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Perceptions and telemonitoring potential of smart toothbrushes among dental professionals and the public: A cross-sectional survey

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Abstract

Objective: Toothbrushing is a fundamental method for maintaining oral hygiene and preventing oral diseases. However, verifying proper brushing techniques remains challenging without professional feedback. With advancements in digital healthcare, smart toothbrushes equipped with self-tracking features offer potential for telemonitoring oral hygiene. This study aimed to assess awareness, perception, and potential telemonitoring applications of smart toothbrushes among dental professionals and the general public.

Methods: A cross-sectional online survey was conducted between September and October 2023, targeting 600 participants, including 200 dentists, 200 dental hygienists, and 200 members of the general public. The questionnaire evaluated demographics, oral hygiene behaviors, familiarity with smart toothbrushes, willingness to use or pay for telemonitoring services, and preferences regarding app functions.

Results: More than 85% of participants reported that they were unfamiliar with smart toothbrushes. Nevertheless, 80% of dental professionals and 87% of the general public indicated willingness to recommend or use them. Females and younger individuals showed higher expectations regarding the effectiveness of smart toothbrushes, while older adults demonstrated greater willingness to pay for professional feedback. App feature preferences differed by age and sex, with younger participants favoring interactive functions and older adults preferring educational content. A notable discrepancy was observed between patients and professionals in terms of acceptable service fees.

Conclusion: Despite low awareness, both professionals and the public showed strong interest in adopting smart toothbrushes. For successful integration into telemonitoring, strategies to enhance public awareness, address financial barriers, and develop user-centred systems are essential.

Keywords

Smart toothbrush, telemonitoring, oral hygiene, digital health, teledentistry

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Introduction

Toothbrushing is the most fundamental and essential method for maintaining oral hygiene and preventing oral diseases.[1] Proper toothbrushing techniques are crucial for effective plaque removal and vary depending on the dentition stage—such as primary, mixed, or permanent dentition—as well as individual oral conditions, including the presence of orthodontic appliances or periodontitis.[2] Regularly practising appropriate toothbrushing methods tailored to individual oral conditions, combined with routine dental check-ups, is essential for preventing oral diseases and maintaining optimal oral health.[3,4]

Although many people recognize the importance of toothbrushing, a considerable number fail to implement effective brushing techniques.[5–7] Even after receiving professional instruction on proper brushing methods at dental

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clinics or through public education, it is often difficult to assess whether individuals are correctly applying these techniques at home without professional validation.[8] While in-person feedback following toothbrushing education would be ideal for ensuring proper technique, such verification is often impractical due to time and accessibility constraints.[9] Thus, alternative methods for monitoring and reinforcing proper brushing behavior are needed.

With the advancement of digital healthcare technologies, various self-monitoring devices integrated with smartphones have been increasingly utilized in daily life.[10,11] Among these, smart toothbrushes—also referred to as intelligent toothbrushes—combine sensors, wireless connectivity, and data analytics to monitor and record users' brushing behaviors through mobile applications. These devices provide personalized feedback on brushing habits, including reminders to meet recommended brushing durations. Some smart toothbrushes also allow dental professionals to remotely access users' brushing data and offer real-time feedback, depending on product capabilities.[12] Consequently, smart toothbrushes hold potential not only for improving personal oral hygiene but also as tools for remote patient monitoring.[12,13]

Although digital healthcare tools are increasingly integrated into daily life, the use and awareness of smart toothbrushes remain limited. While most people understand the importance of toothbrushing, many still practice it inadequately without proper feedback. Recent randomized controlled trials suggest that smart toothbrushes can enhance oral hygiene: Lee et al.[13] demonstrated plaque reduction in children using a smart toothbrush with fluorescence technology, and Kim et al.[12] reported improved plaque control and halitosis through a 6-month smartphone-based telemonitoring program. A study using a three-dimensional (3D) motion-tracking system also showed plaque control comparable to conventional instruction.[14] However, few studies have assessed awareness and perceptions of these technologies across populations. In particular, how factors such as age and professional background influence acceptance remains largely unknown—an important gap this study aims to address.

Building upon these gaps, this study aimed to investigate the awareness and perceptions of smart toothbrushes among dental professionals and the general public, and to explore their potential role as telemonitoring tools for oral hygiene management. We hypothesized that dental professionals would report more favorable perceptions than the general public and that younger individuals would exhibit a stronger preference for interactive features such as real-time feedback and mobile app integration.

Methods

Survey method

This study employed a cross-sectional survey design. The survey was conducted online from September to October 2023 using a commercial online platform (Moaform, Qoom Networks, Seoul, Korea). The survey instrument was developed by the authors based on a comprehensive review of the literature on digital oral health technologies and smart toothbrushes.[12,13,15] The questionnaire consisted of multiple-choice questions and was designed to assess three main areas: demographic information, current oral hygiene management, and awareness and perception of smart toothbrushes. Demographic data included information such as sex, age, educational attainment, residential area, and frequency of smartphone use. Questions on oral hygiene practices covered the type of toothbrush used, daily brushing frequency, average brushing duration, and factors considered most important when brushing. To evaluate awareness and perceptions of smart toothbrushes, participants were asked whether they were familiar with smart toothbrushes, their willingness to use them, preferred functions of smart toothbrush applications, willingness to pay for telemonitoring services and professional feedback, and preferred frequency of dental check-ups when using smart toothbrushes.

The original questionnaire was administered in Korean, and a full version of the survey in both Korean and English has been provided as Supplemental files 1–4. To facilitate participant understanding, explanatory text, and representative price ranges for various types of smart toothbrushes available in Korea were included within the survey. Images of commercial products were shown during the survey but are not reproduced here due to copyright restrictions. Representative examples and price ranges are summarized in Supplemental Table 1. The remaining survey questions were multiple-choice items developed de novo based on previous literature and expert consensus; therefore, no additional psychometric validation was conducted.

Participants

A total of 600 participants—200 dentists, 200 dental hygienists, and 200 members of the general public—were recruited. Dentists and dental hygienists were recruited through professional online communities and websites. Members of the general public were recruited via a professional survey agency using a nonprobability sampling method based on predefined eligibility criteria. No quota sampling was applied. As the survey platform required full completion prior to submission, only participants who consented and completed the entire questionnaire were included in the final analytic sample ($n = 600$). Because denominator data (i.e. the total number of individuals approached) were not available from the professional communities or the survey agency, the response rate could not be calculated.

Dentists and dental hygienists were required to hold valid Korean licences and to be currently engaged in

clinical practice. The general public group included individuals who had visited a dental clinic within the past 5 years but were not employed in any dental-related occupations, such as dentists, dental hygienists, or dental assistants. Individuals who were unable to read the questionnaire, such as non-Korean speakers or illiterate persons, were excluded.

The required sample size was calculated using G*Power 3.1.9.2 software based on a chi-square test with three independent groups (dentists, dental hygienists, and the general public), assuming a small to medium effect size (w=0.2) as recommended by Cohen,[16] a significance level of α=0.05, a power of 90%, and 8 degrees of freedom. The formula used for estimating sample size for a chi-square test is:

$$N = \frac{(\chi^2_{1-\beta,df} + \chi^2_{\alpha,df})}{w^2}$$

where N is the required sample size, w the effect size, $\chi^2_{1-\beta,df}$ the noncentral chi-square value at the desired power, and $\chi^2_{\alpha,df}$ the critical value at the given alpha level. Based on this calculation, the estimated minimum sample size was 478. Considering a projected response rate of approximately 80%, the final target sample size was set at 600 (200 per group).

Ethical considerations

This survey study was approved by the institutional review board of the dental hospital at Yonsei University (IRB number: 2-2023-0042). All participants provided written informed consent electronically before participation. Individuals who did not provide consent were automatically excluded from the survey. No minors or individuals unable to read the consent form were included in the study. All data were anonymised to ensure participant confidentiality.

Statistical analyses

All statistical analyses were performed using IBM SPSS Statistics (version 25.0; IBM Corp., Armonk, NY, USA). Statistical significance was set at a p-value of <0.05. All survey items required a response for submission; thus, there were no missing data for the variables included in the analysis. Accordingly, no imputation or additional handling of missing values was necessary. Descriptive statistics were expressed as frequencies and percentages, as all variables included in this study were categorical.

Internal consistency of the survey was evaluated using two conceptually related items: (1) "Do you think proper toothbrushing is important for oral healthcare?" and (2) "Do you think proper brushing habits contribute to maintaining good oral health?" Both items were rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Cronbach's alpha coefficient was calculated to assess the reliability of these items. No additional psychometric analyses were conducted.

The primary dependent variables were the expectation of smart toothbrush effectiveness, willingness to pay for professional feedback, and, for dental professionals only, willingness to provide feedback. Expectation of smart toothbrush effectiveness was measured on a five-point Likert scale and treated as an ordinal variable, while both willingness to pay and willingness to provide feedback were dichotomized as Yes (1) or No (0). Independent variables included age group, sex, and professional group, and age and sex were additionally included as covariates in the regression analyses to adjust for potential confounding.

Ordinal logistic regression was performed to identify demographic factors (*e.g. sex and age group*) associated with expectations of smart toothbrush effectiveness using a cumulative logit model:

$$\log \frac{P(Y \leq j)}{P(Y > j)} = \alpha_j - \beta_1 X_1 - \beta_2 X_2$$

where Y represents the ordinal outcome (1–5), $j = 1, 2, 3, 4$; X_1 = sex; and X_2 = age group. The parameters α_j, β_1, β_2 are regression coefficients. Binary logistic regression was used to evaluate factors associated with willingness to pay for professional feedback, controlling for age and sex. Generalized estimating equations (GEE) were applied to examine within-subject differences in dental professionals' willingness to provide feedback according to the presence or absence of a fee and to assess interaction effects with sex and age group.

Finally, Pearson's chi-square tests were used to compare differences among the three respondent groups (dentists, dental hygienists, and the general public) regarding their current oral hygiene practices and preferences for smart toothbrush application features.

Results

A total of 600 participants completed the survey, comprising 200 dentists, 200 dental hygienists, and 200 members of the general public. Internal consistency of the survey was high, with a Cronbach's alpha of 0.852. The demographic information of participants was described in Table 1.

Current oral hygiene management method

Most respondents across all groups utilized manual toothbrushes (Dentists: 167 [83.5%]; Dental Hygienists: 189 [94.5%]; General Public: 178 [89.0%]). Only one participant from the General Public reported currently using a smart toothbrush. Brushing three times per day was most common across groups (Dentists: 120 [60.0%]; Dental Hygienists: 153 [76.5%]; General Public: 121 [60.5%]). Average brushing time predominantly ranged between 2 and 3 minutes

Table 1. General characteristics of survey respondents (n = 600).

Characteristics	Dentists (n = 200)	Dental hygienists (n = 200)	General public (n = 200)
Sex			
Male	138 (69.0)	5 (2.5)	74 (37.0)
Female	62 (31.0)	195 (97.5)	126 (63.0)
Age (years)			
20–29	34 (17.0)	123 (61.5)	66 (33.0)
30–39	67 (33.5)	61 (30.5)	83 (41.5)
40–49	55 (27.5)	13 (6.5)	15 (7.5)
50–59	42 (21.0)	3 (1.5)	21 (10.5)
≥60	2 (1.0)	-	15 (7.5)
Education level			
High school graduate	N/A	N/A	17 (8.5)
Associate degree	N/A	107 (53.5)	20 (10.0)
Bachelor's degree	75 (37.5)	87 (43.5)	130 (65.0)
Master's degree or higher	125 (62.5)	6 (3.0)	33 (16.5)
Region of residence or working area			
The capital city (Seoul)	79 (39.5)	113 (56.5)	68 (34.0)
The metropolitan area surrounding Seoul	70 (35.0)	50 (25.0)	79 (39.5)
The eastern region	7 (3.5)	5 (2.5)	4 (2.0)
The western central region	12 (6.0)	12 (6.0)	12 (6.0)
The southeastern region	13 (6.5)	13 (6.5)	19 (9.5)
The southwestern region	10 (5.0)	3 (1.5)	7 (3.5)
Jeju island	9 (4.5)	4 (2.0)	11 (5.5)
Frequency of smartphone use			
Very rarely	6 (3.0)	7 (3.5)	3 (1.5)
Rarely	16 (8.0)	11 (5.5)	9 (4.5)
Occasionally	67 (33.5)	61 (30.5)	72 (36.0)
Frequently	57 (28.5)	56 (28.0)	64 (32.0)
Very frequently	54 (27.0)	65 (32.5)	52 (26.0)

Values are n (%) as indicated. No missing data were observed.

(Dentists: 81 [40.5%]; Dental Hygienists: 87 [43.5%]; General Public: 97 [48.5%]). All groups identified thoroughness as the most crucial aspect of toothbrushing, whereas the technique was the primary concern, followed by selecting toothbrushes and toothpaste (Table 2).

Awareness of smart toothbrushes

More than 85% of participants were unaware of smart toothbrushes, and only 3 respondents (0.5%, one from each group) actively used them (Figure 1). Most respondents believed smart toothbrushes could positively impact oral hygiene (Dentists: 69.5%; Dental Hygienists: 79.5%; General Public: 79.5%, $p = 0.044$).

Preferences for app functionalities differed significantly among groups ($\chi^2 = 53.598$, $p < 0.001$). Dentists showed higher interest in brushing alarms (28.8%) and professional feedback features (15.1%), whereas dental hygienists preferred real-time brushing coaching (24.2%) and feedback transmission (19.2%). In contrast, the general public most frequently selected toothbrush head replacement notifications (26.0%).

Recommendation and payment willingness for smart toothbrushes

More than 80% of both dentists and dental hygienists were willing to recommend and provide feedback on smart toothbrushes to patients, and 87% of the general public were willing to use them. However, when a fee was involved, willingness to pay for feedback dropped to 39% among the public, while more than 91% of dental professionals still expressed willingness to provide feedback. Among dental professionals, willingness to provide feedback did not significantly differ by sex depending on the presence or absence of a fee ($p = 0.493$). However, younger professionals were significantly less willing to provide feedback when no fee was offered, whereas those aged 50 or older showed no significant difference regardless of fee condition ($p = 0.007$).

Dental professionals who were willing to recommend smart toothbrushes most often responded that they would be helpful to patients (243/497, 48.9%), while dentists most frequently cited high cost (13/40, 32.5%) and dental hygienists cited uncertainty about effectiveness (15/37, 40.5%) as reasons for not recommending them. Regarding acceptable fees, dentists most frequently selected "KRW 40,000 or more" (23.5%), dental hygienists "KRW 20,000–29,999" (26.0%), and the public "less than KRW 10,000" (50.5%). The most preferred billing frequency was "once a year" across all groups, and recommended dental check-up intervals for smart toothbrush users were "once a month" or "once every six months." The detailed preferences regarding recommendation,

Table 2. Responses related to current oral hygiene practices and behaviors (n = 600).

	Dentists (n = 200)	Dental hygienists (n = 200)	General public (n = 200)	p-value
Toothbrush type				
Manual toothbrush	167 (83.5)	189 (94.5)	178 (89.0)	0.022
Electric toothbrush	16 (8.0)	5 (2.5)	9 (4.5)	
Smart toothbrush	-	-	1 (0.5)	
Combination of two types	17 (8.5)	6 (3.0)	12 (6.0)	
Brushing frequency per day				
Once	7 (3.5)	3 (1.5)	3 (1.5)	<0.001
Twice	47 (23.5)	24 (12.0)	66 (33.0)	
Three times	120 (60.0)	153 (76.5)	121 (60.5)	
Four times or more	26 (13.0)	20 (10.0)	10 (5.0)	
Brushing time				
Less than 1 minute	6 (3.0)	6 (3.0)	6 (3.0)	0.001
1 to less than 2 minutes	42 (21.0)	30 (15.0)	55 (27.5)	
2 to less than 3 minutes	81 (40.5)	87 (43.5)	97 (48.5)	
3 to less than 4 minutes	38 (19.0)	40 (20.0)	32 (16.0)	
4 minutes or more	33 (16.5)	37 (18.5)	10 (5.0)	
The most important thing when brushing teeth				0.018
Quality of brushing	145 (72.5)	169 (84.5)	156 (78.0)	
Convenience	13 (6.5)	5 (2.5)	10 (5.0)	
Efficiency	38 (19.0)	23 (11.5)	24 (12.0)	
Items used	4 (2.0)	3 (1.5)	10 (5.0)	
The most worrying thing about brushing teeth				<0.001
How to brush teeth	73 (36.5)	69 (34.5)	95 (47.5)	
Toothbrushing time	23 (11.5)	11 (5.5)	14 (7.0)	
How to hold a toothbrush	3 (1.5)	3 (1.5)	1 (0.5)	
How to choose a toothbrush and toothpaste	25 (12.5)	45 (22.5)	69 (34.5)	
No worries	76 (38.0)	72 (36.0)	21 (10.5)	

Values are n (%) as indicated. No missing data were observed.

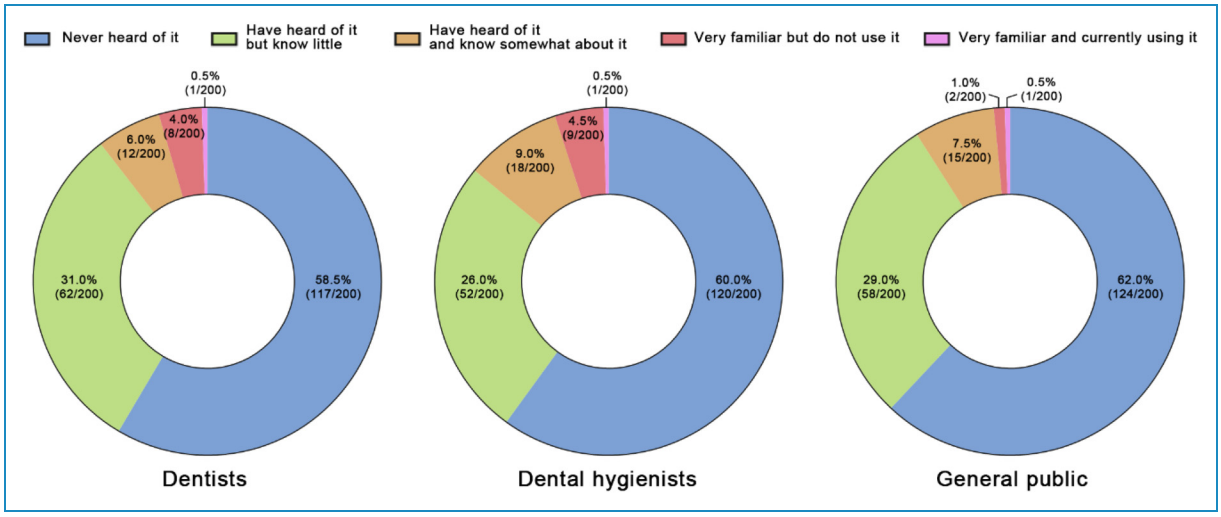

Figure 1. Awareness of smart toothbrushes among dentists, dental hygienists, and the general public. The figure illustrates the level of awareness of smart toothbrushes across the three groups. The majority of respondents in all groups reported that they had never heard of smart toothbrushes (Dentists: 58.5%, Dental hygienists: 60.0%, General public: 62.0%). A small proportion of each group reported being very familiar and currently using smart toothbrushes (0.5% for each group). Overall, awareness and familiarity with smart toothbrushes were low across all groups.

feedback, and payment for smart toothbrush services by group were summarized in Table 3.

Sex and age differences in perceptions and preferences

Ordinal logistic regression analysis revealed that males had significantly lower expectations of smart toothbrush effectiveness compared to females (odds ratio (OR) = 0.577, 95% confidence interval (CI) = 0.400–0.833, $p = 0.003$). With age group ≥60 years as the reference, younger age groups showed significantly higher expectations: 20 s (OR = 0.282, 95% CI: 0.095–0.835, $p = 0.022$), 30 s (OR = 0.261, 95% CI: 0.089–0.771, $p = 0.015$), 40 s (OR = 0.300, 95% CI: 0.096–0.936, $p = 0.038$), and 50 s (OR = 0.313, 95% CI: 0.098–0.997, $p = 0.049$).

Binary logistic regression analysis showed that age was significantly associated with willingness to pay ($p < 0.001$), whereas sex was not ($p = 0.924$). Compared to participants in their 20 s (reference), those in their 50 s (OR = 2.123, 95% CI: 1.162–3.881, $p = 0.014$), and those aged ≥60 years (OR = 16.194, 95% CI: 4.469–58.685, $p < 0.001$) were significantly more likely to be willing to pay for expert feedback (Table 4).

Preferences for smart toothbrush application features varied significantly by sex and age. Females preferred "expert feedback" and "brushing score records," while males preferred "real-time coaching" features ($p < 0.001$). Regarding age differences, participants in their 20s and 30s favored interactive functions such as real-time feedback and gamification, whereas older adults (≥50 s) preferred educational video content ($p = 0.013$).

Discussion

This study aimed to explore awareness of smart toothbrushes and evaluate their potential as a telemonitoring tool for oral hygiene management. Despite the growing interest in digital healthcare devices, our findings revealed that smart toothbrushes are still largely unfamiliar, with the majority of respondents reporting that they had never heard of them.[17] Nevertheless, both dental professionals and the general public showed a high willingness to use or recommend smart toothbrushes. This suggests that although the concept of smart toothbrushes is not yet widespread, there is substantial openness toward adopting innovative oral health management tools if their effectiveness is demonstrated.

Interestingly, while a large proportion of respondents expressed a positive attitude toward the use of smart toothbrushes, their understanding of the devices' telemonitoring potential appeared limited. Although functions such as toothbrushing time alarms were most frequently cited as useful, features essential for telemonitoring—such as transmitting brushing data to dental professionals for feedback—were not highly prioritized.[12] This may reflect a lack of familiarity with telemonitoring services in oral healthcare, especially in contexts like Korea, where telemedicine remains uncommon.[18]

Our findings also highlight important differences in perceptions based on sex and age. Women showed greater expectations for the effectiveness of smart toothbrushes compared to men. Furthermore, younger participants, especially those in their 20 s, had higher expectations for the benefits of smart toothbrushes compared to older

Table 3. Smart toothbrush recommendation and payment preferences by group (n = 600).

Category	Dentist (n = 200)	Dental hygienist (n = 200)	General public (n = 200)
Willingness to recommend or provide feedback (%)	81.0	83.5	87.0 (willingness to use)
Willingness to provide feedback if paid (%)	91.0	93.0	N/A
Willingness to pay for feedback (%)	N/A	N/A	39.0
Preferred feedback cost (most frequent response)	KRW 50,000 or more (23.5%)	KRW 20,000–29,999 (26.0%)	Less than KRW 10,000 (50.5%)
Preferred billing frequency (most frequent response)	Every time of feedback (28.5%)	Twice a year (31.0%)	Once a year (52.5%)
Preferred dental check-up frequency for users	Once a month	Once a month	Every 6 months

Data are presented as percentages (%) of respondents who selected each option.

participants. In contrast, willingness to pay for expert feedback was notably higher among older adults. These findings suggest that although younger individuals are more enthusiastic about adopting smart toothbrushes, older adults may perceive greater value in receiving professional guidance—possibly due to a higher prevalence of oral health concerns that require monitoring, or a greater reliance on expert opinion in managing their health.[19] Therefore, targeted strategies that reflect these demographic differences may be needed when designing and promoting smart toothbrush-based telemonitoring services.

Table 4. Sex and age differences in willingness to pay for expert feedback on smart toothbrush use.

Category	OR	95% CI of OR	p-value
Sex			
Female	1.000	(reference)	
Male	1.020	(0.679–1.533)	0.924
Age			
20s	1.000	(reference)	
30s	1.255	0.804–1.959	0.318
40s	0.589	0.292–1.188	0.139
50s	2.123	1.162–3.881	0.014
≥ 60s	16.194	4.469–58.685	<0.001

Note: OR, odds ratio; CI, confidence interval.

Another important consideration is the gap in perception regarding service fees. While more than 90% of dental professionals were willing to provide telemonitoring services if appropriately compensated, only a minority of the public expressed willingness to pay for such services, and many preferred a minimal cost. This highlights a potential barrier to implementing telemonitoring models in oral healthcare. Patients' expectations of low costs for remote services may be influenced by the broader perception that telemedicine should be more affordable than in-person care.[20] Notably, even among professionals, acceptable fee levels differed: dentists most frequently selected "KRW 40,000 or more," while dental hygienists preferred "KRW 20,000–29,999." This discrepancy may reflect differences in their clinical responsibilities, billing expectations, or perceived time investment required for delivering remote feedback. However, for telemonitoring to be sustainable, it is essential to balance patient affordability with adequate compensation for dental professionals.[21] Therefore, future studies are needed to determine appropriate fee structures that are acceptable to both providers and users, possibly through benefit-cost analyses and pilot implementations.[22]

Song et al.[15] conducted a crossover study in individuals with developmental disabilities, allowing participants to use both manual toothbrushes and smart toothbrushes with remote monitoring support and receive professional feedback. Guardians reported in the questionnaire that prior awareness of smart toothbrushes was low, but interest and positive attitudes increased after device use. Toothbrushing frequency and duration improved while using the smart toothbrush, but both declined when returning to manual brushing. These findings are consistent with our survey, in which more than 85% of dentists, dental hygienists, and the general public

had no prior experience with smart toothbrushes but expressed high willingness to adopt or recommend them. This similarity suggests that initial acceptance of smart toothbrush technology can emerge quickly even in populations with limited exposure.

Kim et al.[12] evaluated healthy adults over 6 months using three groups: remote-monitoring smart toothbrushes, powered smart toothbrushes, and manual toothbrushes. Most participants perceived improvements in oral health after using the smart toothbrush, but showed minimal willingness to continue paid use. Lee et al.[13] conducted a study in children using remote-monitoring smart toothbrushes, powered smart toothbrushes, and manual toothbrushes. After smart toothbrush use, brushing duration increased and parents provided positive feedback, yet willingness for sustained smart toothbrush use remained low. Overall, these studies align with our results: initial awareness of smart toothbrushes is limited, but attitudes are positive and purchase willingness is modest. Our survey extends these insights to dental professionals and the general public, emphasizing that sustained adoption requires clear clinical benefits and cost-effective service models.

From a clinical perspective, telemonitoring via smart toothbrushes holds significant promise, particularly for chronic conditions such as periodontitis, where continuous self-care and professional feedback are essential.[12,23] Although face-to-face education on brushing techniques remains important, smart toothbrushes could enable ongoing monitoring and personalized feedback without the need for frequent in-office visits.[24] This could improve patients' adherence to proper brushing habits and ultimately reduce the risk of disease progression. Additionally, telemonitoring using smart toothbrushes may be especially valuable for populations with limited access to dental care, such as older adults or individuals with disabilities, supporting equity in oral health services.[15,25]

Nevertheless, for telemonitoring with smart toothbrushes to become a practical clinical tool, several issues must be addressed.[26,27] Beyond technical functionality, factors such as patient engagement, dentists' willingness to participate, the establishment of appropriate feedback intervals, and the integration of these tools into existing care workflows are critical.[28,29] Moreover, as our study indicates a divergence in willingness to pay between providers and patients, consensus on cost-sharing models is crucial for successful adoption.

Despite these findings, several limitations should be noted. First, only a small proportion of participants had previous experience using smart toothbrushes, and their perceptions may reflect assumptions rather than informed opinions. Second, as participants were recruited through an online platform, the sample may be subject to self-selection bias, favoring individuals with higher digital literacy or interest in oral health technologies. In addition, social desirability bias may have led some respondents to report more favorable attitudes or intentions than they genuinely held. Furthermore, the general public group was recruited through nonprobability sampling, which may limit the generalizability of the findings to the broader population. The sampling frame was therefore not nationally representative, and results should be interpreted with this limitation in mind. Furthermore, as the survey required completion of all questions before submission, there were no missing data; while this ensured complete datasets, it also precluded assessment of item-level nonresponse. Third, as the study was conducted solely in Korea—where telemonitoring is not yet covered by an established medical fee system—the generalizability of the findings to other countries or healthcare systems may be limited, and the responses regarding willingness to pay should be interpreted with caution, as actual behavior may differ once reimbursement policies are introduced.

Conclusion

Both dental professionals and patients recognized the potential utility of smart toothbrushes for improving oral hygiene, and there was a general openness to using such technology. However, to realize their full potential as telemonitoring devices, further efforts are required to raise awareness, establish effective feedback systems, and overcome barriers related to service cost and integration into routine dental care.

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Ethical considerations

This study was approved by the Institutional Review Board of the Dental Hospital at Yonsei University (IRB number: 2-2023-0042).

Informed consent

Written informed consent to participate in the study was obtained from all participants prior to the survey. All participants provided consent electronically. Individuals who did not provide consent were automatically excluded from the survey. All data were collected anonymously to protect participant confidentiality.

Contributorship

YC, JK, YS, and WP jointly contributed to the conceptualization and design of the study. YC, JK, and YS were responsible for data collection, and JK conducted the formal analysis. YC prepared the original draft and visualizations. WP supervised the project and critically reviewed and edited the manuscript. All authors read and approved the final version of the manuscript.

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Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability

The data that support the findings of this study are available from the corresponding authors upon reasonable request and in accordance with institutional review board policies and privacy regulations.

Gurantor

WP.

Peer Review

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Supplemental material

Supplemental material for this article is available online.

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