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Beyond the Tooth: Dentists and the AI Toothbrush Revolution

Dr. Jayasakthi. S[1], Dr. Deepshika Saravanan[2], Dr.Vijay V.K[3] and Dr. Senthilkumar. M[4]
[1]MDS (Periodontology), RVS Dental College and Hospital, Coimbatore, India
[2]MDS, HOD (Periodontology) RVS Dental College and Hospital, Coimbatore, India
[3]MDS, MBA (H.M), FADI PRINCIPAL cum DIRECTOR, RVS Dental College and Hospital, Coimbatore, India
[4]MDS, M.Sc, PROFESSOR (Periodontology) RVS Dental College and Hospital, Coimbatore, India

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Abstract:

Introduction: *Artificial Intelligence (AI) is revolutionizing healthcare and dentistry is no exception. The emergence of AI-powered toothbrushes represents a significant advancement in oral hygiene, offering real-time feedback, personalized brushing routines and enhanced data tracking. However, the adoption of these tools in clinical practice is still limited, particularly due to a lack of awareness and advocacy among dental professionals.*

Literature Review: *Prior studies demonstrate the effectiveness of AI toothbrushes in improving brushing behavior, reducing gingival inflammation, and supporting preventive dental care. Devices like the Oral-B iO utilize AI-driven sensors and apps to deliver personalized oral care. However, literature also highlights a gap in clinical recommendation and endorsement by dental practitioners, indicating the need for improved professional awareness.*

Methodology: *This study employed a cross-sectional, questionnaire-based survey conducted among 150 dental clinicians in Coimbatore. The questionnaire evaluated clinicians' awareness, usage, and patient education practices regarding AI-integrated toothbrushes. Data were collected via Google Forms and analyzed using descriptive statistics and Chi-square tests to identify correlations between awareness and demographic factors.*

Results: *The results revealed moderate awareness of AI toothbrushes among respondents. Younger clinicians and those engaged in continuing education displayed higher familiarity and openness toward these tools. However, only a small fraction actively recommended AI toothbrushes to patients, and most lacked detailed knowledge of their features and benefits.*

Discussion: *Findings underscore the potential of AI toothbrushes as a preventive tool in dentistry but highlight a disconnect between innovation and clinical implementation. The study suggests that clinician endorsement is critical for patient adoption and that lack of formal training and cost concerns remain key barriers.*

Conclusion: *While AI toothbrushes represent a transformative advancement in oral care, their successful integration into practice hinges on clinician education, training, and proactive recommendation. Incorporating AI tools into dental curricula and promoting clinical-tech partnerships can bridge the knowledge gap and enhance patient outcomes.*

Keywords: Artificial Intelligence, Smart Toothbrush, Preventive Dentistry, Oral Health Technology, Clinical Awareness, Dental Innovation, Patient Education

INTRODUCTION

Artificial Intelligence (AI) has emerged as a transformative force across various industries, and healthcare is no exception. From diagnostic imaging to robotic surgeries, AI technologies are redefining traditional medical practices. Dentistry, a field that combines science with precision, is now embracing AI to enhance patient care and preventive strategies. Among the latest innovations is the AI-powered toothbrush—an intelligent device designed to promote better oral hygiene through real-time feedback, personalized care, and advanced data analysis. The burden of periodontal diseases such as gingivitis and periodontitis remains significant worldwide. These conditions, if left untreated, can lead to tooth mobility, bone loss, and eventual tooth loss. Traditional oral hygiene practices, while effective to an extent, often lack real-time guidance and monitoring. In contrast, AI-integrated toothbrushes offer an innovative solution by continuously analyzing brushing behavior, identifying patterns of negligence, and recommending corrective measures to users. Features like gamification, voice assistance, and connectivity to mobile apps make these tools engaging and accessible, especially in the era of digital health awareness. Despite the technological advancements, the success of such innovations largely depends on their adoption and advocacy by dental professionals. Dentists play a pivotal role in patient education and the promotion of preventive oral health practices. However, there exists a knowledge gap regarding how aware clinicians themselves are of such AI-powered

tools and whether they are recommending them to their patients. This study, therefore, seeks to explore the awareness and attitudes of dental clinicians—particularly in Coimbatore—toward AI-integrated toothbrushes. Through a structured questionnaire-based pilot study, the paper aims to assess the level of understanding among dentists, evaluate how actively they educate patients about this innovation, and analyze the significance of AI tools in routine dental practice. By bridging this awareness gap, the study hopes to contribute meaningfully to the integration of smart technologies in preventive dental care.

REVIEW OF LITERATURE

Artificial Intelligence (AI) has steadily transformed healthcare by mimicking human intelligence in decision-making, pattern recognition, and problem-solving. Over time, its adoption in dentistry has gained traction, particularly in diagnostics, treatment planning, and preventive care.

Bhuyan et al. (2016) highlighted an early challenge in the adoption of mobile health tools, observing that while public usage was on the rise, healthcare professionals remained hesitant, often lacking the familiarity or confidence to recommend such technologies. This was particularly evident in dental practices, where clinician advocacy significantly influences patient behavior.

Al-Nasser and Lamster (2020) reinforced the need for integrating such preventive technologies into standard dental care, particularly for managing chronic oral diseases like periodontitis. Their findings also echoed earlier concerns regarding the limited awareness among dental professionals and the importance of clinical endorsement in technology adoption.

Haque et al. (2020) discussed the emergence of AI-integrated oral care tools, such as smart toothbrushes equipped with sensors, Bluetooth connectivity, and mobile applications. These devices employ machine learning algorithms to monitor and improve oral hygiene through real-time brushing feedback, identification of missed areas, and personalized recommendations.

Zou et al. (2020) reported empirical findings supporting the effectiveness of such toothbrushes in enhancing plaque removal and reducing gingival inflammation compared to traditional manual brushing. Similarly, Chen and Wang (2020) explored the use of AI-powered neural networks to assess oral health conditions using brushing behavior data, underlining the role of data-driven analysis in preventive dentistry.

Adam (2020) presented the Oral-B iO as a case example of how oscillating-rotating micro-motions, combined with AI feedback, can guide users toward optimal brushing habits, showcasing real-world applications of AI in consumer oral health devices.

Schwendicke et al. (2020) provided a broader overview of how AI technologies have increasingly influenced various domains of dentistry, pointing out their potential in transforming routine care and diagnostics.

Chen et al. (2021) further elaborated on the integration of sensors and mobile apps with AI systems in toothbrushes, which not only support better hygiene practices but also provide data for long-term oral health monitoring.

Yu et al. (2022) emphasized the growing momentum in AI adoption in dental practice, underlining its promising role in diagnostics and personalized care.

Thurnay et al. (2022) demonstrated how app-connected toothbrushes could collect behavioral data to detect disease risks, promote compliance through gamification, and enhance patient motivation.

THEORETICAL BACKGROUND

Weak AI vs. Strong AI

Artificial Intelligence (AI) systems are generally classified into two types: **Weak AI** and **Strong AI**. Weak AI, or Narrow AI, is designed to perform specific tasks based on programmed algorithms and learned patterns. It lacks consciousness or self-awareness and is limited to the scope it was trained for (Searle, 1980; Russell & Norvig, 2021). Examples in healthcare include AI-based imaging systems, diagnostic assistants, and smart toothbrushes that guide users based on pre-learned data (Topol, 2019). The AI toothbrush, which offers real-time brushing feedback and behavior analysis, falls under this category (Haque et al., 2020).

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In contrast, Strong AI—also known as Artificial General Intelligence (AGI)—refers to machines that possess the cognitive abilities of a human. These systems can learn, reason, and solve new problems across domains without human intervention (Goertzel & Pennachin, 2007). While strong AI holds promise for the future of healthcare, current dental technologies are built on weak AI models, aimed at improving specific oral care behaviors (Yu et al., 2022).

Technological Foundations of AI Toothbrushes

AI-powered toothbrushes combine several technologies to deliver intelligent and personalized oral care. These include motion and pressure sensors, gyroscopes, timers, and Bluetooth connectivity.

Figure 1*: Oral-B iO Series 8 – An advanced AI-powered toothbrush with real-time feedback, smart connectivity, and personalized brushing analytics.*

Integrated with mobile apps, these brushes use machine learning algorithms to analyze brushing data in real time—assessing brushing angles, duration, pressure, and coverage.

Key features include:

- Real-time feedback through visual or voice prompts
- Gamification elements to engage users
- Progress tracking via mobile applications
- Smart connectivity for data sharing and remote monitoring

Some devices also use cloud storage to track long-term brushing behavior, allowing for predictive analysis and personalized recommendations. This technology makes daily oral care more interactive, data-driven, and responsive.

Clinical Relevance in Periodontal Disease Prevention

Periodontal diseases such as gingivitis and periodontitis are among the most common oral health issues, leading to gum inflammation, bone loss, and tooth mobility. Effective daily oral hygiene is essential to prevent their onset and progression (Kinane et al., 2017).

AI toothbrushes play a critical role in early intervention and prevention by ensuring consistent and thorough cleaning. These devices provide users with corrective feedback, helping reduce plaque accumulation and minimize gingival inflammation (Haque et al., 2020; Yu et al., 2022). By improving brushing techniques and maintaining regular oral hygiene, AI toothbrushes support clinicians in preventive care strategies (Schwendicke et al., 2020).

Moreover, they serve as a tool for patient education and behavioral reinforcement, especially in individuals who are non-compliant or at higher risk. Their use complements clinical efforts and enhances long-term oral health outcomes (Chen et al., 2021).

AI TOOTHBRUSH: FEATURES AND CAPABILITIES

Visual Guide to AI Toothbrush Interface and Features

To further aid understanding and highlight the technological sophistication of the AI toothbrush, key visual components from the manufacturer's manual are provided below. These figures demonstrate the interface, brushing modes, feedback system, and operational symbols used in the Oral-B iO Series.

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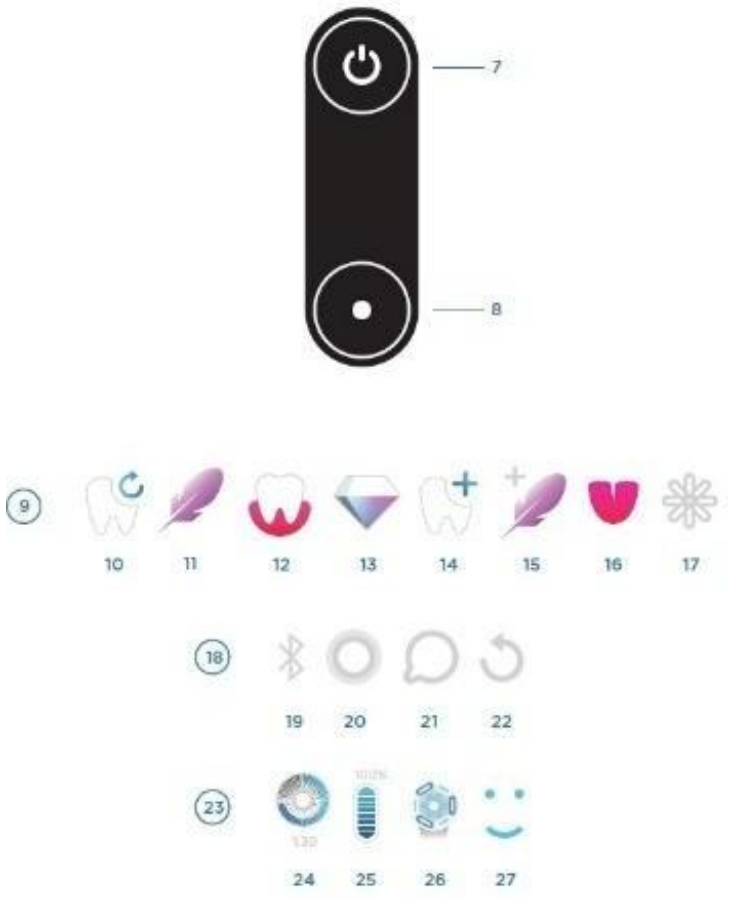

Buttons:
7 – Power button
8 – Mode button

Modes / Functions:
10 – Clean mode
11 – White mode
12 – Gum care mode
13 – Polish mode
14 – Sensitive mode
15 – Whitening mode
16 – Tongue cleaning mode
17 – Refresh mode
18 – Massage mode

Indicators:
19 – Battery indicator
20 – Charging indicator
21 – Pressure sensor indicator
22 – Bluetooth indicator
23 – Travel lock indicator
24 – Brush head replacement reminder
25 – Mode intensity level 1
26 – Mode intensity level 2
27 – Mode intensity level 3

Figure 2: *Control Interface and Brushing Mode Icons*

This figure depicts the smart display and its corresponding icons for brushing modes, battery level, timer, Bluetooth connection, and other interactive feedback features.

Figure 3: *Device Structure and Key Components*

Illustrates the overall design of the AI toothbrush, including the brush head, pressure sensor, handle, power/display buttons, and charging base.

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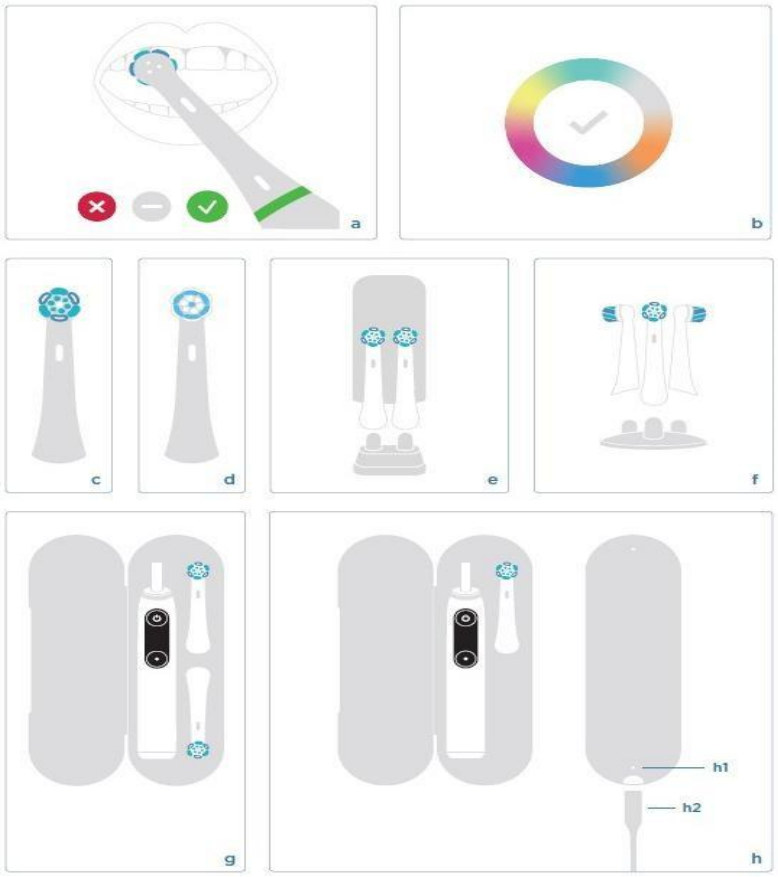

Provides visual instructions on how to properly use the brush, store it, change brush heads, and understand the light ring feedback system for effective brushing.

Here are the parts and sections from the image:

a. *Correct brushing position indication*
b. *Brushing timer/indicator ring*
c. *Standard brush head*
d. *Specialized brush head*
e. *Brush heads stored on charging stand*
f. *Brush heads stored on wall-mounted holder*
g. *Toothbrush and brush heads stored in travel case*
h. *Travel case with charging capability*

- ***h1.*** *Charging indicator light*
- ***h2.*** *Charging port*

Figure 4: *Usage and Setup Illustrations*

Personalized Oral Care

One of the most significant advancements offered by AI-integrated toothbrushes is the delivery of personalized oral care. These smart devices assess an individual's brushing habits and adapt feedback accordingly. By analyzing data on brushing time, frequency, and technique, AI-powered toothbrushes can suggest customized routines and specific improvements (Yu et al., 2022; Haque et al., 2020). Over time, the system learns the user's behavior and tailors recommendations to optimize oral hygiene (Chen et al., 2021). This personalized approach transforms oral care from a generic task into a responsive and adaptive process suited to each user's needs (Topol, 2019).

Real-Time Feedback Mechanism

AI toothbrushes are equipped with real-time feedback systems, typically facilitated through LED indicators, mobile apps, or even voice prompts. These systems immediately alert users if they are brushing too hard, missing certain areas, or not brushing for the required duration (Haque et al., 2020; Yu et al., 2022). The immediacy of the feedback helps users adjust their behavior instantly, making brushing more effective and less damaging. This is especially crucial for patients with sensitive gums or those prone to overbrushing (Chen et al., 2021; Schwendicke et al., 2020).

Data Collection and Analytics

Modern AI toothbrushes include advanced sensors that track brushing patterns, pressure, movement, and coverage. This information is collected and stored, either locally or on a cloud-based platform (Haque et al., 2020; Yu et al., 2022). Over time, this data allows the system to detect trends and suggest preventive strategies. For instance, if the user consistently neglects the molars or applies excessive pressure on the anterior teeth, the system will highlight these areas. Dentists can also use this data (if shared) to provide informed consultations and more targeted recommendations (Schwendicke et al., 2020; Chen et al., 2021).

Smart Connectivity and App Integration

AI toothbrushes typically feature Bluetooth or Wi-Fi connectivity that links the brush to a smartphone application. These apps display brushing scores, heatmaps, alerts, reminders, and oral health tips (Yu et al., 2022; Topol, 2019).

Some apps allow for syncing with dental offices or health tracking systems, facilitating tele-dentistry consultations. Integration with digital calendars and notifications ensures consistent use, transforming a routine task into an engaging digital experience (Schwendicke et al., 2020).

Gamification, Motivation, and Voice Assistance

To encourage consistent use, many AI toothbrushes incorporate gamification features such as points, badges, brushing challenges, and progress streaks. These motivational tools are especially effective for children and adolescents, helping instill proper hygiene habits in a fun and rewarding way (Chen et al., 2021). Additionally, voice assistance offers spoken instructions during brushing, guiding users through each quadrant and providing motivational cues to improve technique and maintain routine (Haque et al., 2020; Yu et al., 2022).

AI DIAGNOSIS, ENERGY EFFICIENCY, AND PRIVACY

Advanced models offer features akin to AI-based diagnostics, where brushing data is used to identify early signs of gingival recession or enamel erosion. While not a substitute for clinical examination, these alerts can prompt early intervention. Moreover, AI toothbrushes are designed with energy-efficient batteries and often include eco-friendly manufacturing practices. Privacy and data security are also major considerations. Users are increasingly aware of the need to protect health data, and manufacturers are integrating strong encryption and user-consent protocols to ensure responsible data use.

MATERIALS AND METHODS

Study Design: Questionnaire-Based Pilot Study

The study was designed as a cross-sectional, questionnaire-based pilot study to evaluate the awareness and attitudes of dental clinicians in Coimbatore regarding AI-integrated toothbrushes. The objective was to gather insights on how familiar practitioners are with this technology and how actively they recommend or educate patients about it.

Sample Size and Population (Coimbatore Dentists)

The study included 150 practicing dental clinicians from Coimbatore. These participants were chosen based on availability and willingness to participate. The study intends to expand in future phases to a sample size of 1000 clinicians for broader applicability.

Questionnaire Framing and Distribution

A structured questionnaire was developed, including both open-ended and multiple-choice questions. The questionnaire comprised:

- Demographic questions (age, years of practice, specialization)
- Awareness-related questions about AI toothbrushes
- Usage and recommendation frequency
- Attitudes toward technological integration in dental practice

The survey was formulated using Google Forms and circulated digitally via email and professional dental groups. Participation was voluntary and anonymous.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Practicing dental clinicians in Coimbatore
- Willingness to participate in the survey
- Any years of experience

Exclusion Criteria:

- Clinicians practicing outside Coimbatore
- Non-consenting individuals

Ethical Considerations and Institutional Approval

The study protocol was reviewed and approved by the Institutional Review Board (IRB) of RVS Dental College. No personal or patient data was collected. Participation was voluntary, and participants could exit the survey at any time. The study posed no risk to patients, as it involved only clinician feedback.

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DATA ANALYSIS

Tools and Statistical Methods Used

Data from the Google Form responses were exported into Microsoft Excel and SPSS for analysis. Basic descriptive statistics were calculated, including frequencies and percentages for categorical variables.

Percentage-Based Evaluation

Each response item was assessed based on the percentage of clinicians who selected each option. This helped identify general trends in awareness, recommendation behavior, and acceptance of AI-integrated devices in clinical practice.

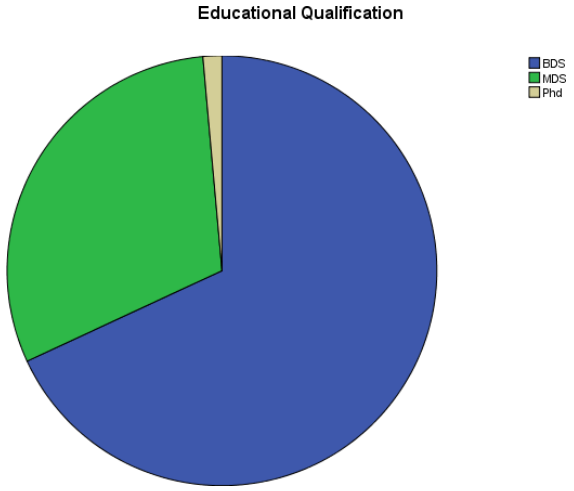
Chi-Square Test Application

The Chi-Square test was applied to identify statistically significant associations between variables such as years of experience and level of awareness or between specialty and frequency of patient education regarding AI toothbrushes. This helped validate the correlations and identify meaningful patterns.

RESULTS

Educational Qualification

Educational Qualification					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BDS	96	68.1	68.1	68.1
	MDS	43	30.5	30.5	98.6
	Phd	2	1.4	1.4	100.0
	Total	141	100.0	100.0	



Years of experience in dentistry

Years of Experience in Dentistry					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5	98	69.5	69.5	69.5
	6-10	30	21.3	21.3	90.8
	11-15	5	3.5	3.5	94.3
	Above 16	8	5.7	5.7	100.0
	Total	141	100.0	100.0	

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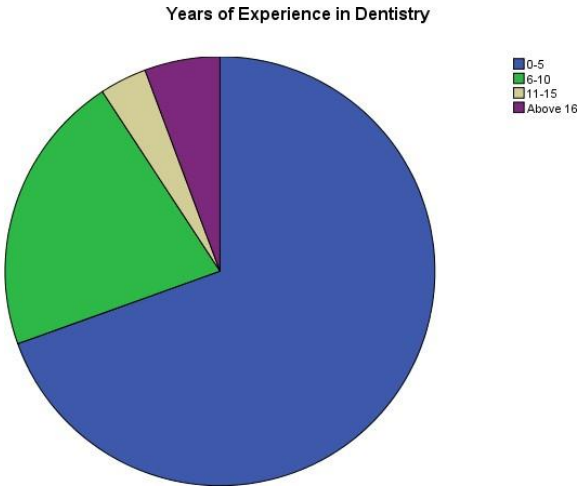
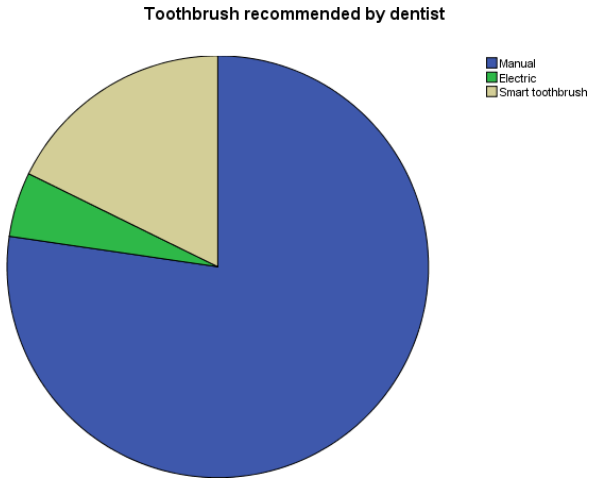


Type of toothbrush do you recommend to your patients

Toothbrush recommended by dentist					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Manual	109	77.3	77.3	77.3
	Electric	7	5.0	5.0	82.3
	Smart toothbrush	25	17.7	17.7	100.0
	Total	141	100.0	100.0	



If smart toothbrush which category would you suggest doctor

Type of Smart Toothbrush recommended by dentist					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sonic waves	25	17.7	17.7	17.7
	Oscillating-rotating	54	38.3	38.3	56.0
	AI incorporated toothbrush	62	44.0	44.0	100.0
	Total	141	100.0	100.0	

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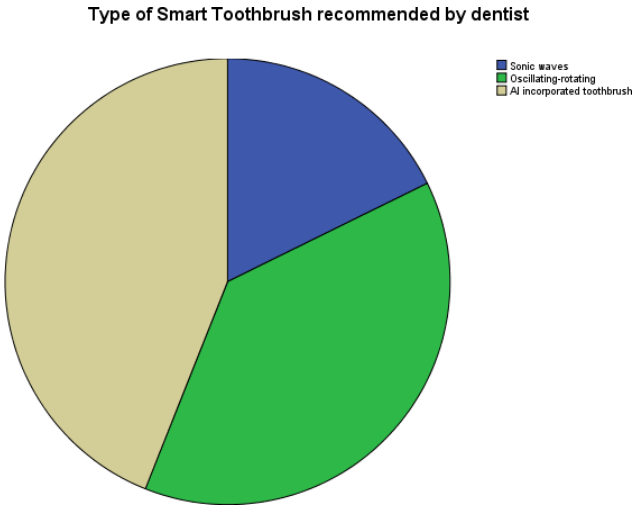
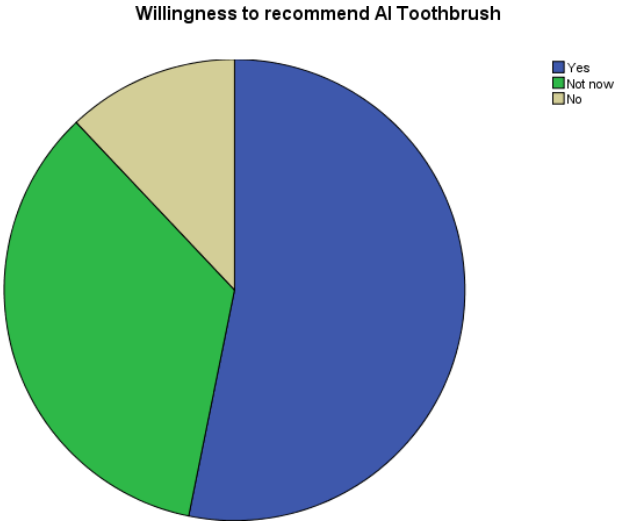


Do you have the willingness to recommend AI toothbrush to your patients?

Willingness to recommend AI Toothbrush					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	75	53.2	53.2	53.2
	Not now	49	34.8	34.8	87.9
	No	17	12.1	12.1	100.0
	Total	141	100.0	100.0	



What are the conditions in which you recommend AI toothbrush for patients?

Conditions to recommend AI Toothbrush					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild care patients	41	29.1	29.1	29.1
	Intensive care patients	77	54.6	54.6	83.7
	Healthy patients	23	16.3	16.3	100.0
	Total	141	100.0	100.0	

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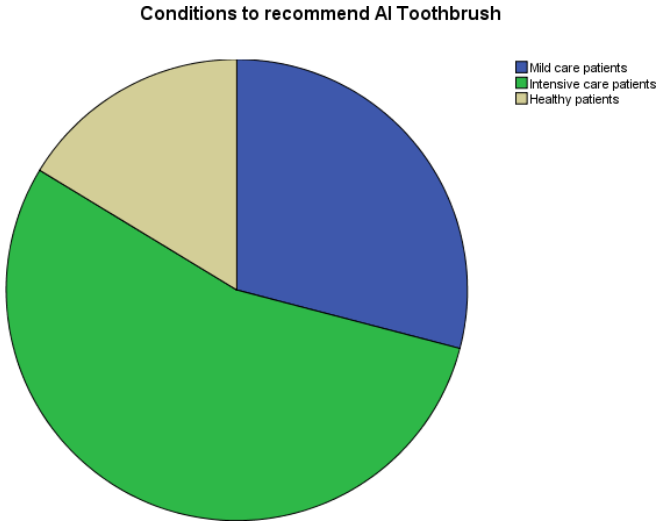
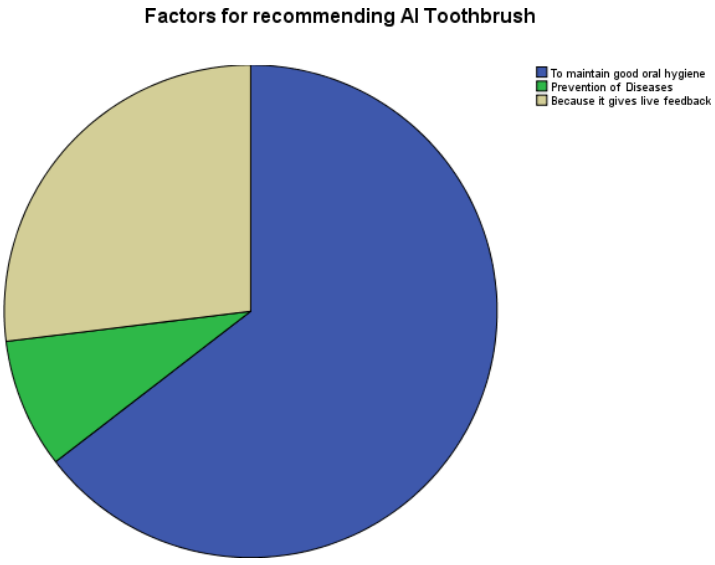


What are the potential factors for recommending AI toothbrush to your patients?

Factors for recommending AI Toothbrush					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	To maintain good oral hygiene	91	64.5	64.5	64.5
	Prevention of Diseases	12	8.5	8.5	73.0
	Because it gives live feedback	38	27.0	27.0	100.0
	Total	141	100.0	100.0	



How do AI Toothbrush differ from traditional ones in terms of effectiveness?

AI Toothbrush differ from traditional ones					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	More Effective	123	87.2	87.2	87.2
	Least Effective	16	11.3	11.3	98.6
	Not Effective	2	1.4	1.4	100.0
	Total	141	100.0	100.0	

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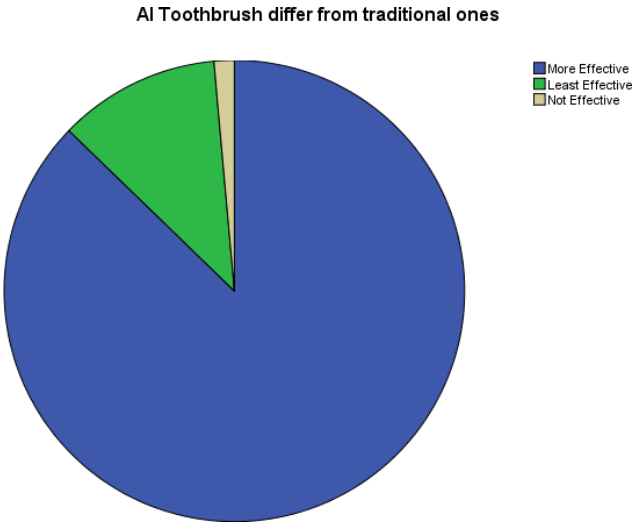
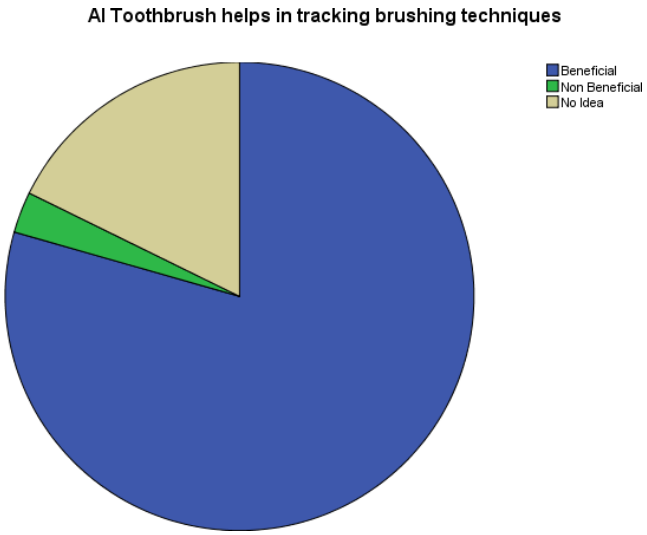


AI toothbrush helps in tracking brushing techniques & methods, your opinion about it?

AI Toothbrush helps in tracking brushing techniques					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beneficial	112	79.4	79.4	79.4
	Non Beneficial	4	2.8	2.8	82.3
	No Idea	25	17.7	17.7	100.0
	Total	141	100.0	100.0	



If you are advising an AI toothbrush for your patients, which brand do you suggest?

Suggestion of Brand					
			Percent	Valid Percent	
Valid	Philips	39	27.7	27.7	27.7
	Oral B	79	56.0	56.0	83.7
	Colgate	23	16.3	16.3	100.0
	Total	141	100.0	100.0	

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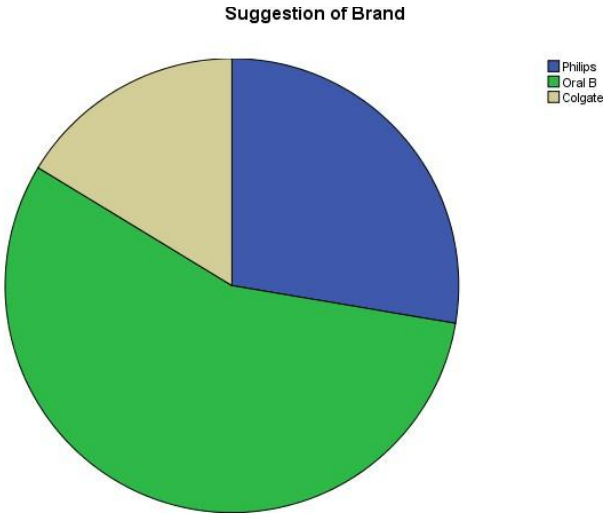
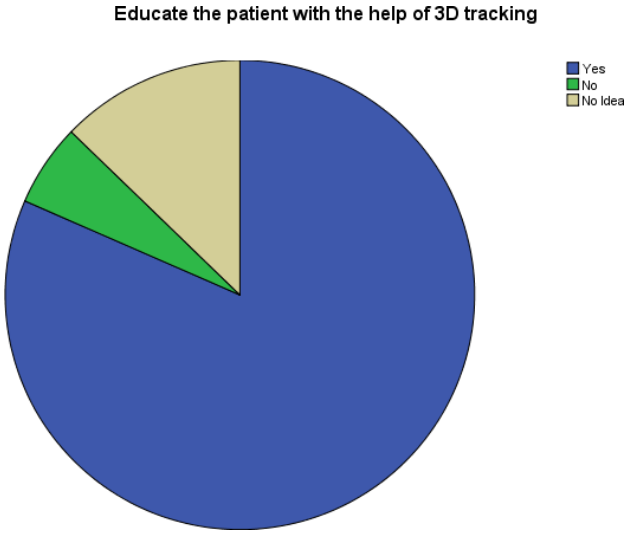


Do you think with the help of 3D tracking , we can educate the patient about the maintenance of good oral health?

Educate the patient with the help of 3D tracking					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	115	81.6	81.6	81.6
	No	8	5.7	5.7	87.2
	No Idea	18	12.8	12.8	100.0
	Total	141	100.0	100.0	



What are the potential factors that affect the purchasing choice of smart toothbrushes?

Factors affect the purchasing of smart Toothbrush					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cost	111	78.7	78.7	78.7
	Knowledge	26	18.4	18.4	97.2
	Incovenience	4	2.8	2.8	100.0
	Total	141	100.0	100.0	

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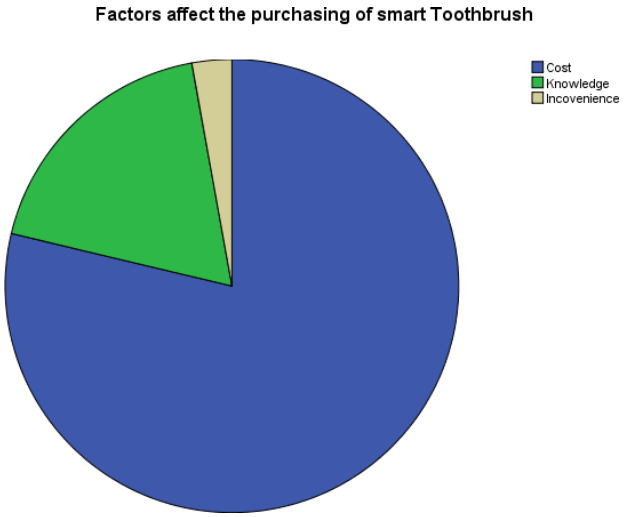
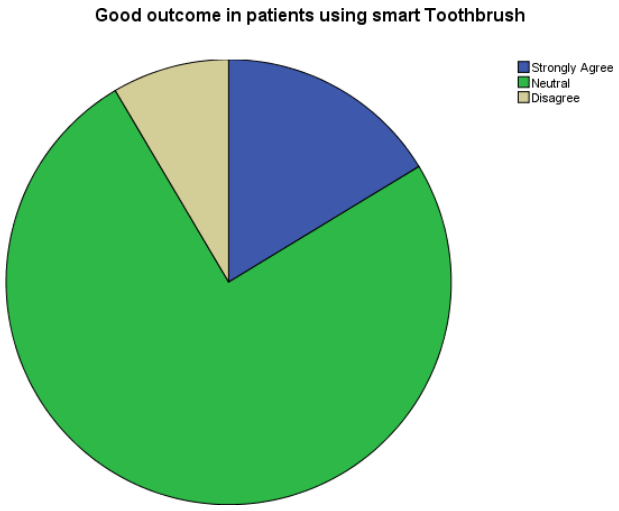


In your clinical experience have you noticed a good outcome in patients using smart toothbrushes?

Good outcome in patients using smart Toothbrush					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	23	16.3	16.3	16.3
	Neutral	106	75.2	75.2	91.5
	Disagree	12	8.5	8.5	100.0
	Total	141	100.0	100.0	



Do you think the collaboration with patient and dentist provided by Oral B app is beneficial to the patients?

Oral B app is beneficial to the patients					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	70	49.6	49.6	49.6
	No	9	6.4	6.4	56.0
	Maybe	62	44.0	44.0	100.0
	Total	141	100.0	100.0	

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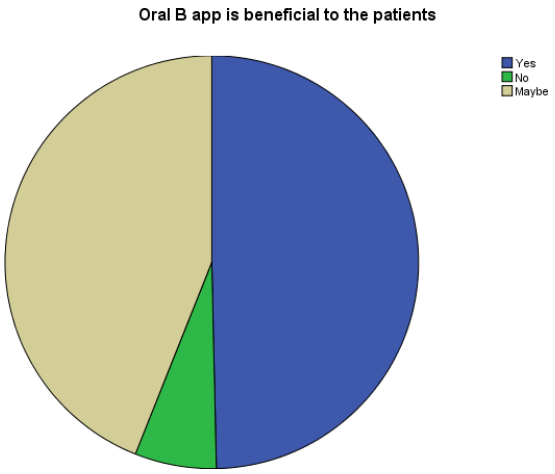

Chi-Square Test no: 1

Relationship between Educational Qualification and Type of toothbrush recommended to patients

Cross tabulation

Educational Qualification * Toothbrush recommended by dentist					
Crosstabulation		Toothbrush recommended by dentist			Total
		Manual	Electric	Smart toothbrush	
Educational Qualification	BDS	71	7	18	96
	MDS	36	0	7	43
	Phd	2	0	0	2
Total		109	7	25	141

Null Hypothesis (H_0): There is no significant relationship between educational qualification and type of toothbrush recommended to patients.

Alternate Hypothesis (H_1): There is a significant relationship between educational qualification and type of toothbrush recommended to patients.

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	**4.245**	4	**0.374**
Likelihood Ratio	6.685	4	.154
Linear-by-Linear Association	1.180	1	.277
N of Valid Cases	141		

p value = 0.374

Degrees of freedom = 4

Level of significance = 5%

Here the p-value (0.374) is more than 0.05.

H_0 is accepted and H_1 is rejected.

Hence we conclude that there is no significant relationship between educational qualification and type of toothbrush recommended to patients.

Chi-Square Test no: 2

Relationship between Years of experience in dentistry and Type of toothbrush recommended to patients

Cross tabulation

Years of Experience in Dentistry * Toothbrush recommended by dentist					
Crosstabulation		Toothbrush recommended by dentist			Total
		Manual	Electric	Smart toothbrush	
Years of Experience in Dentistry	0-5	74	6	18	98
	6-10	24	1	5	30
	11-15	3	0	2	5
	Above 16	8	0	0	8
Total		109	7	25	141

Null Hypothesis (H_0): There is no significant relationship between years of experience in dentistry and type of toothbrush recommended to patients.

Alternate Hypothesis (H_1): There is a significant relationship between years of experience in dentistry and type of toothbrush recommended to patients.

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	**4.725**	6	**0.580**
Likelihood Ratio	6.391	6	.381
Linear-by-Linear Association	.847	1	.357
N of Valid Cases	141		

p value = 0.580

Degrees of freedom = 6

Level of significance = 5%

Here the p-value (0.580) is more than 0.05.

H_0 is accepted and H_1 is rejected.

Hence we conclude that there is no significant relationship between years of experience in dentistry and type of toothbrush recommended to patients.

Chi-Square Test no: 3

Relationship between Years of experience in dentistry and AI brand type suggested to patients

Cross tabulation

Years of Experience in Dentistry * Suggestion of Brand					
Crosstabulation		Suggestion of Brand			Total
		Philips	Oral B	Colgate	
Years of Experience in Dentistry	0-5	30	53	15	98
		7	18	5	
	11-15	0	3	2	5
	Above 16	2	5	1	8
Total		39	79	23	141

Null Hypothesis (H_0): There is no significant relationship between years of experience in dentistry and AI brand type suggested to patients.

Alternate Hypothesis (H_1): There is a significant relationship between years of experience in dentistry and AI brand type suggested to patients.

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Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	**3.994**	6	**0.677**
Likelihood Ratio	4.882	6	.559
Linear-by-Linear Association	.981	1	.322
N of Valid Cases	141		

p value = 0.677

Degrees of freedom = 6

Level of significance = 5%

Here the p-value (0.677) is more than 0.05.

H_0 is accepted and H_1 is rejected.

Hence we conclude that there is no significant relationship between years of experience in dentistry and AI brand type suggested to patients.

Chi-Square Test no: 4

Relationship between Years of experience in dentistry and noticing good outcome in patients

Cross tabulation

Years of Experience in Dentistry * Good outcome in patients using smart Toothbrush					
Crosstabulation		Good outcome in patients using smart Toothbrush			
		Strongly Agree	Neutral	Disagree	Total
Years of Experience in Dentistry	0-5	18	71	9	98
	6-10	3	24	3	30
	11-15	0	5	0	5
	Above 16	2	6	0	8
Total		23	106	12	141

Null Hypothesis (H_0): There is no significant relationship between years of experience in dentistry and noticing good outcome in patients**.**

.**Alternate Hypothesis (H_1):** There is a significant relationship between years of experience in dentistry and noticing good outcome in patients.

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	**4.009**	6	**0.675**
Likelihood Ratio	5.942	6	.430
Linear-by-Linear Association	.045	1	.832
N of Valid Cases	141		

p value = 0.675

Degrees of freedom = 6

Level of significance = 5%

Here the p-value (0.675) is more than 0.05.

H_0 is accepted and H_1 is rejected.

Hence we conclude that there is no significant relationship between years of experience in dentistry and noticing good outcome in patients.

Demographics of Respondents

Out of the 141 respondents, the majority were general dental practitioners with experience ranging from 1 to over 10 years. A balanced mix of male and female participants ensured a representative sample of Coimbatore's dental community.

Awareness Levels Among Clinicians

The findings revealed a moderate level of awareness about AI-powered toothbrushes. While most participants had heard about such technologies, only a small percentage had personally used or recommended them to patients. Awareness was higher among younger clinicians and those more actively engaged in continuing education.

Frequency of Patient Education

A key finding was that while clinicians acknowledged the importance of oral hygiene tools, only a minority regularly educated patients about AI toothbrushes. Most discussions were centered around conventional oral hygiene practices. The hesitation was largely due to limited familiarity with product features and costs associated with AI devices.

Interpretation of Key Questionnaire Insights

The data suggested that although AI toothbrushes are perceived positively, there is a significant gap between awareness and clinical application. The lack of training or exposure to AI-integrated dental tools emerged as a limiting factor. There is a need for targeted workshops and inclusion of smart tools in dental curricula to bridge this gap.

DISCUSSION

Implications of AI Toothbrush Awareness in Dental Practice

The study highlights the importance of clinician engagement in the adoption of AI-based dental technologies. As oral hygiene moves toward digital precision, dentists must evolve from traditional advisory roles to technology advocates who guide patients through evidence-based smart solutions.

COMPARISON WITH GLOBAL LITERATURE AND STUDIES

Findings are consistent with global trends indicating rising interest in digital health tools but limited practitioner endorsement. Studies by Bhuyan et al. (2016) and Thurnay et al. (2022) emphasized the effectiveness of AI-based brushes in behavioral change but pointed out gaps in professional involvement. This underscores the need for greater integration between smart dental technologies and clinical practice to fully realize the potential of AI in oral healthcare.

CHALLENGES, LIMITATIONS, AND OPPORTUNITIES

Challenges identified include:

- Lack of formal training in dental education on AI tools
- Cost and accessibility of smart toothbrushes
- Data privacy concerns among patients and practitioners

However, these challenges also present opportunities for innovation in:

- Dental Continuing Education Programs
- Inclusion of AI-based modules in curriculum
- Partnerships with tech companies for in-clinic demos

If addressed, these steps can bridge the current knowledge gap and promote the integration of AI in daily oral health routines, ultimately improving patient outcomes.

CONCLUSION

This study explored the awareness, attitudes, and patient education practices of dental clinicians in Coimbatore regarding AI-powered toothbrushes. Results from the pilot questionnaire study reveal that while there is a growing awareness of AI integration in oral healthcare, actual implementation in clinical recommendations remains limited. A significant number of clinicians are still unfamiliar with the advanced features of AI toothbrushes or lack confidence in advising their patients about them. The statistical analysis highlighted gaps in professional engagement and the need for further training and exposure to such technologies.

Significance of AI Integration in Oral Healthcare

The integration of Artificial Intelligence into oral care devices marks a major shift in preventive dentistry. AI toothbrushes offer personalized care, real-time feedback, and behavioral insights, all of which contribute to more effective oral hygiene practices (Haque et al., 2020; Chen et al., 2021). By facilitating early detection of issues such as gingival inflammation and plaque accumulation, these tools support clinicians in disease prevention and patient engagement (Yu et al., 2022; Schwendicke et al., 2020). In the digital health era, AI toothbrushes represent a valuable adjunct to clinical practice, especially in promoting long-term compliance and oral health education (Topol, 2019).

Clinicians, as gatekeepers of oral health, have a critical role in bridging the gap between innovation and application. Their endorsement can transform AI toothbrushes from high-tech novelties into mainstream preventive tools (Thurnay et al., 2022). Therefore, increasing awareness, training, and involvement of dental professionals is essential for meaningful integration (Bhuyan et al., 2016; Schwendicke et al., 2020).

Future Directions and Recommendations

To maximize the benefits of AI toothbrushes in clinical settings, the following recommendations are proposed:

1. Expand Sample Size and Demographic Diversity: Future studies should include larger and more diverse populations across multiple cities to validate current findings.
2. Integrate AI Tools in Dental Education: Curriculum development should include modules on AI in dentistry, including hands-on demonstrations of smart oral care devices.
3. Organize Workshops and Continuing Education Programs: Dental councils and institutions should collaborate with technology providers to train clinicians on the benefits and functionalities of AI toothbrushes.
4. Promote Clinical-Industry Partnerships: Encourage collaboration between dental clinics and oral care tech companies to facilitate real-world trials, feedback collection, and data sharing.
5. Conduct Longitudinal Studies: Future research should assess the long-term impact of AI toothbrush usage on patient outcomes and clinical practices.
6. Address Cost and Accessibility: Public health bodies may consider subsidies or awareness programs to promote the adoption of smart toothbrushes in underserved communities.

By implementing these strategies, the dental profession can play a proactive role in integrating AI-based innovations into routine practice, ultimately leading to improved oral health outcomes for patients.

Questionnaire for Dental Professionals

1) Email:_____

2) Name (Dr.):_____

3) Educational Qualification:

☐ BDS
☐ MDS
☐ PhD

4) Years of Experience in Dentistry:

☐ 0–5
☐ 6–10
☐ 11–15
☐ Above 16

5) What type of toothbrush do you recommend to your patients?

☐ Manual
☐ Electric
☐ Smart toothbrush

6) If smart toothbrush, which category would you suggest, Doctor?

☐ Sonic waves
☐ Oscillating-rotating
☐ AI incorporated toothbrush

7) Do you have the willingness to recommend AI toothbrush to your patients?
☐ Yes
☐ No
☐ Not now
8) If yes, to which type of patients?
☐ Elderly
☐ Adult
☐ Children
9) What are the conditions in which you recommend AI toothbrush for patients?
☐ Mild care patients
☐ Intensive care patients
☐ Healthy patients
10) What are the potential factors for recommending AI toothbrushes to your patients?
☐ To maintain good oral hygiene
☐ Prevention of diseases
☐ Because it gives live feedback
11) How do AI toothbrushes differ from traditional ones in terms of effectiveness?
☐ More effective
☐ Least effective
☐ Not effective
12) AI toothbrush helps in tracking brushing techniques & methods. Your opinion about it:
☐ Beneficial
☐ Non-beneficial
☐ No idea
13) If you are advising an AI toothbrush for your patients, which brand do you suggest?
☐ Philips
☐ Oral-B
☐ Colgate
14) Do you think with the help of 3D tracking, we can educate patients about the maintenance of good oral health?
☐ Yes
☐ No
☐ No idea
15) What are the potential factors that affect the purchasing choice of smart toothbrushes?
☐ Cost
☐ Knowledge
☐ Inconvenience
16) In your clinical experience, have you noticed a good outcome in patients using smart toothbrushes?
☐ Strongly agree
☐ Neutral
☐ Disagree
17) Do you think the collaboration with patient and dentist provided by the Oral-B app is beneficial to patients?
☐ Yes
☐ No
☐ Maybe
Final Feedback
18) Any suggestions or your opinion regarding AI incorporated smart toothbrushes?

_____

_____

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