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MOBILE HEALTH APPLICATIONS FOR ORAL HYGIENE PROMOTION AND DENTAL CARIES PREVENTION AMONG ADOLESCENTS AND YOUNG ADULTS: A NARRATIVE REVIEW

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ABSTRACT

Objectives: To review the current evidence on the effectiveness of mobile health (mHealth) applications in promoting oral hygiene and preventing dental caries among adolescents and young adults, with particular attention to behavioral outcomes, clinical effectiveness, app quality, and implementation challenges.
Methods: A narrative literature review was conducted using publications retrieved from PubMed, Scopus, and Google Scholar, supplemented by selected documents from the World Health Organization and the FDI World Dental Federation. Original studies, randomized controlled trials, systematic reviews, meta-analyses, scoping reviews, app quality assessments, and policy documents published between 2007 and 2026 were included. The evidence was synthesized using a qualitative thematic approach.
Key Findings: Current evidence suggests that mHealth applications may improve oral health knowledge, attitudes, self-efficacy, toothbrushing behaviors, and short-term clinical outcomes, particularly plaque and gingival indices. The strongest evidence is available for orthodontic patients using fixed appliances. However, evidence supporting sustained reductions in dental caries remains limited. Studies also highlight considerable variability in the quality of commercially available applications, with many lacking evidence-based content or clinical validation. Additional challenges include data protection, regulatory requirements, digital equity, and integration into routine dental care.
Conclusions: mHealth applications represent promising adjunctive tools for oral hygiene promotion among adolescents and young adults. Although they may enhance preventive behaviors and short-term oral health outcomes, they should complement rather than replace conventional preventive dentistry. Further high-quality longitudinal studies, rigorous clinical validation, and improved quality standards are needed to establish their long-term effectiveness and facilitate their safe implementation in dental practice.

KEYWORDS

Mobile Health, mHealth, Mobile Applications, Smartphone Apps, Oral Hygiene, Dental Caries Prevention, Adolescents, Young Adults, Digital Oral Health, Teledentistry

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Introduction

Oral diseases are among the most common noncommunicable diseases worldwide and continue to be a substantial public health burden, affecting approximately 3.5 billion people globally [1]. Dental caries and periodontal diseases are mostly preventable, yet they remain important problems, particularly in socially and economically disadvantaged populations [2]. Adolescence and early adulthood are especially relevant periods for oral health promotion, as health behaviors and beliefs formed during this stage can influence oral health later in life [3,4]. Young people also gain increasing autonomy and gradually develop the ability to make their own decisions, including those concerning diet and oral hygiene [4]. Frequent intake of free sugars is an important risk factor for dental caries; therefore, the World Health Organization recommends limiting free sugar consumption in both children and adults [5,6]. In addition, fixed orthodontic appliances can make oral hygiene more difficult, promote plaque accumulation, and increase the risk of gingival inflammation and enamel demineralization in the form of white spot lesions [7,8]. Effective strategies to improve hygiene practices and prevent dental caries in adolescents and young adults are therefore important from both clinical and public health perspectives.

Traditional dental health education is usually delivered in clinical, school, or community settings and can include oral hygiene instruction, dietary counseling, and educational programs [9,10]. Although educational interventions can improve short-term hygiene habits, available evidence suggests that such changes do not always translate into long-term reductions in dental caries [11]. Oral hygiene is a repetitive self-care behavior that depends on self-control. Its maintenance requires not only awareness, motivation, self-efficacy, planning, and self-regulation [12,13], but also reminders, feedback, self-monitoring, and sustained engagement over time [13,14]. For this reason, interest has grown in digital health and mHealth solutions that may support preventive behaviors and complement conventional forms of dental education and care [9,15,16]. Mobile health, or mHealth, refers to the use of mobile and wireless technologies, including mobile phones, portable devices, text messages, applications, and monitoring tools, to support health services, health information, and health-related behaviors [15,16]. In dentistry, these tools are increasingly being studied and used in dental caries prevention and patient education [9,17,18], as well as to improve orthodontic patient compliance and monitor gingival health [19,20].

mHealth interventions may be particularly relevant for adolescents and young adults because health behaviors are still being shaped during this period, autonomy is increasing, and mobile technologies can be used to support health education and preventive practices [4,15,16]. Smartphone apps may complement conventional oral hygiene instruction by providing repeated, interactive, and more personalized support for health-related behaviors [13,18,21]. These tools can deliver tailored reminders, visual brushing instructions, goal-setting features, self-monitoring functions, motivational messages, and feedback [13,21]. For younger users, app-based interventions may be more engaging than a single educational session, as they allow educational content to be repeated and preventive practices to be reinforced over time [12,22]. Among orthodontic patients, mobile apps, text messages, and social media-based interventions have been investigated as tools supporting oral hygiene during fixed appliance treatment [19,23–25].

Current evidence indicates that mobile applications and related digital interventions can improve short-term dental hygiene and selected clinical indicators, particularly plaque and gingival indices [17–19]. Several randomized clinical trials in patients with fixed orthodontic appliances have reported beneficial effects of apps, automated text messages, and WhatsApp-based reminders on plaque control, gingival health, and adherence to hygiene recommendations [23–28]. Similarly, systematic and scoping reviews show that mHealth interventions can improve hygiene knowledge, selected dental behaviors, and intermediate plaque indices and gingival health measures [17–19,29]. However, the strength of this evidence varies [17–19,29–31]. Available studies and reviews point to several limitations, including small sample sizes, short follow-up periods, heterogeneity of interventions, declining user engagement over time, reliance on self-reported habits, and the frequent use of intermediate outcomes rather than long-term disease endpoints [11,17–19,29–31].

Findings are less consistent when digital interventions are assessed in terms of long-term dental caries prevention [9,11], rather than short-term changes in hygiene practices or intermediate clinical indicators [17,19]. Although many apps target routines relevant to caries prevention, for example toothbrushing with fluoride toothpaste and reducing sugar intake [6,9], data on their direct and sustained effect on caries reduction remain limited [9,11]. For example, the BRIGHT trial showed a short-term improvement in toothbrushing frequency but did not demonstrate a significant reduction in dental caries over longer follow-up [11]. Caries risk depends on multiple social, dietary, biological, and environmental factors, including fluoride exposure, saliva composition and flow, bacterial biofilm, sugar intake, and hygiene habits [5,6,32].

The quality of commercially available oral health apps remains a separate concern [9,33–35]. App store analyses and quality assessments using tools such as the Mobile Application Rating Scale have shown that many apps designed for oral hygiene and dental caries prevention are of only moderate or low quality, with limited evidence-based content, insufficient use of behavior change theory, and variable usability [9,33–36]. Some contain incomplete, unvalidated, or insufficiently verified information, and many have not been clinically evaluated [9,33–37]. For this reason, findings from controlled studies of specially designed interventions should not be automatically generalized to the wider market of consumer dental apps [9,33,35]. Availability in app stores does not guarantee clinical usefulness, scientific credibility, or safety, particularly when its content, effectiveness, data protection standards, and regulatory compliance have not been adequately assessed [35,38,39].

The implementation of mHealth in oral health promotion also requires attention to broader public health, ethical, and regulatory issues [16,38,39]. Documents from the World Health Organization and the FDI World Dental Federation state that digital technologies may support oral health promotion, health literacy, workforce training, data collection, quality monitoring, and access to care [16,40–42]. Effective implementation also depends on data protection, interoperability, professional accountability, digital competencies, equitable access to devices and the internet, and integration with existing health systems [16,39,43]. Without careful design and attention to digital equity, digital tools in dentistry may fail to reach those who need them most or may even reinforce existing health inequalities [40,41,43].

The growing use of mHealth tools in dentistry has created a need to synthesize evidence across clinical, behavioral, technological, and public health domains [9,17–19,33,34]. Previous reviews and analyses have addressed mobile apps for oral health promotion, orthodontic patient compliance, app quality, and the implementation of digital solutions in dentistry [9,17–19,33–37,39,43]. However, the evidence remains fragmented across different populations, intervention types, and outcomes [9,17–19,29]. It is particularly important to distinguish between short-term improvements in hygiene practices and clinical indicators [17,19] and long-term caries prevention measured through disease-related outcomes [9,11]. App quality, usability, content reliability, legal and ethical issues, and public health implications also need to be considered, rather than only availability or technological appeal [33–39,43].

This narrative review examines the role of mHealth applications in oral hygiene promotion and dental caries prevention among adolescents and young adults. It focuses on clinical effectiveness, behavioral mechanisms, orthodontic and non-orthodontic applications, app quality, and challenges related to implementation, privacy, and health equity. Drawing on randomized clinical trials, systematic and scoping reviews, app quality assessments, and strategic documents, the review discusses the current potential and limitations of mHealth applications as adjunctive tools in preventive dentistry.

Methodology

This narrative review was based on full-text scientific publications identified through searches of PubMed, Scopus, and Google Scholar, supplemented by selected documents from the World Health Organization and the FDI World Dental Federation. Search terms included mobile health, mHealth, mobile applications, smartphone apps, oral hygiene, dental caries prevention, adolescents, young adults, digital oral health, and teledentistry, combined with the Boolean operators AND and OR.

The review included publications from 2007 to 2026. Sources were selected through title and abstract screening, followed by full-text evaluation. Inclusion criteria covered original studies, randomized controlled trials, systematic reviews, meta-analyses, scoping reviews, app quality evaluations, and policy or implementation documents addressing the use of mobile applications and other digital interventions in oral hygiene promotion, dental caries prevention, orthodontic oral hygiene, or digital oral health implementation.

Information from the included sources was extracted descriptively and organized into thematic categories reflecting the clinical, behavioral, technological, and public health aspects of mHealth applications in oral hygiene promotion and dental caries prevention.

Results

Types and functions of mHealth interventions

The mHealth interventions included in the reviewed literature comprised standalone mobile applications, SMS messages, automated reminders, WhatsApp communication, social media-based interventions, and remote self-monitoring tools [14,19,20,23–31]. Their reported functions included oral hygiene education, visual toothbrushing instructions, reminders supporting daily preventive behaviors, goal setting, self-monitoring, motivational messages, and feedback [13,20,21]. In interventions aimed at dental caries prevention, the main components addressed toothbrushing, fluoride toothpaste use, reduced sugar intake, education, and self-monitoring of preventive practices [9,11,13,14]. Among orthodontic patients, digital tools were most often assessed as support for plaque control, gingival health, and adherence to oral hygiene recommendations during fixed appliance treatment [19,23–28,30,31]. Some interventions were relatively simple and relied mainly on reminders or text messages, whereas others included more complex elements, such as multimedia materials, behavior change techniques, photo sharing, professional monitoring, or feedback from the dental team [13,14,20,21,23–25,31].

Behavioral outcomes: oral hygiene, knowledge, and self-efficacy

The behavioral outcomes assessed in the reviewed studies mainly included toothbrushing frequency, oral health knowledge, attitudes, self-efficacy, and self-reported hygiene practices. Schluter et al. reported that a motivational SMS intervention among young adults aged 18–24 years was associated with an increase in the proportion of participants brushing their teeth at least twice daily, from 51% at baseline to 73–74% after 6–9 weeks [14]. Rahaei et al. found that the educational app “My Tooth” led to greater improvements in knowledge, attitudes, and hygiene practices than a traditional lecture and demonstration [22]. Similarly, Marashi et al., using an application based on self-efficacy theory, reported improved mean scores for awareness, attitudes, self-efficacy, and oral health-related behaviors among adolescents [12]. In the prototype study of ToothSense, the app was evaluated in terms of usability, user ratings, and its potential as an oral health promotion tool incorporating education, monitoring, and feedback [21]. In the large school-based BRIGHT trial, classroom-based education combined with twice-daily text messages was associated with improved self-reported toothbrushing frequency after 6 months; however, this behavioral effect was not sustained at the final 2.5-year follow-up [11]. Scoping reviews generally indicated the potential of mobile applications to improve oral hygiene knowledge, skills, and behaviors, particularly among adolescents, while also emphasizing variation in interventions, populations, and outcome measures [18,29].

Clinical outcomes: plaque and gingival health

Clinical outcomes in the reviewed studies mainly included plaque indices, gingival inflammation, gingival bleeding, and overall oral hygiene measures. In the systematic review and meta-analysis by Toniazzo et al., mHealth interventions, including mobile applications and SMS messages, were associated with significant improvements in plaque and gingival bleeding indices compared with conventional oral hygiene instructions [17]. The scoping review by Väyrynen et al. similarly found that some randomized clinical trials of oral health apps reported plaque reduction and improved gingival status [18]. Overall, the available reviews focused mainly on short-term or intermediate indicators, such as plaque, gingival bleeding, and gingival health, whereas long-term disease endpoints were assessed much less frequently [17–19].

Orthodontic applications of dental mHealth

Patients treated with fixed orthodontic appliances represented one of the main groups studied in the context of dental mHealth. In this population, researchers evaluated mobile applications, automated text messages, WhatsApp reminders, social media-based communication, and tools enabling photo sharing and oral hygiene self-monitoring [19,23–28,30,31]. In the study by Zotti et al., an app-based intervention using WhatsApp communication, competitive elements, and photo sharing to document oral hygiene was associated with lower plaque and gingival indices, as well as fewer new white spot lesions and carious lesions, compared with the control group [23].

Alkadhi et al. showed that an app providing active reminders three times daily was associated with a significant reduction in plaque and gingival indices after 4 weeks [24]. Ross et al. reported better hygiene-related outcomes among adolescents receiving daily automated messages compared with weekly messages, including improvements in plaque, gingival inflammation, and gingival bleeding indices [25]. Improvements in selected oral hygiene measures were also observed in studies using the Brush DJ application, while WhatsApp-based reminder programs were assessed as another form of hygiene support for orthodontic patients [26–28]. However, the findings were not uniform. In the multicenter study by Deleuse et al., no overall significant advantage was found for an app-connected toothbrush compared with an electric toothbrush without

app-based features. In the study by Saxena and Gunjal, WhatsApp or email reminders did not lead to significant between-group differences in plaque assessment after 8 weeks [30,31]. The systematic review and meta-analysis by Al-Moghrabi et al. indicated favorable but limited and heterogeneous effects of mobile applications and social media-based interventions in orthodontic patients, particularly for plaque and gingival health indices. No significant effect was found for bleeding on probing, and the data on oral hygiene knowledge and behaviors were less conclusive [19].

Dental caries prevention and long-term outcomes

In studies and analyses addressing dental caries prevention, mHealth interventions and mobile applications mainly focused on daily oral hygiene behaviors, especially toothbrushing, as well as health education, SMS or app-based reminders, self-monitoring, and, in some applications, fluoride use and dietary modification [9,13,14]. In the review by Chen et al., apps in this area primarily included components related to oral hygiene, fluoride use, and diet modification, but the analysis focused on their scope, functions, availability, and quality rather than direct clinical effectiveness [9]. The WhiteTeeth app was developed as an intervention supporting oral health behaviors among adolescents with fixed orthodontic appliances, but the publication describing its development did not report clinical effectiveness outcomes [13]. The BRIGHT trial provided important long-term evidence: a school-based behavioral intervention combined with text messages was associated with short-term improvement in toothbrushing frequency but did not show a significant reduction in dental caries after 2.5 years [11]. Overall, the available evidence on mHealth for caries prevention more often concerns preventive behaviors, app functions, and intermediate oral hygiene indicators than direct, long-term caries outcomes [9,11,14].

App quality, usability, and evidence base

Assessments of publicly available oral health apps have reported variable standards, usability limitations, and weak theoretical and empirical foundations in many tools. In the study by Tiffany et al., which included 33 English-language oral health promotion apps for adults, the apps as a group were rated as low quality, with substantial usability problems, no demonstrated empirical validation, and no stated theoretical basis for their content [33]. Sharif and Alkadhimi, using the Mobile Application Rating Scale and an assessment of educational content, found moderate overall quality among patient-focused oral hygiene apps, with lower scores for information quality and frequent absence of complete, guideline-consistent content on dental caries and periodontal disease prevention [34].

In the review by Chen et al., apps targeting dental caries prevention often included content on oral hygiene, fluoride use, and diet, yet many did not meet high-quality criteria [9]. Similar limitations were reported in more recent app quality evaluations, which described suboptimal or variable quality, limited inclusion of evidence-based content, and an insufficient number of clinical studies confirming real-world effectiveness [35–37]. In studies of apps for children, and partly also adolescents, some tools achieved moderate quality scores; however, these assessments mainly concerned content, usability, information quality, or potential influence on knowledge, attitudes, and behaviors, rather than direct clinical outcomes [36,37]. Overall, these analyses indicated that availability in digital app stores was not equivalent to confirmed clinical effectiveness, reliable information, or clinical validation of the app itself [9,33–37].

Implementation, privacy, regulation, and equity

Sources addressing mHealth and digital oral health implementation mainly included strategic documents, statements from international organizations, and studies on system-level barriers. The WHO/ITU guide presented mobile technologies as tools that may be used in oral health promotion, patient education, workforce training, detection of health problems, data collection, and quality monitoring [16]. Documents from the FDI World Dental Federation on dental apps, teledentistry, and digital dentistry emphasized ethical and responsible design, regulatory compliance, privacy and data security, evidence-based practice, and the need to align digital solutions with patient needs and safety [38,41,42]. In the scoping review by Mariño and Zaror, the most frequently discussed legal issues in digital oral health included data security, professional liability, informed consent, confidentiality, and jurisdiction [39]. Emami et al., in a study on the global implementation of digital oral health, identified barriers related to funding, interoperability, access to equipment and connectivity, workforce preparedness, and organizational and health system readiness [43]. These sources indicate that the effectiveness and safety of digital tool implementation depend not only on the technology itself, but also on infrastructure, regulation, data protection, workforce preparation, and equitable access to devices and the internet [16,39–43].

Discussion

The findings of this review indicate that mHealth applications may support oral hygiene promotion in adolescents and young adults, but their role should be interpreted as adjunctive and context-dependent. The most consistent evidence concerns short-term improvements in hygiene behaviors and intermediate clinical indicators, whereas evidence for sustained caries prevention remains limited [9,11,12,14,17–19,22,29].

From a behavioral perspective, one important value of mobile applications lies in extending oral health education beyond a single dental visit. Because oral hygiene requires repeated self-care, reminders, feedback, self-monitoring, and reinforcement may help maintain preventive routines in everyday settings [13,14,21]. This may be particularly relevant in adolescence and early adulthood, when health behaviors are still being shaped, and oral health beliefs may influence later outcomes [3,4].

The relatively stronger evidence in orthodontic patients may reflect the clinical relevance and short-term measurability of plaque accumulation, gingival inflammation, and white spot lesions during fixed appliance treatment [7,8,19]. However, findings across individual trials were not fully consistent, suggesting that the effectiveness of digital support depends on intervention design, user engagement, and follow-up duration [19,23–26,28,30,31]. In orthodontics, mHealth should therefore be regarded as an adjunct to patient education and compliance support rather than as a standalone solution for insufficient oral hygiene [19,30,31].

This distinction is particularly important in dental caries prevention. Although many apps target behaviors relevant to caries prevention, evidence for a direct and sustained reduction in caries incidence remains limited [6,9,11,13,14]. The BRIGHT trial illustrates this gap, showing that short-term improvement in self-reported toothbrushing frequency does not necessarily translate into measurable caries reduction over longer follow-up, particularly given the multifactorial nature of dental caries [5,6,11,32].

A further concern is the gap between research-specific tools evaluated in controlled studies and apps available in commercial stores. Positive findings from individual interventions should not be generalized to the broader app market, where quality, usability, evidence-based content, and clinical validation remain inconsistent [9,13,20,21,33–37].

From a clinical perspective, mHealth applications may be useful as part of a broader preventive strategy. They can support hygiene instruction, remind users to brush, reinforce motivation, facilitate self-monitoring, and help maintain contact with patients between visits [13,14,20,21,41]. However, they should not replace individual caries risk assessment, professional education, plaque control, fluoride-based prevention, dietary counseling, or regular dental care [9,34,38,41,42]. The most reasonable approach is to treat apps as supportive tools whose effectiveness depends on content quality, alignment with patient needs, ease of use, and integration with care delivered by dental professionals [33–38,41,42].

Implementation also raises ethical, legal, and public health challenges. Safe and effective use of mHealth requires data protection, regulatory compliance, interoperability, workforce preparation, appropriate user information, and equitable access to devices and internet connectivity [16,38–43]. Without these conditions, digital tools may fail to reach those most in need or may reinforce existing health inequalities [40,41,43].

The limitations of the available evidence should also be considered. Many studies had short follow-up periods, small samples, heterogeneous interventions, and varied endpoints, which makes direct comparison difficult and limits the strength of conclusions [17–19,29]. The findings of Deleuse and of Saxena and Gunjal further show that the effects of digital interventions are not consistent across study designs [30,31]. Some studies relied on self-reported behaviors, such as toothbrushing frequency [11,14], and many interventions were tested in specific populations, particularly orthodontic patients [17,19,23–31]. A further limitation of the present review is its narrative design, which allows broad integration of different source types but does not provide a quantitative estimate of effect size or a formal assessment of certainty of evidence.

Future research should include larger samples, longer follow-up, and clearly defined endpoints [17–19,29]. Future studies should assess not only knowledge, attitudes, self-efficacy, and self-reported behaviors, but also objective clinical indicators such as plaque, gingival bleeding, white spot lesions, and caries increment [11,17–19,29]. Further app development should be grounded in behavior change theory, current preventive guidelines, usability testing, clinical validation, and appropriate data protection standards [9,13,33–39].

In summary, mHealth applications may support oral hygiene promotion and preventive practices in adolescents and young adults. Their best-documented effects concern short-term improvements in hygiene behaviors, oral health knowledge, attitudes, self-efficacy, and plaque and gingival health indices, particularly among orthodontic patients [12,14,17–19,22–29]. Evidence for sustained caries reduction remains limited, and app effectiveness depends on design quality, user engagement, scientific content, integration with dental care, and implementation conditions [9,11,33–43]. In practice, mHealth should be viewed as an adjunct to, rather than a replacement for, professional dental prevention [9,38,41,42].

Conclusions

Mobile applications and other mHealth interventions may support oral hygiene promotion and preventive practices in adolescents and young adults, particularly as adjuncts to conventional dental education and care. Their current role appears strongest in supporting short-term hygiene behaviors and intermediate clinical indicators, especially among patients with fixed orthodontic appliances. Evidence for sustained caries reduction remains limited, and the quality of commercially available apps is variable. Further clinical validation, quality standards, data protection, and equitable access are needed to support the safe and effective use of mHealth in preventive dentistry.

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