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Awareness of Tele Dentistry and Oral Hygiene Apps, Attitudes Toward Remote Consultations, And Willingness to Use Smart Oral Hygiene Devices

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ABSTRACT

Background: Teledentistry and digital oral-hygiene technologies are increasingly used to enhance remote care, patient engagement, and preventive oral health. Understanding user awareness and attitudes is essential for effective implementation.

Aim: To assess awareness of teledentistry and oral-hygiene mobile apps, attitudes toward remote consultations, and willingness to use smart oral-hygiene devices.

Methods: A descriptive cross-sectional study was conducted among 101 participants from dental institutions between July and September 2025. Data were collected using a validated digital questionnaire and analyzed using SPSS. Descriptive statistics summarized awareness and perceptions, while chi-square tests assessed associations ($p < 0.05$).

Results: Awareness of teledentistry was moderate, with 49.5% familiar but uncertain of its meaning. Attitudes toward remote consultations were largely positive. Awareness of smart devices significantly varied by education ($p = 0.0322$), and gender influenced privacy and device-related concerns. Willingness to adopt smart devices was moderate but influenced by cost and usability.

Conclusion: Participants demonstrated favorable attitudes toward digital dentistry, though awareness remains developing, highlighting the need for improved education and accessibility.

Keywords: Teledentistry, Digital Dentistry, Oral-Hygiene Apps, Smart Toothbrush, Remote Consultations.

INTRODUCTION

The rapid advancement of digital technologies has transformed healthcare delivery worldwide, and dentistry is no exception. In recent years, teledentistry has emerged as an innovative extension of

telehealth, enabling dental professionals to provide remote consultations, deliver oral-health education, conduct follow-up assessments, and support patient monitoring without requiring physical visits. Its integration into modern dental care became particularly prominent during the COVID-19 pandemic, when the need for physical distancing accelerated the adoption of digital and remote solutions to maintain continuity of oral-health services.[1] This shift highlighted the potential of teledentistry to overcome traditional barriers to dental access, especially for individuals in rural or underserved communities, patients with mobility limitations, and individuals requiring frequent monitoring.[2]

Parallel to the rise of teleconsultations, the widespread use of smartphones and digital devices has fueled the growth of oral-hygiene mobile applications aimed at improving patient awareness and self-care behaviors. These apps offer features such as brushing reminders, plaque-tracking tools, instructional videos, and behavioral feedback systems that support daily oral-hygiene practices.[3] As oral diseases remain highly prevalent globally, mobile health (mHealth) technologies represent a valuable strategy to enhance prevention, early detection, and personalized oral-health management. Combined with teledentistry, such tools contribute to a more proactive and patient-centered model of dental care, encouraging individuals to take greater responsibility for their oral health.[4]

Another emerging trend in digital dentistry is the development of smart oral-hygiene devices, particularly smart toothbrushes equipped with sensors, artificial intelligence (AI), and app-based monitoring systems.[5] These devices track brushing frequency, duration, angulation, and coverage, offering real-time feedback and personalized recommendations. Studies have shown that smart toothbrushes can significantly improve brushing effectiveness and patient compliance, particularly among children and individuals with limited oral-hygiene skills.[6] As public interest in digital health grows, smart devices are increasingly viewed as promising tools that complement teledentistry by enabling remote monitoring and enhanced patient engagement.[7]

Despite these advancements, the successful implementation of digital dentistry relies heavily on the awareness, attitudes, and acceptance of potential users. In this context, the present study was undertaken to assess the awareness of teledentistry and oral-hygiene applications, evaluate attitudes toward remote dental consultations, and determine the willingness to use smart oral-hygiene devices among individuals

MATERIALS AND METHODS

This descriptive cross-sectional study aimed to evaluate participants' awareness of teledentistry and oral-hygiene mobile applications, their attitudes toward remote dental consultations, and their willingness to adopt smart oral-hygiene devices. The study was conducted over a three-month period, from July to September 2025, during which data collection, statistical analysis, and report compilation were completed. Data were gathered using a structured and validated self-administered digital questionnaire that included major sections on teledentistry, mobile applications, remote consultation preferences, and related perceptions. The questionnaire was distributed among participants from dental institutions. The collected responses were analyzed using SPSS software. Descriptive statistics, including frequencies and percentages, were used to summarize awareness and response patterns, while inferential statistics such as chi-square tests were employed to assess differences between demographic groups and to determine the statistical significance of variations across study variables. A p-value of < 0.05 was considered statistically significant for all inferential analyses.

RESULTS

A total of 101 participants completed the survey. The majority belonged to the 21–30 years age group (95.05%), followed by 31–40 years (3.96%) and above 40 years (0.99%). Gender distribution was nearly equal (50.5% male, 49.5% female). Most respondents were undergraduates (79.21%), with smaller proportions holding a professional healthcare degree (12.87%), postgraduate degree (6.93%), or school-level qualification (0.99%).

Awareness of teledentistry was moderate, with 49.5% having heard of the term but uncertain of its meaning, 30.69% knowing it well, and only 13.86% reporting no awareness; however, chi-square analysis showed no significant association with gender ($p = 0.264$) or education ($p = 0.210$). Similar non-significant findings applied to learning sources ($p = 0.673$; $p = 0.891$) and perceived uses of teledentistry ($p = 0.679$; $p = 0.470$). Awareness of oral-hygiene apps ($p = 0.361$; $p = 0.427$), app usage patterns ($p = 0.211$; $p = 0.230$), and perceived usefulness of these apps ($p = 0.164$; $p = 0.109$) also showed no demographic influence. Attitudes toward remote consultations—including willingness to consult online ($p = 0.786$; $p = 0.618$), perceived advantages ($p = 0.063$; $p = 0.399$), and concerns such as diagnostic accuracy, privacy, and technical issues ($p = 0.161$; $p = 0.385$) were not significantly associated with either gender or education. Notably, awareness of smart toothbrushes showed significant association with educational level ($\chi^2 = 18.26$, $p = 0.032$), though not with gender ($p = 0.145$). However, willingness to use smart toothbrushes ($p = 0.247$; $p = 0.384$) and likelihood of recommending them ($p = 0.301$; $p = 0.243$) showed no meaningful demographic variations. Perceptions that digital dentistry improves oral-health awareness were uniform ($p = 0.455$; $p = 0.666$), whereas beliefs about digital dentistry being the future were significantly associated with education ($\chi^2 = 17.51$, $p = 0.041$). Disadvantages of teledentistry ($p = 0.830$; $p = 0.268$) and confidence in online consultations ($p = 0.598$; $p = 0.519$) showed no demographic significance. Importantly, gender significantly influenced concerns about sharing dental records online ($\chi^2 = 13.15$, $p = 0.004$) and challenges faced with smart oral-hygiene devices ($\chi^2 = 12.47$, $p = 0.006$), while education did not. Concerns discouraging smart-device adoption showed borderline significance for education ($p = 0.055$) but remained non-significant for gender ($p = 0.123$). Perceptions regarding the cost-benefit justification of smart devices were not significantly linked to gender ($p = 0.869$) or educational level ($p = 0.498$). Overall, only four questions—awareness of smart devices and belief in the digital future of dentistry (education-related), and privacy/device-related concerns (gender-related)—showed statistically significant variation, while all other variables demonstrated demographic uniformity.

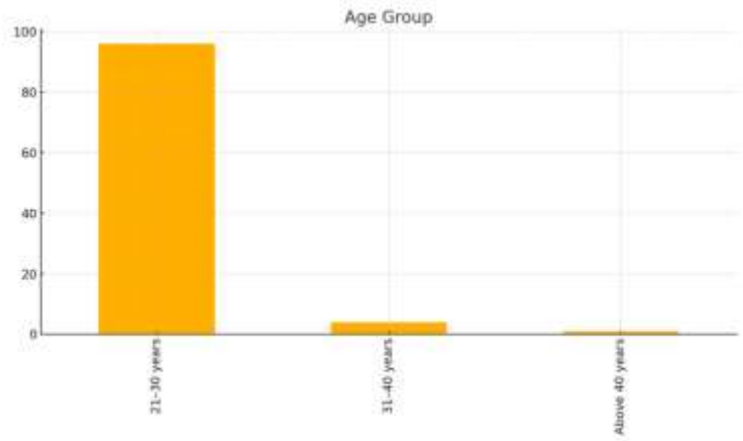

Figure 1: Age Distribution of Participants

Figure 1 shows that the sample is predominantly young adults, with 95% belonging to the 21–30 age group. Only 4% fall between 31–40 years, and 1% are above 40 years, indicating a youthful participant pool typical of dental institution settings.

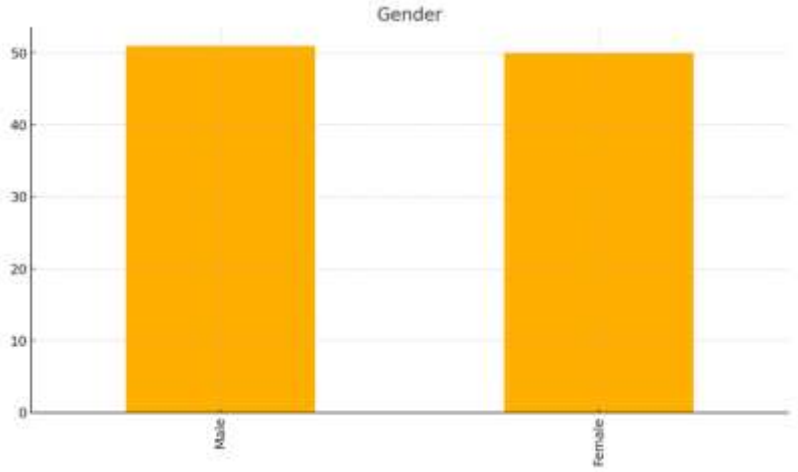

Figure 2: Gender Distribution

Figure 2 illustrates an almost equal distribution of males (50.5%) and females (49.5%), showing balanced representation and minimizing gender bias in responses.

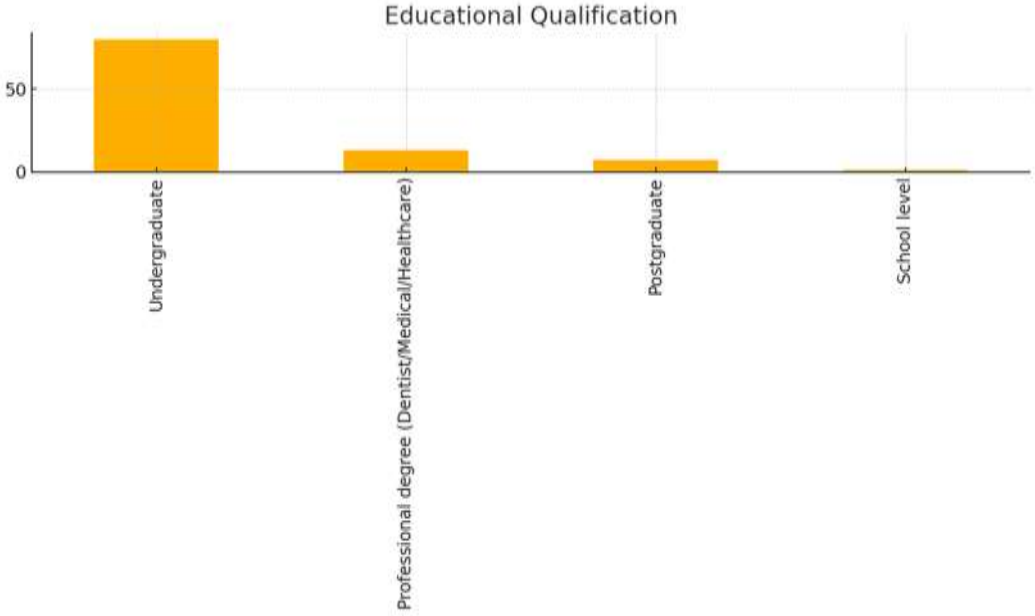

Figure 3: Educational Qualification

Figure 3 reveals that most participants are undergraduates (79.2%), followed by those with professional degrees (12.9%) and postgraduates (6.9%), with only 1% at school level, indicating a primarily academically active and healthcare-oriented sample.

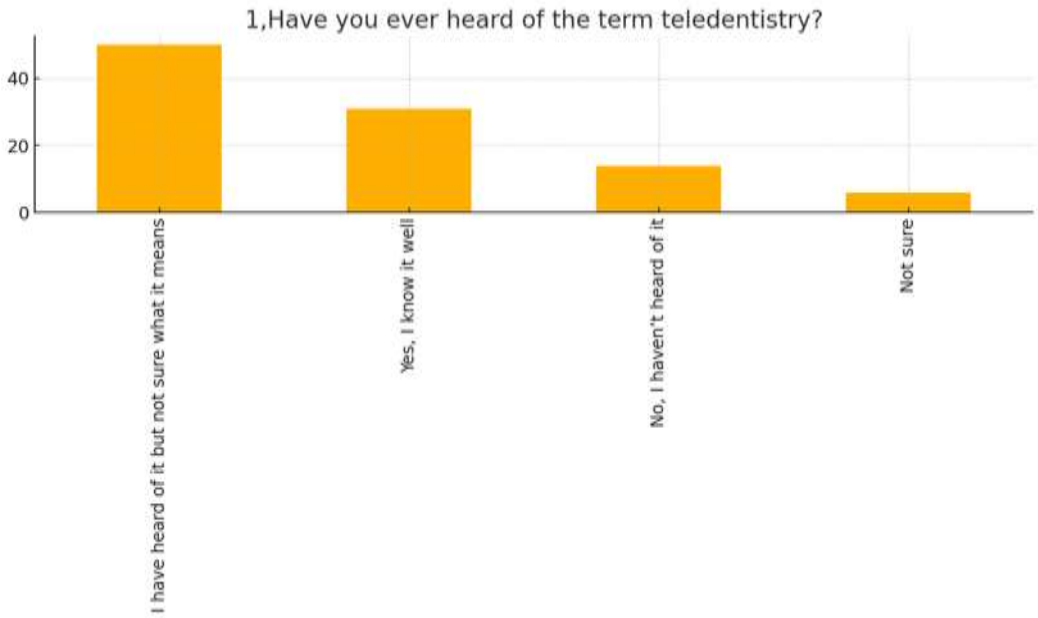

Figure 4: Awareness of the Term "Teledentistry"

Figure 4 shows that while 49.5% have heard of the term but are unsure about its meaning, only 30.7% fully understand it. About 13.9% have never heard of teledentistry, reflecting partial but developing awareness.

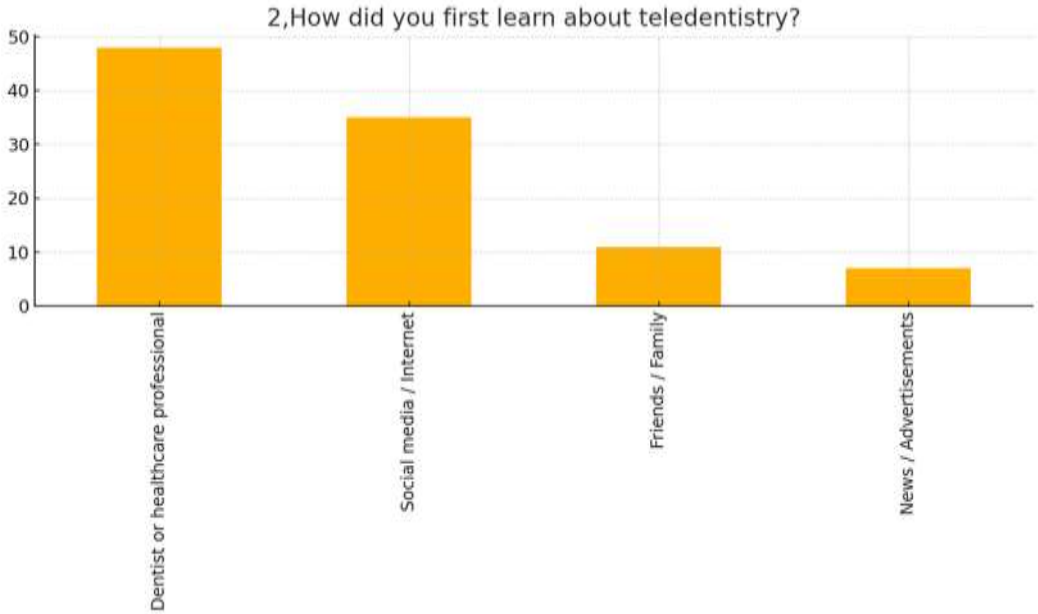

Figure 5: Source of Learning About Teledentistry

Figure 5 indicates that dental professionals are the main source of information (47.5%), followed by social media (34.7%), while friends/family (10.9%) and news outlets (6.9%) play a smaller role.

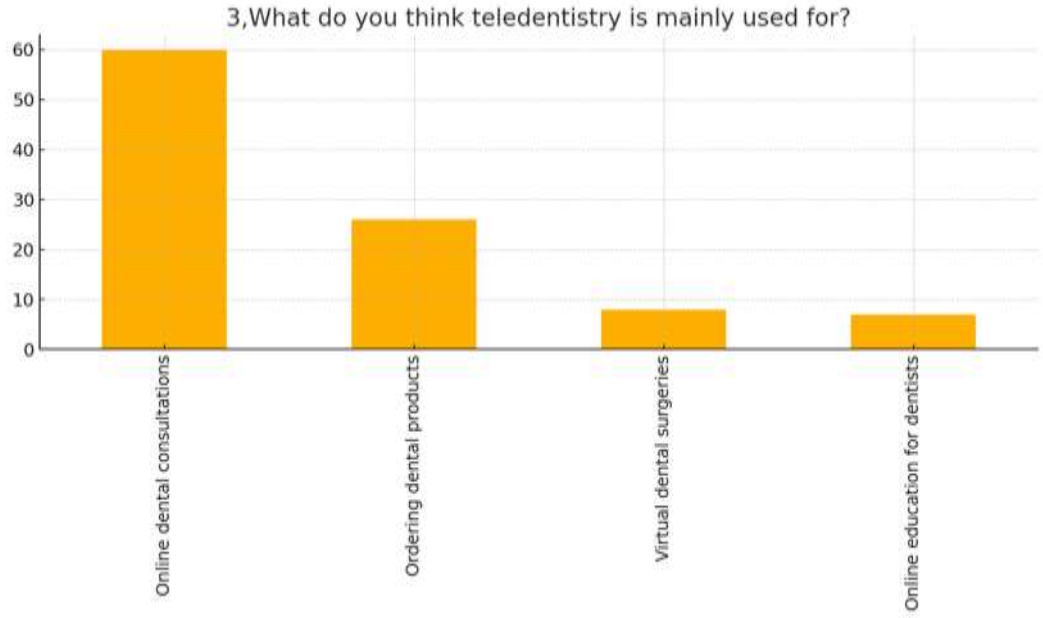

Figure 6: Perceived Main Use of Teledentistry

Figure 6 demonstrates that the majority (59.4%) believe teledentistry is mainly used for online consultations, while fewer associate it with ordering products (25.7%), virtual surgeries (7.9%), or dentist education (6.9%).

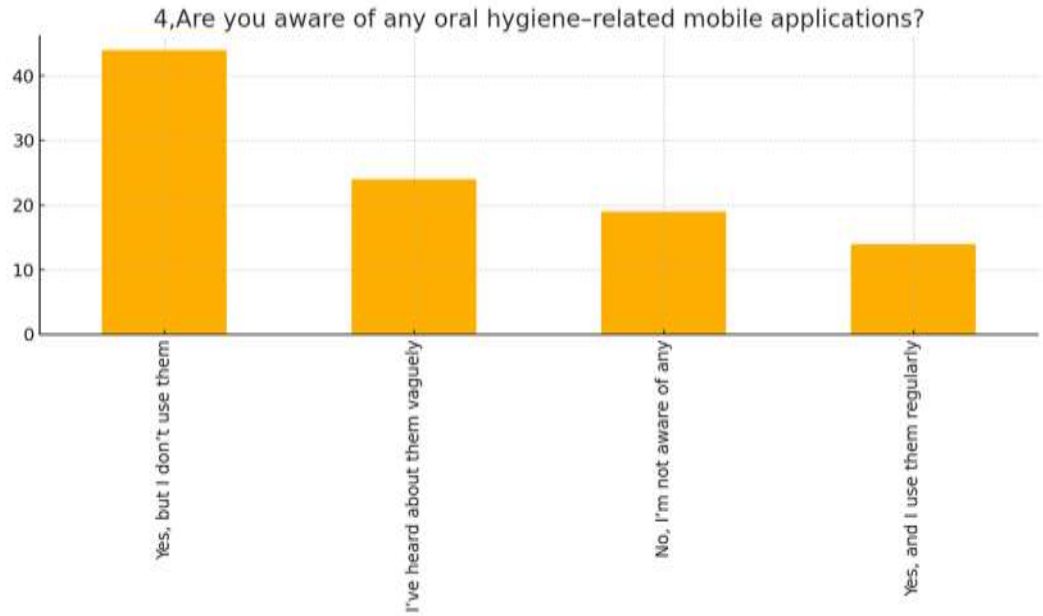

Figure 7: Awareness of Oral-Hygiene Mobile Apps

Figure 7 shows that although 43.6% are aware of such apps but do not use them, 23.8% have vague awareness and 13.9% use them regularly. Nearly 19% remain unaware, highlighting a mixed but growing familiarity.

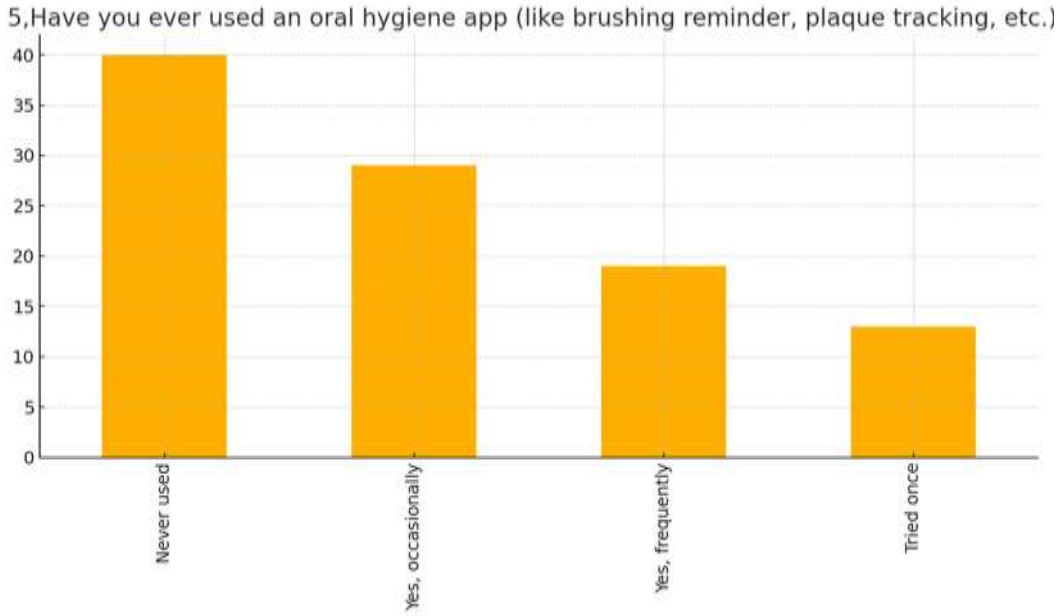

Figure 8: Use of Oral-Hygiene Apps

Figure 8 indicates that 39.6% have never used an oral-hygiene app, while 28.7% use them occasionally and 18.8% frequently. Only 12.9% have tried them once, suggesting moderate engagement.

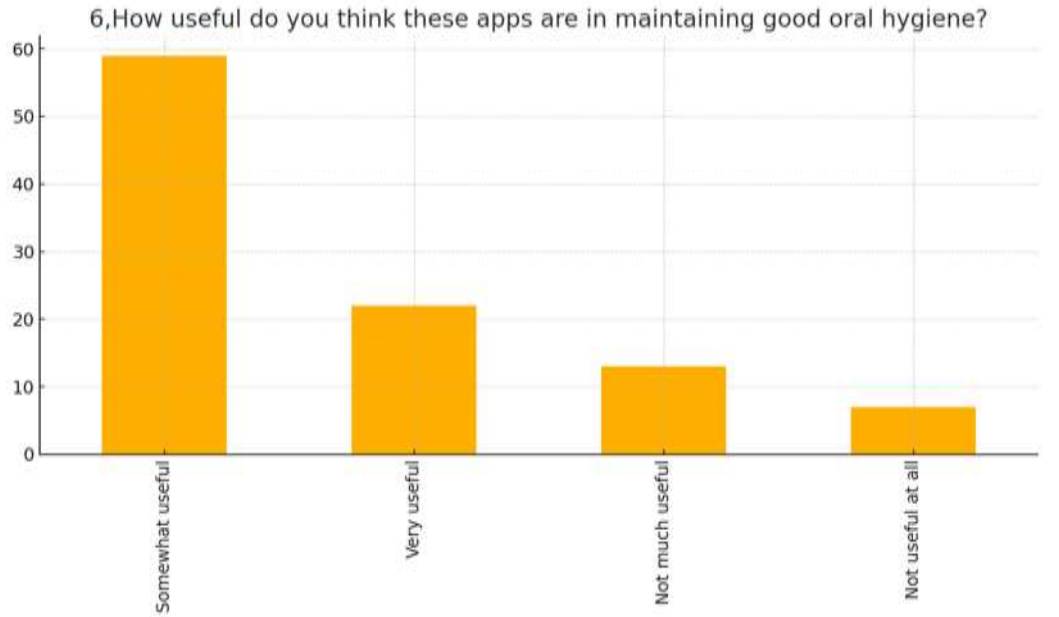

Figure 9: Perceived Usefulness of Oral-Hygiene Apps

Figure 9 shows that 58.4% find such apps somewhat useful and 21.8% very useful, while only a minority believe they are not useful, indicating overall positive perceptions.

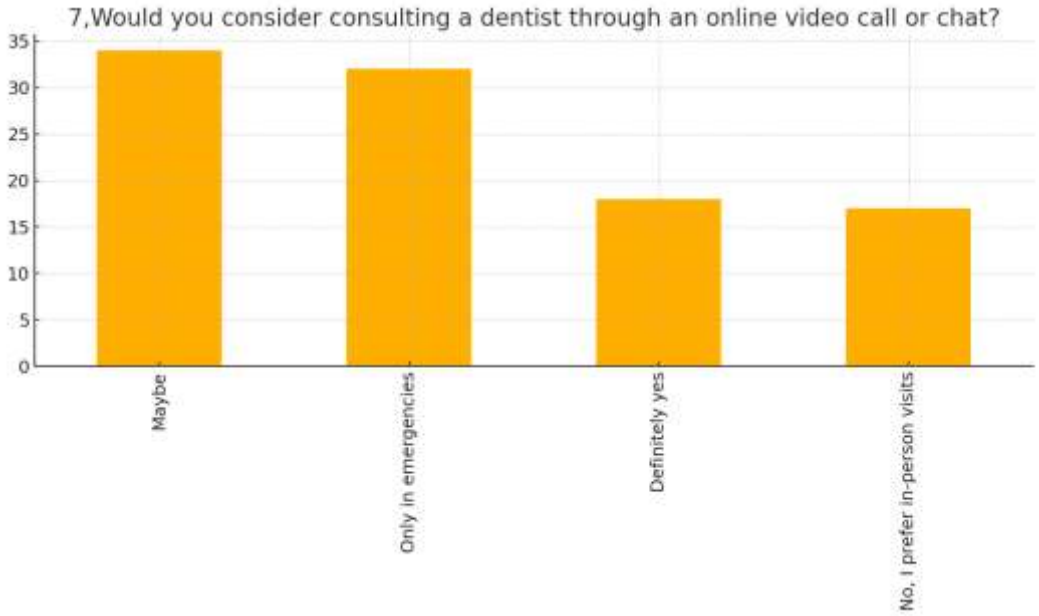

Figure 10: Willingness for Online Dental Consultations

Figure 10 demonstrates that 33.7% may consider virtual consultations and 31.7% would use them only in emergencies. Around 17.8% are definitely willing, while 16.8% prefer in-person visits.

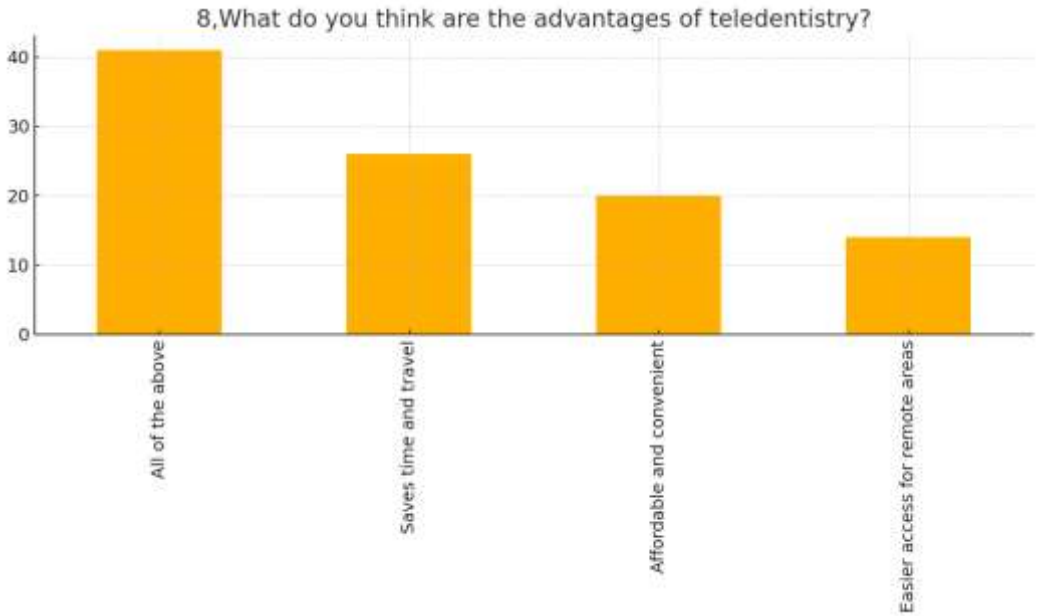

Figure 11: Advantages of Teledentistry

Figure 11 shows that 40.6% selected "all of the above," recognizing multiple benefits. Time-saving (25.7%), affordability (19.8%), and improved access (13.9%) were also notable advantages.

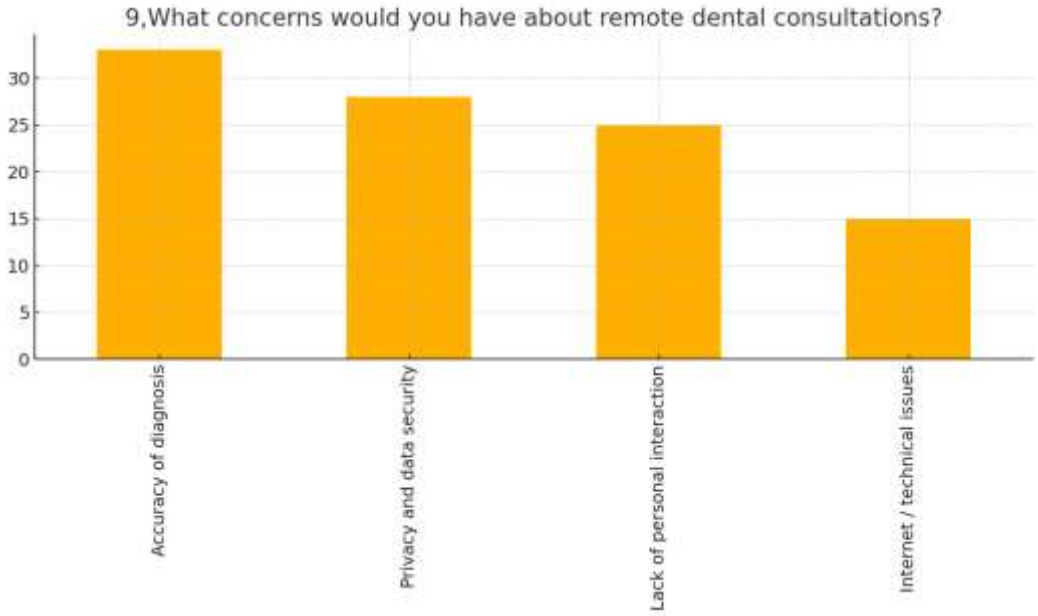

Figure 12: Concerns About Remote Consultations

Figure 12 highlights that accuracy of diagnosis (32.7%) and privacy issues (27.7%) are the most common concerns, followed by lack of personal interaction (24.8%) and technical issues (14.9%).

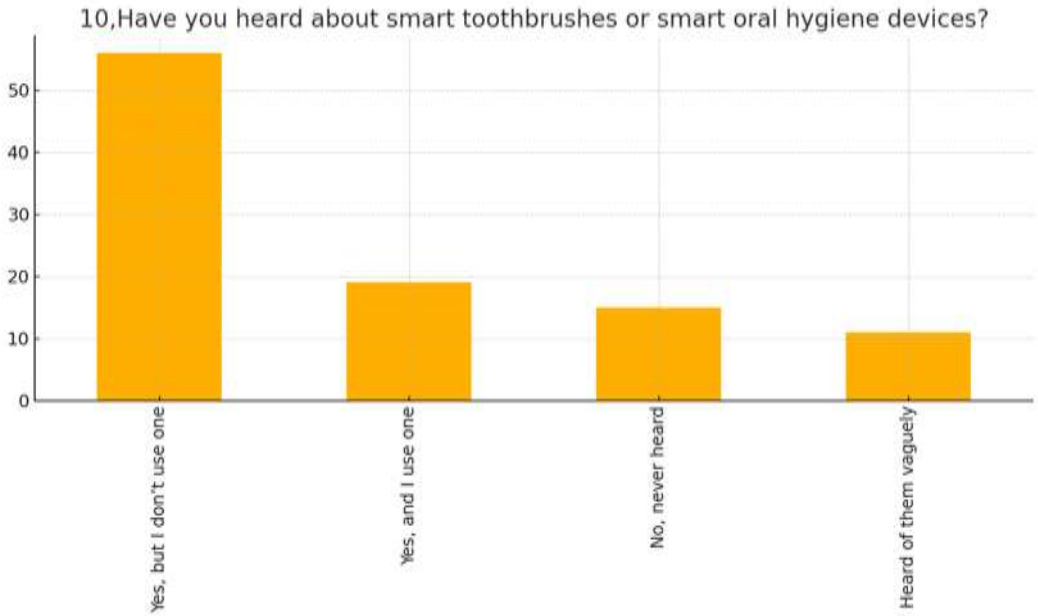

Figure 13: Awareness of Smart Oral-Hygiene Devices

Figure 13 indicates that 55.4% have heard of smart toothbrushes but do not use them, 18.8% use one, and 14.9% have never heard of them. About 10.9% have vague awareness, suggesting limited exposure.

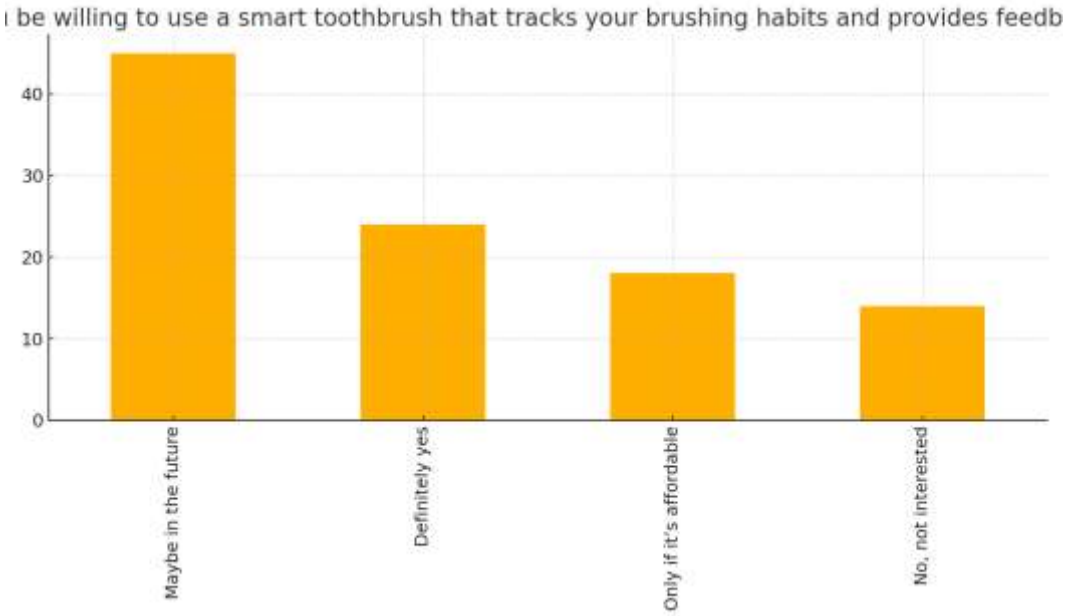

Figure 14: Willingness to Use a Smart Toothbrush

Figure 14 shows that nearly half (44.6%) may use a smart toothbrush in the future, 23.8% are definitely willing, while affordability (17.8%) and lack of interest (13.9%) influence acceptance.

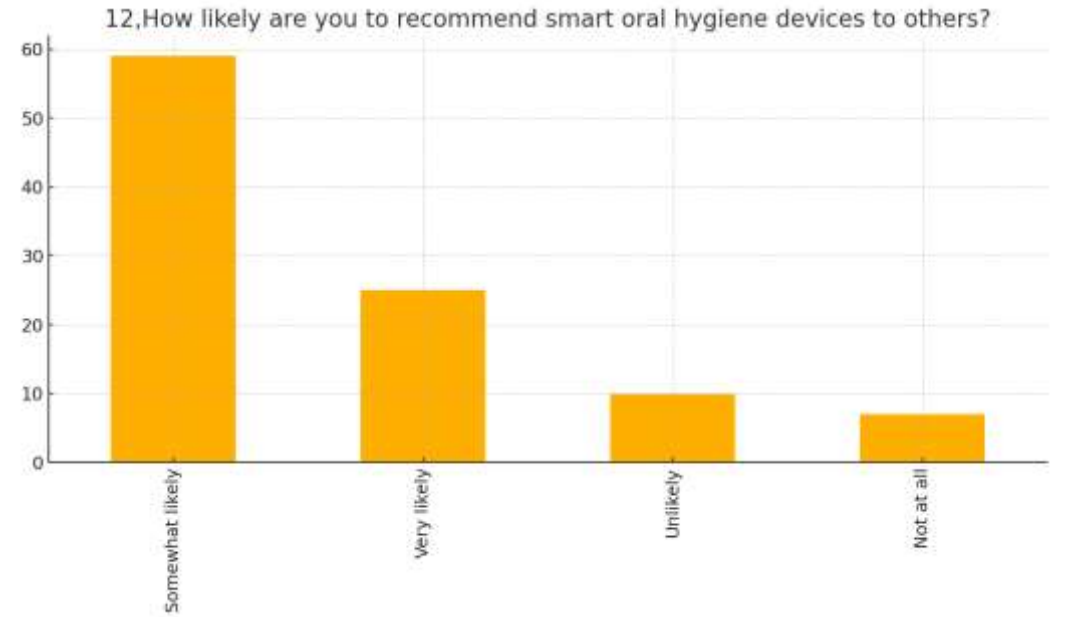

Figure 15: Likelihood of Recommending Smart Devices

Figure 15 demonstrates strong support, with 58.4% somewhat likely and 24.8% very likely to recommend smart devices. Only small proportions are unlikely (9.9%) or not at all likely (6.9%).

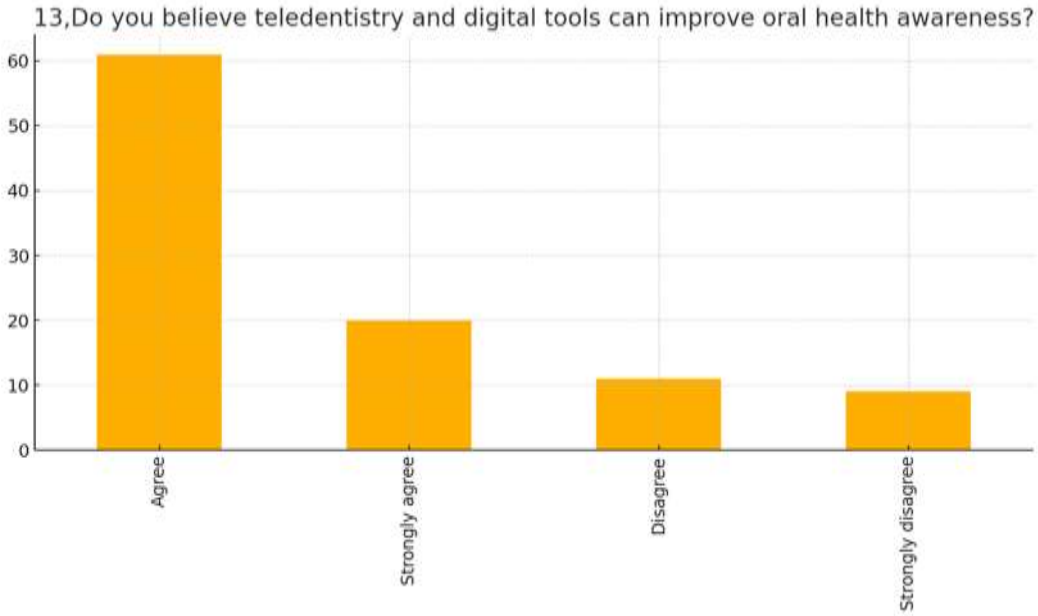

Figure 16: Belief That Digital Tools Improve Oral-Health Awareness

Figure 16 shows predominantly positive views: 60.4% agree and 19.8% strongly agree that digital tools improve awareness. Only around 20% express negative opinions.

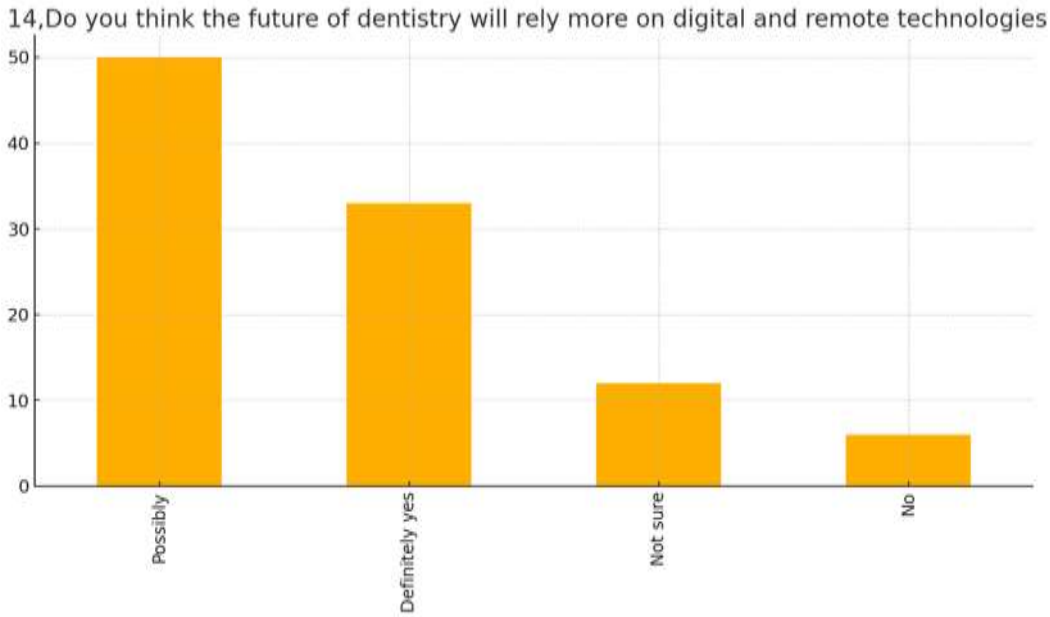

Figure 17: Belief in a Digital Future for Dentistry

Figure 17 indicates that half the respondents (49.5%) believe digital dentistry is "possible," and 32.7% believe it is definite. Only 17.8% express uncertainty or disagreement.

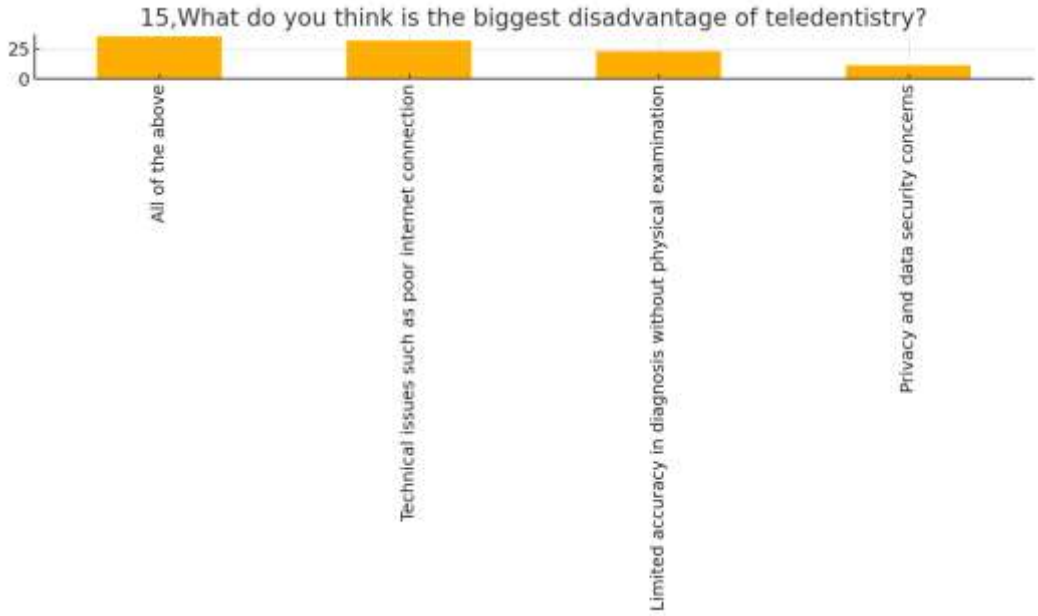

Figure 18: Biggest Disadvantage of Teledentistry

Figure 18 illustrates that 34.7% view multiple issues as disadvantages, while 31.7% specifically cite technical issues. Limited diagnostic accuracy (22.8%) and privacy concerns (10.9%) are also notable barriers.

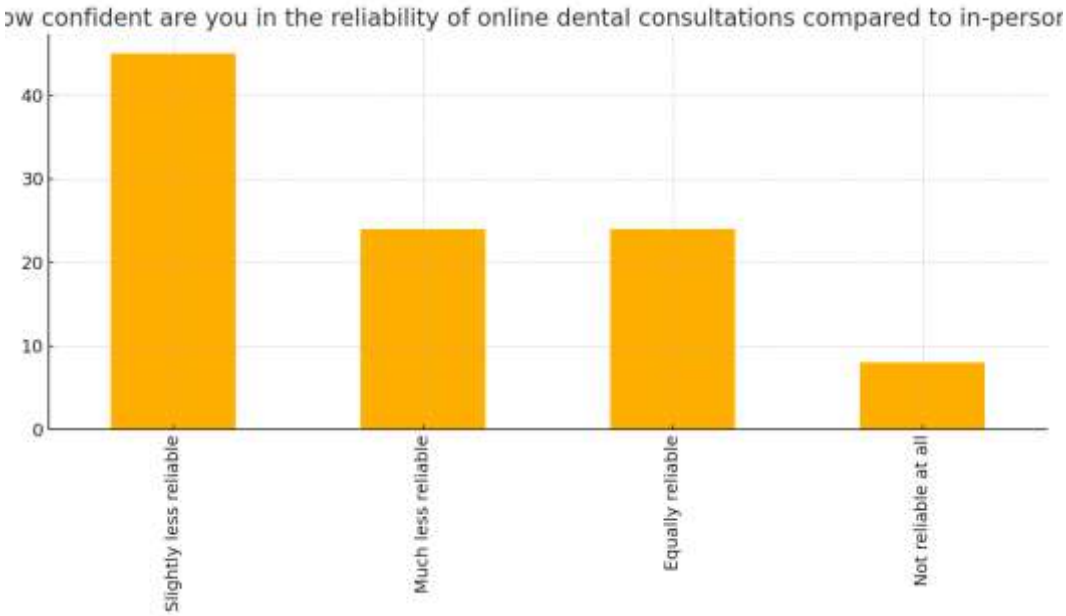

Figure 19: Confidence in Online Dental Consultations

Figure 19 shows moderate confidence levels: 44.6% consider them slightly less reliable than in-person visits, while 23.8% view them as much less reliable or equally reliable. Only 7.9% find them not reliable at all.

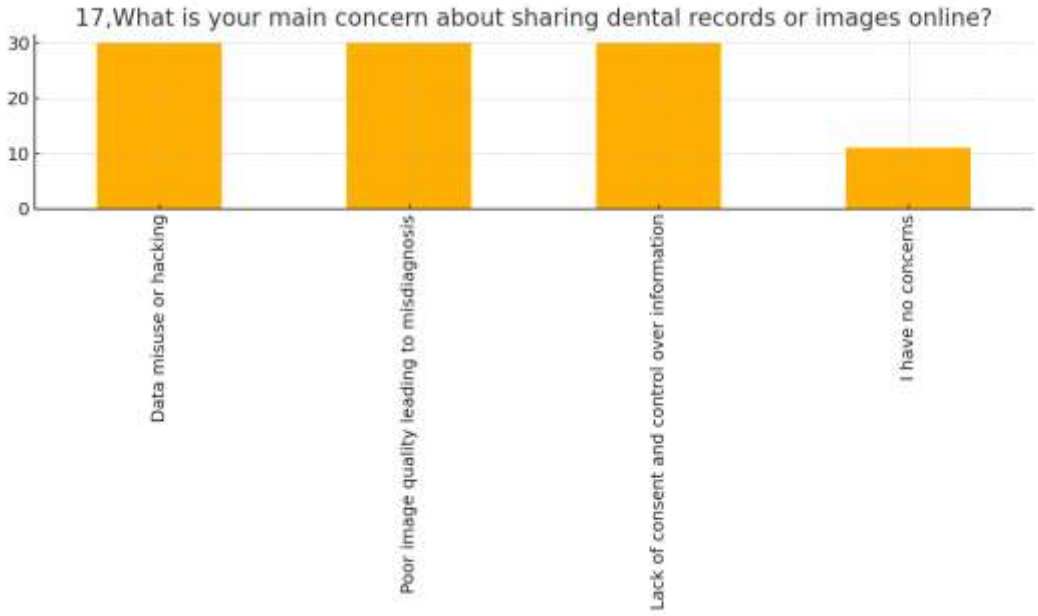

Figure 20: Concerns About Sharing Dental Records Online

Figure 20 highlights almost equal concerns across data misuse (29.7%), poor image quality (29.7%), and lack of consent (29.7%), with just 10.9% expressing no concerns.

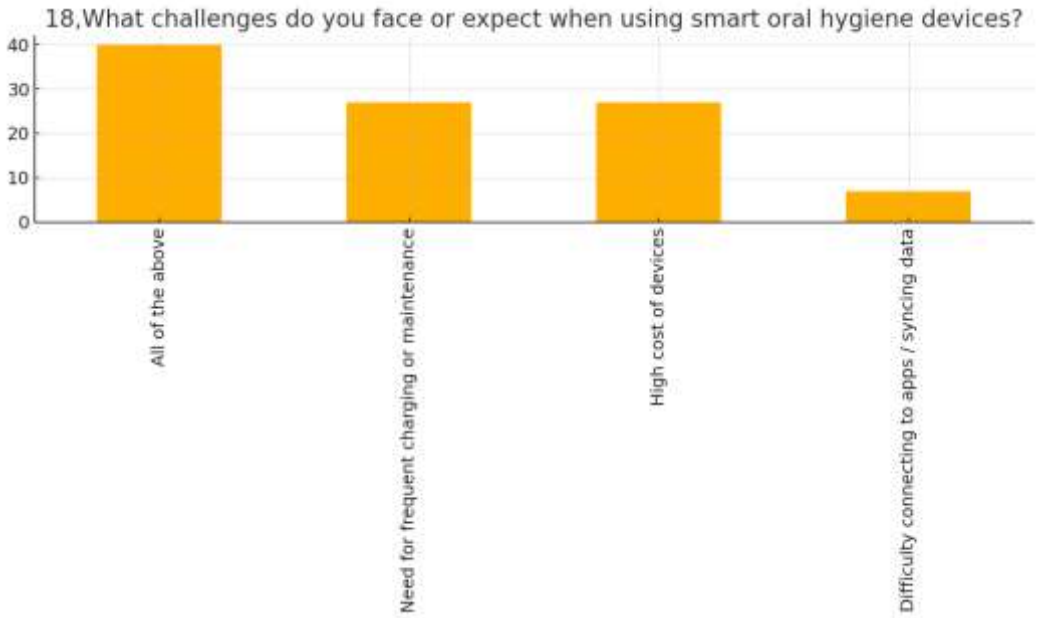

Figure 21: Challenges Faced in Using Smart Devices

Figure 21 shows that 39.6% face multiple challenges, while high cost (26.7%), charging/maintenance demands (26.7%), and syncing issues (6.9%) are common barriers.

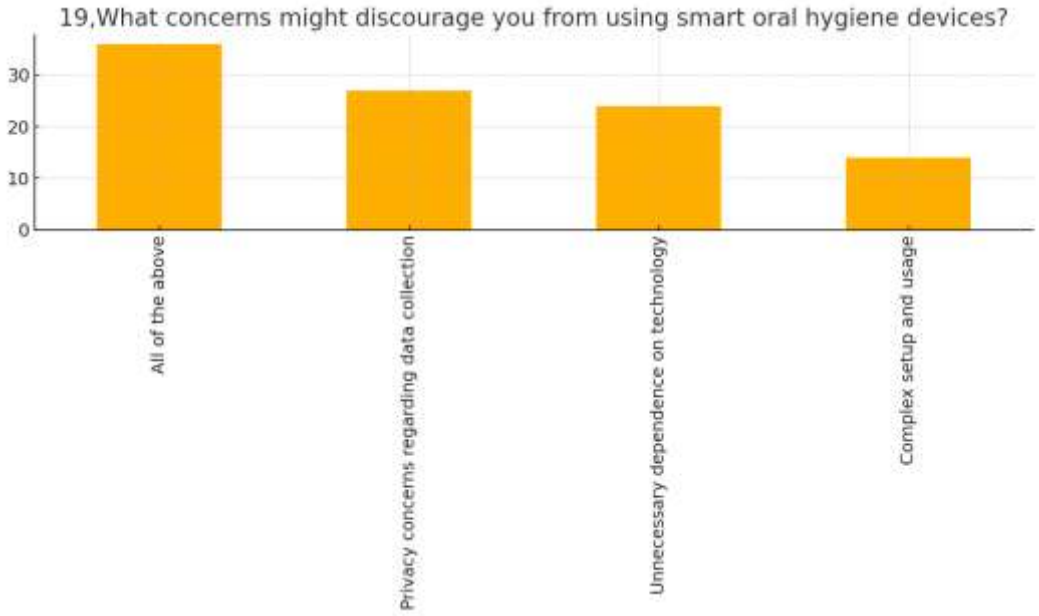

Figure 22: Concerns Discouraging Smart-Device Use

Figure 22 reveals that 35.6% report multiple concerns, followed by privacy fears (26.7%), technology dependence (23.8%), and difficulty in setup (13.9%).

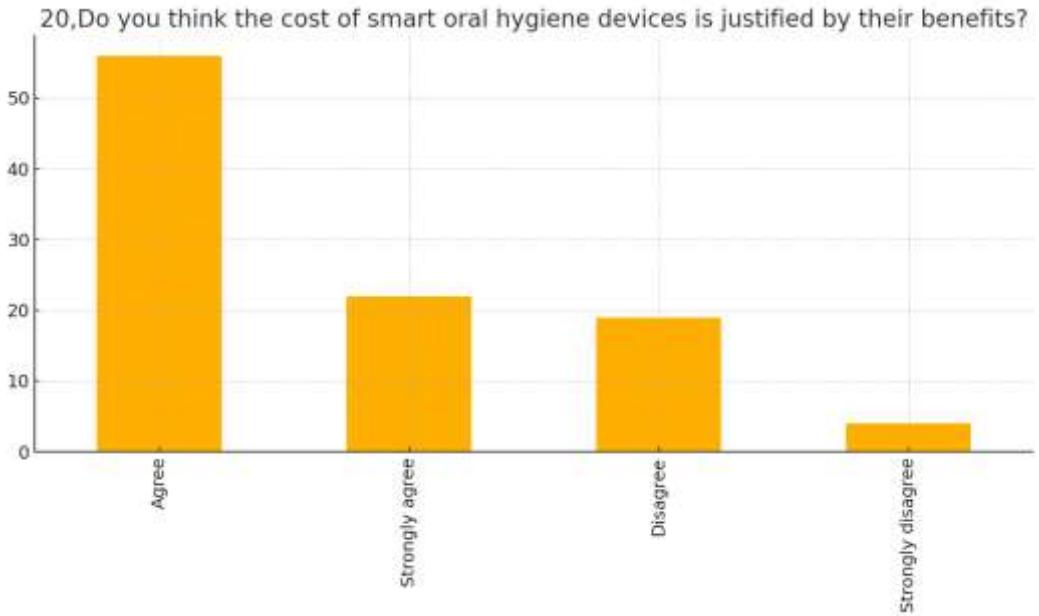

Figure 23: Perception of Cost Justification for Smart Devices

Figure 23 shows positive financial perception, with 55.4% agreeing and 21.8% strongly agreeing that costs are justified. Around 22.8% disagree to varying degrees.

DISCUSSION

Our study indicated a relatively uniform acceptance and perception of digital dentistry concepts across most demographic groups. A core finding was the limited impact of gender and educational level on attitudes toward teledentistry, including willingness for remote consultations, perceived advantages, and use of oral-hygiene apps, mirroring findings in other general health technology acceptance studies. However, the moderate awareness of teledentistry suggests the need for broader educational campaigns. Notably, the significant association between educational level and awareness of smart toothbrushes, alongside the belief that digital dentistry represents the future, highlights the importance of academic exposure in shaping knowledge of advanced technology. Furthermore, the strong influence of gender on concerns regarding the sharing of dental records and challenges with smart devices highlights specific privacy and usability anxieties that require targeted attention from developers and practitioners to ensure equitable adoption.

The findings of our study align closely with previous research on teledentistry awareness, attitudes toward remote dental care, and the adoption of smart oral-hygiene devices. In the present survey, awareness of teledentistry was moderate, with nearly half of the participants reporting familiarity with the term but uncertainty regarding its meaning. This is consistent with studies such as Pradhan et al., which reported that 72–79% of dental students and professionals demonstrated satisfactory knowledge and positive attitudes toward teledentistry.[7] Similarly, an earlier study from Lin et al found that over 70% of postgraduate dental students believed that teledentistry could facilitate expert consultation and would likely become a future practice standard.[8] Our results, however, showed that awareness varied significantly by educational level, echoing findings from Akçiçek et al., where structured training programs led to significantly improved knowledge scores among dental students. This suggests that formal education and exposure play a key role in enhancing understanding of teledentistry.[9]

The importance of teledentistry's diverse applications including remote consultations, triaging, patient education, and specialist referrals has been emphasized in the literature. Khan et al highlighted these functions as central to increasing public awareness and improving the reach of dental services. Our findings similarly showed that participants primarily associated teledentistry with online dental consultations and saw clear advantages such as convenience and time-saving. This supports the broader consensus that teledentistry can strengthen preventive care and dental outreach.[10]

Regarding attitudes toward remote consultations, our study found generally favorable perceptions, with most respondents willing to consider virtual consultations either routinely or under specific circumstances such as emergencies. This mirrors global trends observed during and after the COVID-19 pandemic. Khamlich et al. reported increased acceptance of remote dental care as it allowed continuity of services while reducing physical contact, a sentiment echoed in our respondents' concerns about diagnostic accuracy and data security rather than rejection of the modality itself.[11] Likewise, Bhargava et al demonstrated that integrating telecommunication technologies in dental practice enhanced patient access and satisfaction benefits also reflected in our participants' recognition of teledentistry's convenience and accessibility for remote populations.[12]

Willingness to use smart oral-hygiene devices in our study revealed moderate acceptance: while awareness of such devices was limited, attitudes toward their potential benefits were positive. This pattern is widely supported by contemporary evidence. Shenoy et al. noted that adoption of smart toothbrushes and digital health devices increases with greater exposure to technology.[13] Choi et al. similarly reported that 85% of dentists, hygienists, and the public were willing to adopt or recommend smart toothbrushes, while a 2025

public survey showed 87% willingness to use smart toothbrushes although willingness to pay for professional monitoring was lower (approximately 39%). This discrepancy parallels our finding that many participants were open to using smart devices but expressed concerns regarding cost, maintenance, and technical complexity.[14]

Further support comes from intervention-based research. Studies by Kim et al. and Lee et al. demonstrated that smart toothbrush use improved brushing duration, frequency, and perceived oral health among adults and children. However, both studies found minimal willingness for long-term or paid use, reinforcing that while initial attitudes are positive, sustained adoption depends on affordability and perceived value concerns echoed in our study, where gender significantly influenced perceived challenges such as cost and maintenance.[15,16] Likewise, Song et al. found that individuals with developmental disabilities and their caregivers showed increased interest and improved oral-hygiene behaviors during smart toothbrush use, though awareness was initially low again consistent with our participants' limited prior exposure but positive response patterns.[17]

Finally, the belief in teledentistry's future expansion was notably stronger among participants with higher educational qualifications, mirroring findings from multiple studies suggesting that exposure to digital health education enhances acceptance of technology-driven dental care. Halima Sadia Hakim also reported that 66–74% of users believed teledentistry significantly aided consultations and management, reinforcing our finding that participants acknowledged the potential of remote services to enhance healthcare access and patient engagement. This reinforces the need for targeted educational initiatives and practical demonstrations to improve long-term adoption and integration of digital dental technologies.[18]

CONCLUSION

The study demonstrates that while awareness of teledentistry and smart oral-hygiene technologies is still developing, overall attitudes toward remote consultations and digital tools are largely positive. Participants showed strong acceptance of teledentistry's convenience and potential benefits, though concerns related to diagnostic accuracy, privacy, and technical issues remain. Awareness and perception were significantly influenced by educational level, and gender played a role in privacy and device-related concerns. Although willingness to adopt smart oral-hygiene devices was moderate, cost and long-term usability were key hesitations. Overall, the findings highlight the growing openness toward digital dentistry and highlight the need for enhanced education, accessibility, and affordability to support wider adoption.

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