THE JOURNAL OF PROSTHETIC DENTISTRY

CLINICAL RESEARCH

Impact of WhatsApp on improving denture care knowledge and the awareness of the relationship between edentulism and general health

Wan Nor Hayati Wan Abd. Manan, DDS, MClinDent, MPros,[a] Dayang Nur Sharin Abg. Abd. Mohd Rizal, BDS,[b] Farah Wajihah Borhan, BDS,[c] Widya Lestari, DDS, MDSc, PhD,[d] Azlini Ismail, B. Biotech. PhD,[e] Muhd Firdaus Che Musa, BDS, DDPHRCS, MCOH, PhD,[f] Mohamad Shafiq Mohd Ibrahim, BSc, MSc, PhD,[g] Judy Chia-Chun Yuan, DDS, MS, MAS,[h] and Cortino Sukotjo, DDS, PhD, MMSc, MHPE[i]

ABSTRACT

Statement of problem. Denture wearers are susceptible to diseases related to denture hygiene and are more prone to develop systemic disease because of poor understanding and awareness of the impact of edentulism on general health.

Purpose. The purpose of this clinical study was to evaluate the effectiveness of traditional chairside practice and WhatsApp in improving patient knowledge of denture care and their awareness of the impact of edentulism on general health.

Material and methods. Sixty-two participants who attended the Polyclinic Kulliyyah of Dentistry, IIUM Kuantan in 2022 for removable prosthesis fabrication were recruited. The participants were randomized into 2 groups: control (traditional chairside) and intervention (WhatsApp) group. Video intervention was sent via WhatsApp to the participants. Pretreatment and posttreatment questionnaires were distributed from March to September 2022 to survey their sociodemographic data, knowledge of denture care, and awareness of the effect of edentulism on general health. Data were obtained and checked for normality using the Shapiro-Wilk test. Data were analyzed using the Mann-Whitney U and Wilcoxon-Paired Signed-Rank tests (α=.05).

Results. Eighty-two percent of participants favored WhatsApp as a tool for receiving information and used it daily (66.1%). The level of overall knowledge and awareness increased in groups after denture insertion instruction. Participants' knowledge of denture care (P=.001) and awareness of the effect of edentulism on general health (P=.001) improved significantly in the WhatsApp intervention group compared with the control group.

Conclusions. WhatsApp can be used as an alternative tool for improving denture care knowledge among denture wearers; increased awareness was observed with WhatsApp compared with the traditional chairside approach. (J Prosthet Dent 2025;133:1560-1568)

The explosion of social media platforms, including Facebook, YouTube, Instagram, and WhatsApp, has allowed vast amounts of information to be shared with subscribers anytime and anywhere.[1] The potential for using social media to disseminate oral healthcare education is enormous,[2] as it transmits vast and current information and promotes user engagement and interaction.[3]

Recent statistics for Malaysian mobile device users have indicated the increased penetration rate, internet subscription, and usage of mobile apps and social media.[4] In January 2024, about 83.1.5% of the Malaysian population were active social media users, a 4.6% increase from 2023.[4] Over 98%

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.
[a]Assistant Professor, Prosthodontics Department, Kulliyyah of Dentistry, International Islamic University Malaysia, Kuantan, Pahang, Malaysia.
[b]Private practice, Kuantan, Pahang, Malaysia.
[c]Private practice, Kuantan, Pahang, Malaysia.
[d]Associate Professor, Fundamental Dental and Medical Sciences Department, Kulliyyah of Dentistry, International Islamic University Malaysia, Kuantan, Pahang, Malaysia.
[e]Associate Professor, Fundamental Dental and Medical Sciences Department, Kulliyyah of Dentistry, International Islamic University Malaysia, Kuantan, Pahang, Malaysia.
[f]Assistant Professor, Paediatric Dentistry and Dental Public Health Department, Kulliyyah of Dentistry, International Islamic University Malaysia, Kuantan, Pahang, Malaysia.
[g]Assistant Professor, Paediatric Dentistry and Dental Public Health Department, Kulliyyah of Dentistry, International Islamic University Malaysia, Kuantan, Pahang, Malaysia.
[h]Professor and Associate Dean for Clinical Affairs, Department of Restorative Dentistry, College of Dentistry, University of Illinois, Chicago, Chicago, Ill.
[i]Professor and Chair, Department of Prosthodontics, School of Dental Medicine, Pittsburgh, PA.

Clinical Implications

Social media can disseminate information and educational resources, as it streamlines information sharing. WhatsApp can be an alternative to message-sharing and educational information-sharing on social media.

of consumers in Malaysia used mobile devices to connect to the internet,[5] with WhatsApp (WhatsApp Inc; Facebook Inc) being the preferred social media communication platform among users.[5] WhatsApp is a free instant messaging platform that allows users to connect and communicate with each other, requiring only a mobile device with internet connection.[6] Among users, it is popular for sharing various types of information, such as images, videos, audio, and precise locations, in a secure manner.[7] The use of WhatsApp allows for easier, more rapid communication and individual or group discussions that facilitate learning.[8] WhatsApp has also been reported to be much more efficient in terms of response times than e-mail correspondence.[9]

The use of WhatsApp has increased for e-medicine in interprofessional and doctor-patient communication.[10] This highlights the educational benefits of using instant messaging, such as WhatsApp, as medical learning tools.[11] Using WhatsApp to improve knowledge and awareness and to monitor, support, and deliver home care is advantageous, especially in difficult-to-access communities where in-person communication may be limited. This includes rural areas, medium- to low-income populations,[12] and migrant and mobile populations[13] and helps reduce geographic barriers during consultations.[14] WhatsApp has been previously reported for use in teledentistry education and prevention programs for childhood caries patients, with scalability, cost-effectiveness, and patient empowerment for better self-dental care outcomes.[15] The implementation of WhatsApp messaging in parent-oriented strategies has also been successful at reaching socioeconomically vulnerable parents and changing risky behaviors in children to prevent early childhood caries.[16] WhatsApp has made a fundamental contribution to the remote diagnosis and management of oral and maxillofacial pathologies, especially during the COVID-19 pandemic.[17] Consultations in oral medicine and radiology[18] and oral hygiene care for orthodontics patients[19] have also been conducted via WhatsApp. However, studies reporting the use of WhatsApp in prosthodontics are sparse.

As of 2021, the Malaysian geriatric population over 65 years old was 3.60 million[20] with a prevalence of edentulism of 7%.[21] Malaysia is expected to be an aging nation, and 15% of its population will be at least 60 years old by the year 2030.[22] Consequently, the prevalence of edentulism is rising among the aging population in Malaysia.[23] A significant portion of the population, particularly those aged 35 to 44 (76.9%) and 60 to 70 (23.9%), have fewer than 20 functional teeth. Among those still with teeth, the average count remained at 24.5 between 2000 and 2010.[24] Reasons for tooth extraction include caries, periodontal disease, injury, infection, or dental treatments.[25–28] According to Malaysia's Ministry of Health 2020 data, approximately 16.3% of the population sought dental prosthetic solutions. This demand breaks down to about 8% for partial dentures and 5% for complete dentures.[29] Failure to replace missing teeth with prosthesis (removable prosthesis or implant-supported prosthesis) can significantly reduce quality of life, comparable with the impact of serious illnesses like cancer or kidney disease.[30] Addressing this edentulism is essential, as edentulous individuals are at higher risk of systemic disease and have elevated mortality rates.[31] Improving oral health literacy and raising awareness of edentulism and its related risks may result in better oral health outcomes, as awareness increases patient compliance and adherence to self-care instructions.[32] Although traditional means of improving literacy involve a face-to-face, chairside approach with personalized dentist-patient interaction to motivate and immediately apply the learned skills,[33] this study sought to utilize WhatsApp as a platform for imparting knowledge and raising awareness about edentulism. Hence, this study aimed to compare WhatsApp with the traditional chairside methods of delivering denture care knowledge and promoting an awareness of the relationship between edentulism and general health in removable denture wearers at the Polyclinic Kulliyyah of Dentistry, International Islamic University Malaysia (IIUM) Kuantan. The null hypotheses were that WhatsApp would not improve denture care knowledge and would not increase awareness of the link between edentulism and general health.

MATERIAL AND METHODS

Ethical approval (Ref. No: IREC 2022–014) was obtained from the IIUM Research Ethics Committee, and Figure 1 shows the overall flow of the study. The inclusion criteria for this study were partially or completely edentulous patients receiving removable prostheses at the Polyclinic Kulliyyah of Dentistry, IIUM Kuantan during the study period, those with no communication difficulties, those who understood Malay and English, and those using mobile phones and WhatsApp. The exclusion criteria for this study were those who did not complete the second questionnaire. A software program (Sample size calculator; Raosoft) was used to calculate that the minimum recommended sample size for this study was 62. This figure was based on the population

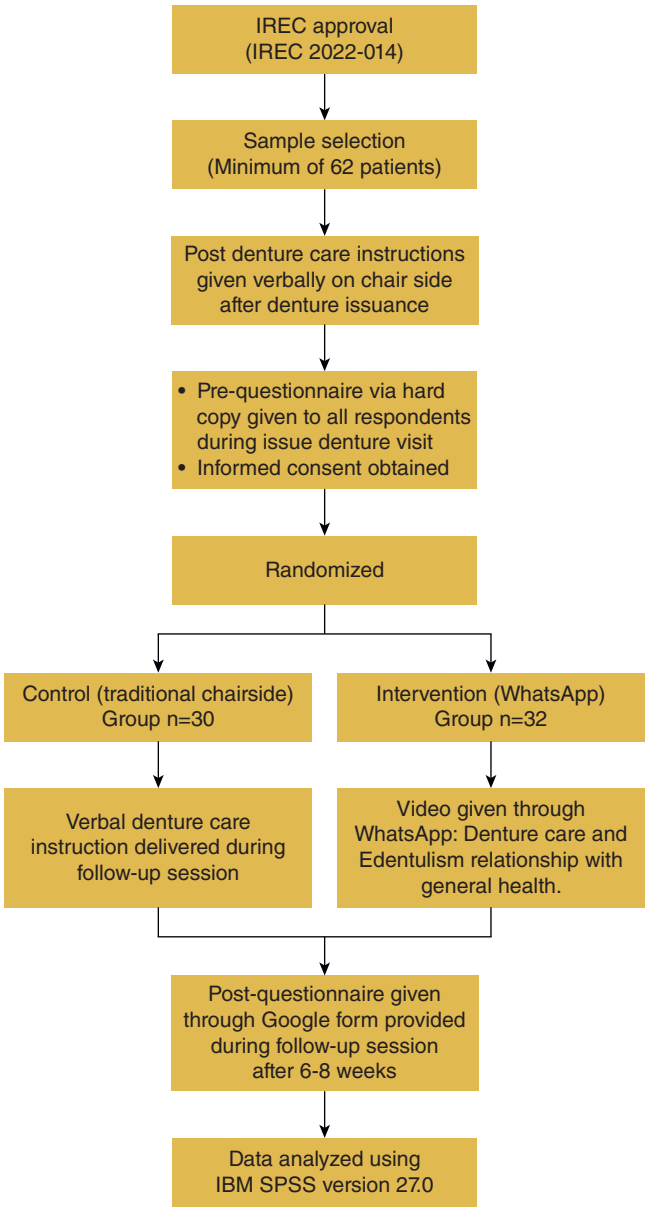

Figure 1. Flow of study.

size of denture wearers seen by dental students across all clinical years, with 95% confidence level and 5% acceptable margin of error.

The study was conducted through a self-administered questionnaire starting in March and completed in September, 2022. The modified validated questionnaire[34] was used to assess participants' knowledge of denture care and their awareness of the relationship between edentulism and general health. A pilot test was performed to assess the suitability of the questions and was reviewed by a panel of experts for its content, reliability, and validity. The questionnaire was written in Malay and English and consisted of 3 domains: sociodemographic background, knowledge of denture care, and awareness of the relationship between edentulism and general health. The knowledge and the awareness domain consisted of 7 and 5 questions, respectively. A 5-point Likert scale was used with the following response options: strongly disagree, disagree, not sure, agree, and strongly agree. The participants' past denture prostheses and WhatsApp experience were part of the questionnaire.

Each participant signed an informed consent form after a thorough explanation of the nature, risks, and benefits of the study. Following chairside denture insertion, all participants received verbal home care instructions on denture care and benefit and illustrated written standard denture care instruction (Fig. 2). The verbal home care instruction included a demonstration of the denture cleaning process and oral hygiene instructions. The instruction covered the frequency, material and methods needed to clean, maintain, and store the dentures. After receiving both the verbal and written instructions, participants were given a hard copy of the pretreatment questionnaire.

The participants were then randomized into 2 groups: control (traditional chairside) and intervention (WhatsApp). Simple random sampling or method of chances, in which each member of the population had an equal chance to be chosen as the sample, was applied.[35] Participants in both control and intervention groups received the same information. For the WhatsApp group, a series of instructional home denture care information videos which were made in-house (Fig. 3) were shared via WhatsApp and at weeks 1, 3, 5, and 7 after denture insertion and before the postinsertion questionnaires. At each respective week, participants received the following content: Week 1: Denture care (Part 1), Week 3: The relationship between edentulism with general health (Part 1), Week 5: Denture care (Part 2), and Week 7: The relationship between edentulism and general health (Part 2). The control group received instructions at the chairside on denture care in Week 1 and information on the relationship between edentulism and general health in Week 3. Participants were informed about the consequences of not following the home care instructions. During the follow-up sessions, participants' prostheses, oral health, and hygiene were assessed to evaluate compliance with the recommended hygiene and health measures. The posttreatment questionnaire was administered as either a hard copy or via a Google form (Google; Google LLC) within 6 to 8 weeks for the control and intervention groups.

Data were analyzed using a statistical software program (IBM SPSS Statistics, v27; IBM Corp). The Shapiro-Wilk test was used to assess the normality distribution of the data. The Wilcoxon Signed-Rank test was used to compare pre-intervention and post-intervention scores for each item in each domain of knowledge and level of awareness in each group. The

Figure 2. Written, illustrated standard instruction of denture care (Malay version).

Figure 3. A, Screenshot of infographic video for WhatsApp about denture care. Video available at https://youtu.be/ZBFv79biXx4. B, Screenshot of infographic video for WhatsApp on relationship between general health and edentulism. Video available at https://m.youtube.com/shorts/fTZBNIRAahg.

Table 1. Sociodemographic background of respondents (n=62)

Variables	Frequency n (Total=62)	%
Sex		
Male	29	46.8
Female	33	53.2
Age		
28–37	3	4.8
38–65	48	77.4
>65	11	17.7
Race		
Malay	60	96.8
Chinese	1	1.6
Indian	1	1.6
Residential Area		
Rural	20	32.3
Urban	42	67.7
Highest education level		
Primary school	8	12.9
Secondary school	33	53.2
Diploma	11	17.7
Bachelor	9	14.5
Postgraduate	1	1.6
Preferred method to receive oral hygiene education		
WhatsApp	51	82.3
Chairside traditional	11	17.7
Regularity using WhatsApp		
Daily use	41	66.1
Occasionally	17	27.4
Never	4	6.5
Type of intervention		
Control (traditional chairside)	30	48.4
Intervention (WhatsApp)	32	51.6
Type of removable prosthesis		
Partial denture	29	46.8
Complete denture	33	53.2

Mann-Whitney U test was used to compare level improvements between the 2 methods. Paired *t* tests compared the total scores for each domain of knowledge and level of awareness between pre- and postinterventions, whereas independent *t* tests were used to compare knowledge increments between the 2 groups (α=.05).

RESULTS

Sixty-two participants from the control group (traditional chairside, n=30) and the intervention group (WhatsApp, n=32) participated in the study (Table 1). The majority of participants (53.2%) were women, Malays (77.4%), and 38 to 65 years old (96.8%). Most participants lived in urban areas (67.7%) and were secondary school graduates (53.2%). The majority of participants used WhatsApp on a daily basis (66.1%) and preferred WhatsApp (82.3%) for receiving instructions on oral hygiene care. The majority of participants had complete denture treatment (53.2%) and had past denture experience (69.4%) (Table 1).

The WhatsApp delivery mode significantly enhanced participants' understanding that "dentures must be cleaned using a toothbrush and water" (*P*=.020), that "dentures should be removed during cleaning" (*P*=.019), and that "dentures need to be soaked in water" (*P*<.001) (Table 2). However, the traditional chairside group showed significantly greater improvement than the WhatsApp group (*P*<.001) in cleaning denture surfaces.

Both delivery modes significantly improved participants' knowledge that edentulism could affect general health (traditional chairside: *P*=.013; WhatsApp: *P*<.001), that edentulism and cardiovascular disease were closely associated (traditional chairside: *P*=.003; WhatsApp: *P*<.001), and that edentulism negatively affects the digestive system because of a reduced intake of fruits and vegetables (traditional chairside: *P*=.040; WhatsApp: *P*=.020) (Table 3). However, the WhatsApp group showed significant improvement compared with the traditional chairside group in the understanding of how "edentulism causes lower quality of life" (*P*<.001) and "edentulism causes jawbone resorption" (*P*=.009).

Overall, no difference was observed between the 2 groups, except for the understanding that "dentures need to be soaked in water" (*P*=.021), where significant improvement was observed in the WhatsApp group compared with the traditional chairside group (Table 4). Significant improvement in the awareness of how "edentulism causes lower quality of life" and "jawbone resorption" and of the close association between "edentulism and cardiovascular disease" was observed between the 2 groups (Table 5). Participants had better awareness of how "edentulism caused low quality of life" (*P*=.012) and "jawbone resorption" (*P*=.037) and of the "close association between edentulism and cardiovascular disease" (*P*<.001) in the WhatsApp group compared with the traditional approach cohort.

Significant improvement in comprehensive denture care knowledge (Table 6) was observed in the WhatsApp group

Table 2. Level of knowledge items (pre- and postintervention) on denture care within groups

	Traditional Chairside (Mean ±SD)			WhatsApp (Mean ±SD)		
	Pre	Post	*P*	Pre	Post	*P*
1. Denture must be cleaned using a toothbrush and water	2.73 ±1.31	3.00 ±0.95	.112	2.75 ±0.92	3.31 ±1.12	.020*
2. Denture should be removed during cleaning.	3.00 ±1.15	2.97 ±1.33	.936	2.97 ±1.12	3.50 ±0.80	.019*
3. Denture should be cleaned at least once daily.	3.00 ±0.87	3.13 ±0.78	.429	2.88 ±0.98	2.75 ±1.30	.680
4. All denture surfaces should be cleaned.	3.37 ±0.56	3.50 ±0.57	.046*	3.38 ±0.61	3.50 ±0.72	.197
5. Denture should be worn at all times except during sleep at night.	3.17 ±0.79	3.30 ±0.84	.380	3.16 ±0.85	3.44 ±0.91	.067
6. Denture needs to be soaked in water.	2.63 ±1.16	2.77 ±1.14	.477	2.56 ±0.91	3.19 ±0.64	<.001*
7. Denture should be kept inside a closed container.	2.20 ±1.24	2.27 ±1.17	.749	2.28 ±1.30	2.78 ±1.34	.085

*Significant at *P*<.05. *P* value represents the differences between pre-intervention score and postintervention score using Wilcoxon-Paired Signed-Rank test. SD, standard deviation.

Table 3. Level of awareness items (pre- and postintervention) within groups on relationship between general health with edentulism

	Traditional Chairside (Mean ±SD)			WhatsApp (Mean ±SD)		
	Pre	Post	P	Pre	Post	P
1. I am aware that edentulism could affect individuals' general health.	2.73 ±1.17	3.07 ±0.79	.013*	2.56 ±1.10	3.25 ±0.95	<.001*
2. Edentulism causes low quality of life.	3.23 ±0.77	3.37 ±0.62	.102	2.84 ±1.08	3.50 ±0.72	<.001*
3. Edentulism causes jawbone resorption.	2.67 ±0.92	2.80 ±0.93	.340	2.94 ±0.76	3.34 ±0.90	.009*
4. Edentulism is closely related to increase in risk of cardiovascular disease in individuals.	1.77 ±0.73	2.07 ±0.52	.003*	1.81 ±0.59	2.84 ±0.92	<.001*
5. Edentulism badly affects the digestion system of individuals due to reduced intake of fruits and vegetables.	3.03 ±1.10	3.27 ±0.79	.020*	3.22 ±0.66	3.56 ±0.67	.040*

*Significant at $P<.05$. *P* value represents the differences between pre-intervention score and postintervention score using Wilcoxon-Paired Signed-Rank test. SD, standard deviation.

Table 4. Comparison of level of improvement of denture care knowledge items between groups

	Traditional Chairside (Mean ±SD)	WhatsApp (Mean ±SD)	P
1. Denture must be cleaned using a toothbrush and water	0.27 ±0.87	0.56 ±1.19	.149
2. Denture should be removed during cleaning.	−0.03 ±1.54	0.53 ±1.22	.151
3. Denture should be cleaned at least once daily.	0.13 ±0.86	−0.12 ±1.45	.791
4. All denture surfaces should be cleaned.	0.13 ±0.35	0.12 ±0.79	.555
5. Denture should be worn at all times except during sleep at night.	0.13 ±0.78	0.28 ±0.81	.256
6. Denture needs to be soaked in water.	0.13 ±1.00	0.63 ±0.87	.021*
7. Denture should be kept inside a closed container.	0.07 ±1.23	0.50 ±1.57	.210

*Significant at $P<.05$. *P* value represents differences between traditional chairside and WhatsApp methods using Mann Whitney U test. SD, standard deviation.

Table 5. Comparison of level of improvement in level of awareness items between groups and on general health related to edentulism from both methods

	Traditional Chairside (Mean ±SD)	WhatsApp (Mean ±SD)	P
1. I am aware that edentulism could affect individuals' general health.	0.33 ±0.66	0.69 ±0.99	.134
2. Edentulism causes low quality of life.	0.13 ±0.43	0.66 ±1.00	.012*
3. Edentulism causes jawbone resorption.	0.13 ±0.73	0.41 ±0.13	.037*
4. Edentulism is closely related to increase in risk of cardiovascular disease in individuals.	0.30 ±0.47	1.03 ±0.86	<.001*
5. Edentulism badly affects the digestion system of individuals due to reduced intake of fruits and vegetables.	0.23 ±0.50	0.34 ±0.86	.390

*Significant at $P<.05$. *P* value represents the differences between traditional chairside and WhatsApp methods using Mann-Whitney U test. SD, standard deviation.

Table 6. Level of overall knowledge on denture care and awareness on relationship between general health and edentulism pre- and post-intervention within groups

	Traditional Chairside (Mean ±SD)			WhatsApp (Mean ±SD)		
	Pre	Post	P	Pre	Post	P
Knowledge	20.10 ±3.09	20.93 ±2.91	.065	19.97 ±2.95	22.47 ±2.78	<.001*
Awareness	13.43 ±3.23	14.57 ±2.48	<.001*	13.38 ±2.62	16.50 ±3.22	<.001*

*Significant at $P<.05$. *P* value represents the differences between pre-intervention score and postintervention score using paired *t* test. SD, standard deviation.

($P<.001$). Conversely, in total scores for the level of awareness of the relationship between edentulism and general health, significant improvement was observed in the WhatsApp ($P<.001$) and traditional chairside ($P<.001$) groups. However, scores for overall denture care knowledge and levels of awareness were significantly different between the 2 groups (Table 7). Overall, significantly improved knowledge ($P=.014$) and level of awareness ($P<.001$) were observed in the WhatsApp group compared with the traditional chairside group.

Table 7. Comparison of extent of improvement based on overall understanding of denture care and awareness of relationship between general health and edentulism between groups

	Traditional Chairside (Mean ±SD)	WhatsApp (Mean ±SD)	P
Knowledge	0.83 ±2.38	2.50 ±2.77	.014*
Awareness	1.13 ±1.67	3.12 ±2.76	<.001*

*Significant at $P<.05$. *P* value represents the differences between traditional chairside and WhatsApp methods using independent *t* test. SD, standard deviation.

DISCUSSION

The null hypotheses that WhatsApp would not improve denture care knowledge and would not increase awareness of the link between edentulism and general health were rejected, as WhatsApp was more effective than traditional chairside methods in delivering knowledge regarding denture care and increasing awareness of the relationship between edentulism and general health in denture wearers. Current trends indicate that social media are and will continue to be indispensable for communication and education because of its ease of creating, curating, and sharing user-generated content individually and collaboratively.[2]

This study examined the WhatsApp approach and reported it to be the preferred method among local participants because of its popularity, accessibility, and ability to spread health education to the community.[11] The educational benefits of using instant messaging such as WhatsApp and medical learning tools in the medical setting have been highlighted in this study.[11] WhatsApp eases communication by sharing documents, audio recordings, videos, and images, all of which are deemed beneficial for information and knowledge exchange.[36]

Video and animation have been used to deliver information to patients because they are effective.[8] Video-based learning can enhance learning because of its ability to assist with visualizing what may be difficult to explain in words,[37] thus increasing the knowledge and awareness of particular aspects of health. Its effectiveness was evident because of the direct delivery of information to respondents, further emphasizing the utility of WhatsApp over more public social media platforms.[33]

The simple operation scheme of WhatsApp makes it accessible to people of different ages and backgrounds.[8] WhatsApp is a message-sharing social media application and has been more commonly used in older age groups than Twitter or Instagram.[5] Individuals aged 40 and above have been reported to prefer using WhatsApp to communicate compared with other social media platforms.[5] The present study also found that 32.3% of participants reside in rural areas and are able to use WhatsApp for communication purposes. Using video on easily accessible social media such as WhatsApp can efficiently communicate health information and provide access to health information, particularly for individuals with low health literacy[38] and those living in rural areas.[12]

The authors are unaware of a previous study evaluating the use of WhatsApp as a tool for the delivery of edentulism knowledge and general oral health awareness. The findings revealed that participants' denture care knowledge and their awareness of the relationship between edentulism and general health significantly improved after intervention via WhatsApp compared with baseline knowledge. Participants with improved oral health knowledge after social media intervention has been reported.[39] Similarly, participants receiving verbal and written instructions had better denture cleanliness outcomes because of a higher level of knowledge than participants receiving verbal instructions alone.[40] Therefore, WhatsApp can effectively engage and influence patients in promoting dental hygiene practices when used as a complementary tool to the traditional chairside method. It is a suitable option for informative and entertaining patient education. WhatsApp messages provided an opportunity for the participants to clarify dialog with the healthcare provider when they received the information through the videos[8] and created bilateral communication between the participant and the healthcare provider.[19]

The majority of telemedicine services have been delivered via video calls, followed by instant messaging applications, including WhatsApp, Facebook Messenger, WeChat, and Telegram.[10] The present study showed that WhatsApp improved the delivery of knowledge to denture wearers. Participants receiving information from WhatsApp had better denture care knowledge, whereas awareness of the relationship between edentulism and general health significantly improved for the intervention group as compared with the control group. Thus, WhatsApp is a suitable option for disseminating oral care information to patients, as it is a more informative and entertaining educational tool.[13]

WhatsApp has gained popularity because of its straightforward use, wide application, and low expense. However, using WhatsApp in medicine and dentistry comes with some drawbacks, such as clinical risks that can affect patient care and outcomes. Additionally, there are significant privacy and security risks to patient data and accounts,[40] which could lead to unauthorized access and breaches of confidential information. Healthcare providers need to be cautious while using communication tools like WhatsApp in order to protect patient data confidentiality.

Limitations of the present study included that it was conducted within a limited time frame, which made it challenging to assess participants' compliance with home care instructions objectively. A longer duration may allow patients more time to process information and improve their compliance. Further, this study was only performed in 1 institution. Therefore, it may not be relevant in other institutions because of cultural and regional differences. WhatsApp technology and the method of communication in this study might not be suitable for the healthcare system in countries such as the United States. However, it could be beneficial in other regions, such as Asia and Africa. In developing

countries, WhatsApp could serve as a valuable tool for teledentistry, helping to address issues related to access to care.

Future research should explore innovative ways to optimize WhatsApp's impact on patient behavior, leading to better oral health outcomes. More educational videos that focus on proper denture care techniques and highlight their broader implications for overall health should be developed. The long-term impact on patient behavior of delivering oral health education via WhatsApp should also be investigated in the future.

CONCLUSIONS

Based on the findings of this clinical study, the following conclusions were drawn:

1. WhatsApp can be used as a tool to improve denture care knowledge and increase awareness of the relationship between edentulism and general health among denture wearers.
2. The significant increase in knowledge and awareness observed in the intervention group highlights the WhatsApp platform's potential as a valuable tool for patient education.

REFERENCES

1. Ortiz-Ospina, E. The Rise of Social Media. 2019. Available at: ⟨https://ourworldindata.org/rise-of-social-media⟩.
2. Chandra Bidyasagar Bal S, Dalai R. Social media as a tool in dental public health. *Indian J Forensic Med Toxicol*. 2020;14:8463.
3. Cinelli M, Peruzzi A, Schmidt AL, et al. Promoting engagement with quality communication in social media. In: Guidi B, editor. *PloS One,*. 17. 2022:e0275534.
4. Penetration rate of social media in Malaysia 2016–2024. 2024. Available at: ⟨https://www.statista.com/statistics/883712/malaysia-social-media-penetration/⟩. Accessed October 13, 2023.
5. Statista Research Department. 2024. Available at: ⟨https://www.statista.com/topics/6615/smartphones-in-malaysia/#topicOverview⟩. Accessed October 15, 2023.
6. Kant R. WhatsApp usage: Attitude and perceptions of college students. *Conflux. J Educ*. 2018;5:27–35.
7. WhatsApp. WhatsApp status URL: ⟨http://blog.whatsapp.com/⟩[WebCite Cache ID webwhatsappcom]. Accessed October 10, 2023.
8. Moe-Byrne T, Evans E, Benhebil N, Knapp P. The effectiveness of video animations as information tools for patients and the general public: A systematic review. *Front Digit Health*. 2022;4:1010779.
9. Poblete P, Nieto E. Does time matter? WhatsApp vs electronic mail for dental education. A pilot study. *Eur J Dent Educ*. 2020;24:121–125.
10. Su XV, Isnani S, Sharifah Khadijah WMS, et al. Perception of primary care doctors towards telemedicine in Kuching, Sarawak: A cross-sectional study. *Malays Fam Physician*. 2024;19:10.
11. Coleman E, O'Connor E. The role of WhatsApp in medical education; A scoping review and instructional design model. *BMC Med Educ*. 2019;19:279.
12. Gebbia V, Piazza D, Valerio MR, Firenze A. WhatsApp messenger use in oncology: A narrative review on pros and contras of a flexible and practical, non-specific communication tool. *Ecancermedicalscience*. 2021;15:1334.
13. Martins JCS, de Lima JB, Cartaxo RO, et al. Use of WhatsApp in dental education: A scoping review. *Med Sci Educ*. 2022;32:561–567.
14. Manji K, Hanefeld J, Vearey J, et al. Using WhatsApp messenger for health systems research: A scoping review of available literature. *Health Policy Plan*. 2021;36:594–605.
15. Aguirre PEA, Lotto M, Strieder AP, et al. The effectiveness of educational mobile messages for assisting in the prevention of early childhood caries: Protocol for a randomized controlled trial. *JMIR Res Protoc*. 2019;8:e13656.
16. Ribeiro YJS, Ferreira LG, Nelson-Filho P, et al. Influence of digital media in the oral health education of mother-child pairs: Study protocol of a parallel double-blind randomized clinical trial. *Trials*. 2022;23:639.
17. Petruzzi M, De Benedittis M. WhatsApp: A telemedicine platform for facilitating remote oral medicine consultation and improving clinical examinations. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2016;121:248–254.
18. Tamba B, Diatta M, Kounta A, et al. Whatsapp platform as a teledentistry tool in oral and maxillofacial pathologies in Senegal. *Adv Oral Maxillofac Surg*. 2021;3:100123.
19. Pubalan S, Zi Hong O, Yongxian T, Mabel L. Assessing effectiveness of WhatsApp messaging program in oral hygiene care for orthodontic patients: A randomised controlled trial. *J Orthod* 2024:14653125241230561.
20. Demographic statistics, Malaysia, Fourth quarter 2021, Department of Statistic Malaysia official portal 2021.
21. Oral Health Profile (Malaysia). [Internet]. 2022. ⟨https://cdn.who.int/media/docs/default-source/country-profiles/oral-health/oral-health-mys-2022-country-profile.pdf?sfvrsn=d3ec19b5_6download=true⟩. Accessed October 5, 2023.
22. Statista Research Department. 2023. ⟨https://www.statista.com/statistics/713529/malaysia-aging-population/⟩. Accessed October 5, 2023.
23. Tanti IR, Yoke MC, Rahimah AK, Tengku AAH. Association between oral health-related quality of life and nutritional status among older adults in district of Kuala Pilah, Malaysia. *BMC Public Health*. 2019;19:547.
24. Oral Health Division, Ministry of Health Malaysia. National Oral Health Survey of Adults 2010 (NOHSA 2010). Kuala Lumpur: Government printers,; 2013.
25. Muller A, Hussein K. Meta-analysis of teeth from European populations before and after the 18th century reveals a shift towards increased prevalence of caries and tooth loss. *Arch Oral Biol*. 2017;73:7–15.
26. Ong G, Yeo JF, Bhole S. A survey of reasons for extraction of permanent teeth in Singapore. *Community Dent Oral Epidemiol* 1996:24124–24127.
27. Richards W, Ameen J, Coll AM, Higgs G. Reasons for tooth extraction in four general dental practices in South Wales. *Br Dent J*. 2005;198:275–278.
28. Taiwo AO, Ibikunle AA, Braimah RO, et al. Tooth extraction: Pattern and etiology from extreme Northwestern Nigeria. *Eur J Dent*. 2017;11:335–339.
29. Fact Sheet National Health And Morbidity Survey (NHMS) 2020: Ministry Of Health Malaysia National Oral Health Survey Of Adults (NOHSA) 2020.
30. Mack F, Schwahn C, Feine JS, et al. The impact of tooth loss on general health related to quality of life among elderly Pomeranians: Results from the study of health in Pomerania (SHIP-O). *Int J Prosthodont*. 2005;18:414–419.
31. Emami E, de Souza RF, Kabawat M, Feine JS. The impact of edentulism on oral and general health. *Int J Dent*. 2013;2013:1–7.
32. Ju X, Jamieson LM, Mejia GC, Mittinty MN. Effect of oral health literacy on self-reported tooth loss: A multiple mediation analysis. *Community Dent Oral Epidemiol*. 2022;50:445–452.
33. Haridas R, S S, Ajagannanavar SL, Tikare, et al. Health literacy and oral health status among adults attending dental college hospital in India. *J Int Oral Health*. 2014;6:61–66.
34. Shankar T, Gowd S, Suresan V, et al. Denture hygiene knowledge and practices among complete denture wearers attending a postgraduate dental institute. *J Contemp Dent Pract*. 2017;18:714–721.
35. Shagofah N, Omid T, Jawad G. Simple random sampling. *Int J Educ Lang Studies*. 2022;1:78–82.
36. Lee CE, Chern HH, Azmir DA. WhatsApp use in a higher education learning environment: perspective of students of a Malaysian Private University on academic performance and team effectiveness. *Educ Sci*. 2023;13:244.
37. Navarrete E, Hoppe A, Ewerth R. A review on recent advances in video-based learning research: Video features, interaction, tools, and technologies. *CEUR Workshop Proceedings*. 2021;7:3052.
38. Dahdal S. Using the WhatsApp social media application for active learning. *J Educ Technol Syst*. 2020;49:239–249.
39. Aboalshamat K, Alharbi J, Alharthi S, et al. The effects of social media (Snapchat) interventions on the knowledge of oral health during pregnancy among pregnant women in Saudi Arabia. *PloS One*. 2023;18:e0281908.
40. Bahabri RH, Zaidan AB. The impact of social media on dental practice promotion and professionalism amongst general dental practitioners and specialists in KSA. *J Taibah Univ Med Sci*. 2021;16:456–460.

Corresponding author:
Dr Cortino Sukotjo
Department of Prosthodontics
School of Dental Medicine
3501 Terrace Street
Pittsburgh, PA 15261
Email: cos162@pitt.edu

Acknowledgments
The authors thank their dental colleagues who gave full commitment to allow short interviews with their patients during the clinical session. The authors offer special thanks to all of the respondents to this study.

CRediT authorship contribution statement

Wan Nor Hayati Wan Abd. Manan: Conceptualization, Methodology, Writing- original draft preparation, reviewing and editing, Supervision, Project administration. **Dayang Nur Sharin Abg. Abd. Mohd Rizal**: Methodology, Data collection, Data analysis, Writing- original draft preparation. **Farah Wajihah Borhan**: Methodology, Data collection, Data analysis, Writing- original draft preparation. **Widya Lestari**: Conceptualization, Methodology, Data analysis, Writing- reviewing and editing. **Azlini Ismail**: Conceptualization, Methodology, Data analysis, Writing- reviewing and editing. **Muhd Firdaus Che Musa**: Conceptualization, Methodology, Data analysis, Writing-reviewing and editing. **Mohamad Shafiq Mohd Ibrahim**: Data analysis, Writing- reviewing and editing. **Judy Yuan**: Data analysis, Writing-reviewing and editing. **Cortino Sukotjo**: Conceptualization, Methodology, Data analysis, Writing- reviewing and editing.

https://doi.org/10.1016/j.prosdent.2024.11.004