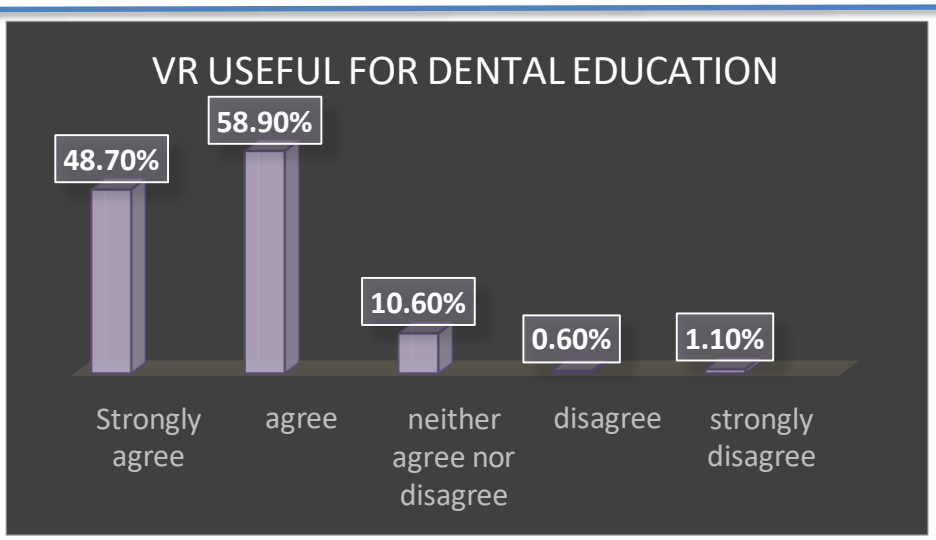
Graph 1:



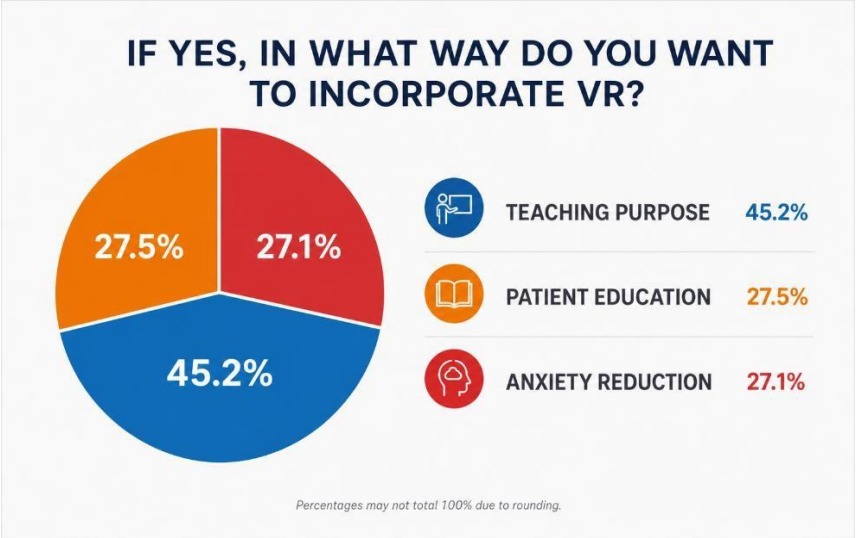
1. 2. 3. Mark only one oval. BDS -1st year BDS -2nd year BDS -3rd year BDS - 4th year Intern 4. Mark only one oval. Intern This content is neither created nor endorsed by Google. Virtual reality : Is it a reality among dental students?- A Questionnaire Study * Indicates required question Name of the student * e - mail ID



Graph 3:



Graph 4:



Most of the students rated their knowledge as good (37%) and fair (24.7%), followed by very good (20.9%), poor (14.9%), and very poor (2.60%) [graph 1]; and most of them agreed (58.9%) and strongly agreed (48.7%) that VR could be useful for their education [graph 3]. A few of them (10.6%) neither agreed nor disagreed, and 86.8% of the students wanted to incorporate VR in dental practice [graph 2], mostly for teaching purposes, followed by patient education and anxiety reduction [graph 4].

DISCUSSION

The surge in research related to virtual reality (VR) in dentistry became particularly evident after 2019, largely influenced by the pandemic COVID-19, which sped up embrace of digital learning platforms and remote training modalities in health care education worldwide (Schlenz et al.,[1] Iyer et al.[2]). Bibliometric studies by Huang et al.[3] and Zitzmann et al.[4] identified the United States, the United Kingdom, and the Netherlands as leading contributors to VR-based dental education research, highlighting the global relevance and rapid advancement of immersive educational technologies.

VR Applications in Dental Education

Virtual reality has become an integral component of preclinical dental education by providing realistic simulations that enables students to practice psychomotor skills, enhance procedural accuracy, and develop hand-eye coordination without posing any risk to patients.(Towers et al.[5], Al-Janabi et al.[6]). Systematic reviews by Murbay et al.[7] and Roy et al.[8] demonstrate that VR-assisted learning significantly enhances training in cavity preparation, dental anatomy, endodontics, prosthodontics, and oral health education, often resulting in improved academic performance and superior learning outcomes compared with traditional teaching methods. Similar benefits were reported in prosthodontic education by de Boer et al. [9].

Patient Management and Clinical Efficiency

VR has shown to be an effective non-pharmacological distraction technique. According to Furman et al.[1] and Wiederhold et al.[11], significant changes in patient anxiety, stress, and perceived pain during dental treatment in the presence of VR as an adjunctive tool

were reported. Furthermore, Javaid et al.[12] pointed out that the implementation of extended reality (XR), such as VR and augmented reality (AR), enhances the efficiency of the procedure and clinical workflow, as well as improves the patient experience and the performance of professionals.

Clinical Performance and Skills

VR simulators based on haptic education can be used to train fine motor skills by means of a tactile feedback that is very similar to the real clinical experience. The early application of the simulation technology to education was highlighted by Buchanan 13, with Suebnukarn, et al. 14 demonstrating that VR can greatly assist in acquisition of skills and realism in the operative procedures. Luciano et al.[15] have further validated the use of tactile VR training in dental procedures.

Specialty Opportunities

VR applications have demonstrated significant potential in implant dentistry and oral and maxillofacial surgery. Ma et al.[16] and Al-Ekrish et al.[17] demonstrated better educational results in training in the field of implant dentistry. In addition, the AR-assisted surgical guidance systems characterized by Chen et al.[18] have been found to enhance the accuracy of surgery and patient outcomes.

Collaboration and Limitations

Although the research volume on VR-related topics in dentistry is increasing rapidly, Khanagar et al.[19] found that the scholarly output is still confined in a small number of countries, with rather weak international collaboration networks. The main barriers to universal adoption, as pointed out by Wang. et al.[20] and Perry. et al.[21], include the absence of standard training protocols, a lack of accreditation of VR systems, the high cost to implement, and the absence of large-scale randomized controlled trials.

Future perspectives

The implementation of VR in dental curricula is likely to keep expanding, but Plessas[22] noted that some additional high-quality studies are necessary to overcome the technological constraints, set up uniform guidelines, and enhance cost-effectiveness. As VR systems continue to become more affordable and technologically advanced, Kwon and Park23 indicated that the immersive technologies will leave a revolutionary impact on education, clinical training, and patient care.

CONCLUSION

CONCLUSION:

Only half of the dental students were aware of VR being used in dentistry. The majority of participants reported having good knowledge of virtual reality technology. Most students agreed that VR could be beneficial in dental education and expressed interest in incorporating VR-based tools into dental practice in their teaching and for patient education and anxiety management.

The integration of virtual reality into dental education has the potential to improve students' clinical competence, confidence, and preparedness, thereby contributing to better clinical practice.

QUESTIONNAIRE:

Demographic data

1. Name of the student:
2. Gender:
3. mail id:
4. Year of study:

Evaluating the general knowledge on VR

5. Have you ever used VR technology?
   Yes
   No
6. If yes, have you enjoyed using VR technology?

   Yes
   No
7. What best describes virtual reality in the context of healthcare education?

A computer-based simulation that replicates real-world dental scenarios
A video recording of clinical procedures
An advanced form of dental radiography
A social media platform for dental professionals

8. Which component is most essential for experiencing virtual reality?

Data management software
Head-mounted display or VR headset
Dental articulator
3D printing hardware

Application of VR in dentistry

9. Have you ever used VR technology for educational purposes?

Yes
No

10. Have you heard of Virtual reality being used in dentistry?

Yes

No

11. How would you rate your knowledge of VR technology in dentistry?

Very good

Good
Fair
Poor
Very poor

12. Do you think VR could be useful in your dental education or future practise?

Strongly agree
Agree
Neither agree nor disagree
Disagree
Strongly disagree

13. What are the potential applications of VR in dentistry?

Patient education

Pain management

Anxiety reduction
Surgical training

Treatment planning

14. What do you think will be the challenge to implement VR in dental practise?

Cost and accessibility
Technical issue and support
Faculty try in
Broad acceptance from patients and dental staff

15. Have you ever received education or training on VR technology in dentistry in your dental program?

Yes
no

16. Do you want to incorporate VR technology in your dental program?

Yes
No

17. If yes, in what way do you want to incorporate VR?

For teaching purposes
Patient anxiety reduction
Patient education

18. Will you invest in VR technology for your clinical practise?

Yes, definitely
Maybe
no

19. Can you describe any situation where VR would be more helpful than traditional methods?

20. Do you think VR will become a standard tool in dental education in the upcoming era?

Definitely yes
No
Maybe

BIBLIOGRAPHY

1. Schlenz MA, Schmidt A, Wöstmann B, Krämer N, Schulz-Weidner N. Students' and lecturers' perspective on the use of virtual reality in dental education. J Dent Educ. 2020;84(10):1085-92.
2. Iyer P, Aziz K, Ojcius DM. Impact of COVID-19 on dental education in the United States. J Dent Educ. 2020;84(6):718-22.
3. Huang TK, Yang CH, Hsieh YH, Wang JC, Hung CC. Augmented reality and virtual reality applied to dental education: A bibliometric analysis. Healthcare (Basel). 2022;10(4):699.
4. Zitzmann NU, Matthisson L, Ohla H, Joda T. Digital undergraduate education in dentistry: A systematic review. Int J Environ Res Public Health. 2020;17(9):3269.
5. Towers A, Field J, Stokes C, Maddock S, Martin N. A scoping review of the use and application of virtual reality in preclinical dental education. J Dent Educ. 2019;83(5):569-77.
6. Al-Janabi S, Al-Janabi A. Immersive virtual reality and its role in dental education. Eur J Dent Educ. 2021;25(2):325-33.
7. Murbay S, Neelakantan P, Chang JW, Yeung S. Evaluation of the effectiveness of virtual reality simulation in dental education: A systematic review. Int J Med Robot. 2020;16(5):e2061.
8. Roy E, Bakr MM, George R. The need for virtual reality simulators in dental education: A review. Saudi Dent J. 2017;29(2):41-7.
9. de Boer IR, Lagerweij MD, Wesselink PR, Vervoorn JM. Evaluation of a virtual reality simulation for preclinical education in prosthodontics. Eur J Dent Educ. 2019;23(4):432-8.
10. Furman E, Jasinevicius TR, Bissada NF, Victoroff KZ, Skillicorn R, Buchner M. Virtual reality distraction for pain control during periodontal procedures. J Am Dent Assoc. 2009;140(12):1508-16.
11. Wiederhold BK, Gao K, Sulea C, Wiederhold MD. Virtual reality as a distraction technique in chronic pain patients. Cyberpsychol Behav Soc Netw. 2014;17(6):371-8.
12. Javaid M, Haleem A, Pratap Singh R, Suman R. Dentistry 4.0 technologies applications in dentistry. J Oral Biol Craniofac Res. 2022;12(3):292-9.
13. Buchanan JA. Use of simulation technology in

dental education. J Dent Educ. 2001;65(11):1225-31.
14. Suebnukarn S, Haddawy P, Rhienmora P, Gajananan K. Haptic virtual reality for skill acquisition in dental training. J Dent Res. 2010;89(10):1128-33.
15. Luciano C, Banerjee P, DeFanti T. Haptics-based virtual reality dental training simulator. Stud Health Technol Inform. 2015;220:301-7.
16. Ma L, Choi J, Wang S, Li C. Virtual and augmented reality in oral and maxillofacial surgery. Br J Oral Maxillofac Surg. 2021;59(2):e17-23.
17. Al-Ekrish AA, Al-Sadhan R. Virtual reality applications in implant dentistry education. Saudi Dent J. 2019;31(3):287-95.
18. Chen X, Xu L, Wang Y, Wang H. Augmented reality-assisted dental surgery: A systematic review. J Dent. 2020;95:103302.
19. Khanagar SB, Al-Ekrish AA, Alhajrasi MJ, et al. Global research trends in virtual reality applications in dentistry. BMC Med Educ. 2022;22:700.
20. Wang D, Bhardwaj A, Jamal A. Barriers and challenges in implementing virtual reality in dental education. Educ Sci. 2021;11(9):482.
21. Perry S, Bridges SM, Burrow MF. A review of the use of simulation in dental education. Eur J Dent Educ. 2018;22(3):e273-80.
22. Plessas A. Computer-assisted learning in dentistry. Eur J Dent Educ. 2017;21(Suppl 1):3-6.
23. Kwon HB, Park YS. Future directions of virtual reality in dental education. J Dent Educ. 2020;84(5):538-46.