Smartphone application: a solution for the follow-up of patients with primary hip arthroplasty during COVID-19 pandemic

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Introduction
Since the appearance of coronavirus disease-2019, the challenge is how to follow the recommendations of the WHO, which stressed the importance of social distancing to avoid infection and at the same time provides satisfactory medical services. This study was conducted to evaluate the feasibility and efficacy of the WhatsApp social media program in the postoperative follow-up of patients with primary hip arthroplasty at the time of the pandemic.
Patients and methods
This is a prospective, randomized, comparative study carried out on 167 patients with primary hip arthroplasty. The follow-ups were delivered by a group on the WhatsApp program for all patients. Later on, a reassessment was done by a routine clinical visit. The authors recorded overall satisfaction and time consumption for each method. In addition, any missed clinical or radiological signs during the electronic method.
Results
The electronic visit recorded better satisfaction (96.35±3.21), and less time consumption (39.11±6.41) with no reported missed major clinical or radiological signs in comparison to the routine follow-up. Patients over 50 years, those with an educational level above high school, and patients with a travel distance greater than 100 km recorded statistically significant more satisfaction scores with an electronic visit in comparison to routine visits.
Conclusion
WhatsApp application could be an acceptable and satisfactory tool to follow-up patients with primary hip arthroplasty, and it could be a safe alternative to usual clinical visits at the time of the pandemic.

Keywords:
hip arthroplasty, patient's satisfaction, telemedicine, WhatsApp

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Introduction

Over the last decades, there have been an evolution in the methods of communication between people. With the expanded use of smartphones and the Internet with high speed, social media programs have replaced the traditional methods of communication [1,2]. Telemedicine is a term that appeared to express the transmission of medical information through these social programs [3].

In orthopedics, the technology of social media has been used many times to communicate and for the follow-up of patients in different subspecialties, for example, trauma, pediatric, and arthroplasty [4–6]. Marsh *et al*. [7] invented a method of follow-up after joint replacement based on patient feedback through voice messages by a healthcare system based on the Internet. Semple *et al*. [8] developed a mobile application for follow-up patients after breast reconstruction depending on photographs taken by the patients and a self-assessment questionnaire.

Since the appearance of coronavirus disease-2019 (COVID-19), all hospitals and healthcare givers across the world became worried about the safe way to care for their patients and to protect them from being infected. The challenge is how to follow the recommendations of WHO, which stressed on the importance of social distancing to avoid infection and at the same time provide a satisfactory medical service [9].

To avoid unnecessary attendance of patients and to decrease the burden on hospitals, we designed a group on WhatsApp application to follow-up patients with primary hip arthroplasty.

The aim is to evaluate the efficacy of electronic postoperative evaluation of those patients and

their satisfaction with this method of follow-up in comparison to routine visits at the time of pandemics.

Patients and methods

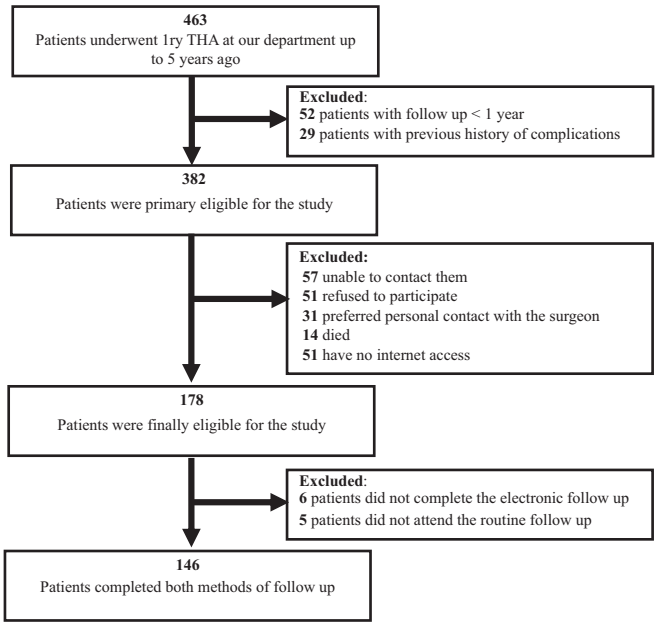
This is a prospective, randomized, comparative study (level of evidence I) carried out between April 2020 and November 2020. We reviewed all registered patients who underwent primary total hip arthroplasty (THA) at our department up to 4 years ago. Four hundred and sixty-three patients were recorded in our database.

Our inclusion criteria were any patients who went for primary THA at least 1 year ago, in addition to the familiarity of the patient or one close relative (e.g. son or daughter) with smartphone applications. We excluded patients who have no facility or experience with computers or the Internet and do not have a close relative to assist them and patients with any previous complications (e.g. infection, dislocation, and loosening).

After reviewing patients' files, we excluded 52 patients with a follow-up of less than 1 year and 29 patients with a previous history of complications. Three hundred and eighty-two patients were initially eligible for the study. We contacted them by telephone calls to ask them to be included in the study. We were unable to contact 57 patients, 51 refused, 31 preferred personal contacts with the surgeon, 14 patients died, and 51 patients did not have Internet access. One hundred and seventy-eight patients were finally eligible to be included in our research. Only 167 patients completed both electronic and routine follow-up and these were our final materials (Fig. 1). Patients' demographic data are summarized in Table 1.

We designed a group on WhatsApp for all patients included in the study. The questionnaires were sent to the group to be filled by the patients in addition to a request for routine radiographic follow-up. Also, we used the group to send an announcement, schedule of routine visits, and some instructions about how to answer the questionnaires. To keep the privacy of patients' information, every patient was asked to resend the file and radiographs to the surgeon's private account. We collected data received by all patients and reviewed them. If there was any serious complaint or major radiological finding we asked the patient for an immediate clinical visit. At 1 month later, we started to recall all patients for a routine follow-up visit (RV) and reevaluate them clinically and radiologically. We asked the patients to calculate the total time needed for completion of the questionnaires, and the time needed for x-ray and we added the time needed for reviewing

Figure 1



Flowchart of the study.

Table 1 Patients' demographic data

Demographic data	*n* (%)
Age (years)	
Up to 30	12 (7.19)
>30 to 50	56 (33.53)
>50 to 70	66 (39.52)
>70	33 (19.76)
Sex (male : female)	88:79 (52.69 : 47.31)
Postoperative time (years)	
Mean±SD	3.2 ± 1.68
Range	(1.1-5)
Social status	
Married	86 (51.50)
Divorced	15 (8.98)
Widowed	37 (22.16)
Single	29 (17.37)
Distance between the patient's city and the hospital (km)	
Up to 50	65 (38.92)
>50 to 100	41 (24.55)
>100 to 150	35 (20.96)
>150	26 (15.57)
Educational level	
None	17 (10.18)
Elementary	22 (13.17)
High school	38 (22.75)
College graduate	81 (48.50)
Postgraduate	9 (5.39)
Occupation	
None	19 (11.38)
Retired	32 (19.16)
Student	7 (4.19)
Housewife	31 (18.56)
Full-time employment	59 (35.33)
Part-time employment	19 (11.38)

these files. The same was done at the RV including the time of transportation. We obtained written consent from all of the participants after the discussion about the aim of the research and the confidentiality of their data.

All procedures performed in the study were following the ethical standards of our department and with the 1964 Helsinki Declaration and its later amendments.

We evaluated the effectiveness of the electronic visit (EV) by calculating the number of missing complications or signs detected at the time of RV and require any interference or close observation.

Patient's evaluation

Clinical evaluation

We sent a file containing the Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) [10], Short Form Health Survey Clinical care (SF12) [11], and Self-Administered Patient Satisfaction Scale [12]. These files were filled by the patients and resent back to a surgeon's private account to keep the privacy of information. We sometimes contacted the patients by a telephone call if there was a query about any item. As regards patient satisfaction, we asked the patients to rate their satisfaction on a scale from zero to 100 (100–75 very satisfied, <75–50 somewhat satisfied, <50–25 somewhat dissatisfied, and <25 dissatisfied). Those who were not satisfied are requested to explain the cause of dissatisfaction. We grouped patients who reported their answers as very or somewhat satisfied as satisfied and others who were somewhat or very dissatisfied as dissatisfied.

These questionnaires were repeated at the time of RV by a physician not aware of the results of the previous questionnaires filled by the patient.

Radiological evaluation

The radiological assessment included the accuracy of the position of the x-ray and proper alignment of the bony landmark in addition to the quality. The radiology included anteroposterior and lateral views with visualization of the entire prosthesis. The assessment included an apparent change in the position of the prosthesis or any signs of loosening. We used a cup abduction angle [13] to an evaluation of any changes in cup position. For a cementless stem, we depend on the scoring system applied by Engh *et al*. [14], and Gruen zones [15] were used for the evaluation of the cemented one. We considered any distal migration of more than 3 mm or change in cup position more than 3° as evidence of loosening.

A radiological assessment was done by an independent physician and his report was compared with the assessment done at the RV.

Statistical analysis

The data were statistically analyzed by SPSS V.16. Software, SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. Chicago, USA. Quantitative variables were expressed in the form of range, means, and SD. Categorical variables were expressed as count and percentage. Paired *t*-tests were used for comparison between quantitative variables and to compare patient satisfaction with independent variables. A *P*-value of less than 0.05 represents a significant relation.

Results

At the RVs, we did not record any missing major clinical or radiological data from the EV evaluation. Our results recorded that patients were more satisfied with EV than RV and this was statistically significant (P=0.041).

Patients who were dissatisfied with EV attributed this to problems with the Internet (five patients), inability to ask other questions out of the questionnaire sent (11 patients), and some patients reported that they were more trusted in direct personal contact with the surgeon (15 patients). No significant difference was found between WOMAC and SF12 completed by the patients at EVs and those filled by the surgeon during RVs. As regards time consumption, the EV recorded less time consumption in comparison to RV and this was statistically significant (P=0.038) (Table 2).

Table 2 Comparison between clinical and radiological results of both methods of follow-up

Results	E-visit (mean±SD)	R-visit (mean±SD)	*P* value
WOMAC	23.73±1.70	25.51±2.41	0.392
SF12			
Mental component	55.81±5.21	53.13±6.50	0.481
Physical component	48.11±9.58	46.71±7.61	0.277
Satisfaction score	96.3±3.21	82.4±5.21	0.041*
Time consumption (min)	39.1±6.41	61.6±8.93	0.038*
Missed major clinical or radiological data	0	0	-

SF12, Short Form Health Survey; WOMAC, Western Ontario McMaster Universities Osteoarthritis Index.
*Significant at P<0.05 using paired *t*-test.

Table 3 Patients' satisfaction scores of both methods of follow-up to sociodemographic data

Studied variable	E-visit (mean±SD)	Routine visit (mean±SD)	*P* value
Age groups (years)			
Up to 30	96.15±1.10	90.27±3.28	0.636
>30 to 50	92.41±2.65	89.13±2.17	0.416
>50 to 70	97.21±1.17	85.35±5.13	0.029*
>70	94.52±1.52	82.70±3.11	0.047*
Sex			
Male	93.67±2.41	88.49±1.32	0.731
Female	94.33±1.16	89.51±2.15	0.592
Social status			
Married	92.37±1.51	90.64±1.15	0.622
Divorced	89.52±4.52	87.17±2.14	0.642
Widowed	90.39±2.60	90.22±1.32	0.277
Single	92.11±3.57	90.22±1.24	0.538
Postoperative time (years)			
1–3	92.31±3.11	88.14±3.10	0.538
>3–5	90.90±2.81	91.17±1.47	0.661
Educational level			
None	93.15±1.17	88.15±3.18	0.352
Elementary	90.21±3.83	90.38±2.19	0.112
High school	92.57±2.61	89.11±1.79	0.638
College	94.27±2.72	83.86±3.11	0.035*
Postgraduate	92.41±3.13	80.31±3.18	0.047*
Occupation			
Non	91.16±2.70	90.31±2.41	0.441
Housewife	93.19±3.47	91.51±2.11	0.653
Retired	93.14±2.41	90.16±3.19	0.243
Student	94.30±2.33	90.52±3.38	0.481
Full-time work	92.40±2.27	90.41±2.59	0.538
Part-time work	93.26±2.47	89.41±4.63	0.625
Distance from the hospital (km)			
Up to 50	90.52±2.41	88.72±3.18	0.512
>50 to 100	90.11±4.17	87.41±2.26	0.651
>100 to 150	93.72±3.42	81.22±2.81	0.042*
>150	92.81±1.66	80.51±2.90	0.049*

*Significant at $P<0.05$ using paired *t*-test.

We studied the degree of satisfaction in patients' demographic data. We found patients over 50 years, those with an educational level above high school, and patients with a travel distance greater than 100 km recorded more statistically significant satisfaction scores with EV in comparison to RV (Table 3).

Discussion

With the discovery of Coronavirus (COVID-19) in China at the end of 2019, the whole world becomes threatened by this highly contagious disease [16,17]. The healthcare providers and their patients are highly susceptible to being infected or working as a carrier transmits the disease [18]. In response to this pandemic, measures were taken all over the world to slow down the progression of infection. Till now, social distancing remains the golden standard against the spread of infection. Accordingly, digital healthcare may be a good alternative to usual patient visits to keep the balance between the advisement to stay at home and at the same time provide satisfactory healthcare [19].

Although the idea of telemedicine has been studied in many specialties, data about its use in the postoperative evaluation of arthroplasty patients are scarce. The American College of Physicians in 2013 concluded that telemedicine should be used as an assistant not replace the usual physician–patient communication [20]. Because of COVID-19, the field of telemedicine has rapidly grown up to overcome this pandemic.

Previous studies comparing telemedicine with usual care after total joint replacement found favorable results in telemedicine follow-up [21]. Nevertheless, the setup of a special platform and website specialized for this purpose is not an easy task because of the cost and the need for high technical support [22]. With limited time and resources at the time of the pandemic, we tried a convenient alternative that may be suitable for a small database such as the WhatsApp application. It is free, most popular in our country, allows privacy by chatting without sharing information with others, and allows easy upload of videos and photos.

To establish this method of follow-up, it is important to evaluate patient satisfaction in addition to its clinical efficacy. So, we investigated this tool following patient and surgeon perspectives by including both clinical evaluation and patient satisfaction in comparison to usual follow-up visits.

Our clinical assessment was done using the WOMAC score and SF12 as they are useful questionnaires that fulfill most of the daily activity of the patients and gives a global idea about their health. In addition, they are easy to be answered by the patient without assistance. By combining the results of these questionnaires with a good quality digital x-ray, it is possible to have a good assessment of arthroplasty patients postoperatively [23]. At the time of RV, we did not record any missing major complications or clinical data in comparison to EV. This is supported by the results of previous literature, which stated no difference between both methods during the postoperative follow-up of total joint replacement [24–27].

Our results recorded better overall satisfaction with EV in comparison to RV, and this was statistically significant ($P=0.041$). This was in harmony with the results of Sharareh and Schwarzkopf [25]. Conversely, a study in Norway reported no difference in patient satisfaction between video consultation and standard

visits. However, it also reported no complications or side effects of the use of telemedicine in the postoperative follow-up of traumatic or chronic orthopedic diseases [24]. Because of the importance of patient characteristics on the preference and the use of social media [28], it was fundamental to study the relationship between patients' satisfaction and their demographic data. Despite their concerns about the use of telemedicine in the elderly, we found patients older than 50 years were significantly better satisfied with EV than others. This is in harmony with McLiesh who concluded that old age gets more benefits with telemedicine because of limited mobility and high risk of morbidity [29]. However, Rao *et al*. [30] reported some difficulties with older age in dealing with computer and Internet services. We explained the difference reported in our work to assistance that may be received by their relatives. In addition, old patients know that they are more susceptible to infection and they found telemedicine is a good and safe alternative, especially at the time of a pandemic.

The time factor is one of the important determinants of patient satisfaction. Kummerow *et al*. [31] concluded that online follow-up was less time consuming in comparison to usual follow-up visits. This is in agreement with our results, and it was statistically significant (P=0.038). In contrast, Benger *et al*. [32] found more time consumption with telemedicine visits in comparison to the standard one.

As regards the effect of distance between a patient's home and the hospital, Curry *et al*. [33] discovered that a patient living at a distance of between 120 and 180 miles tends to prefer social media as a method of communication to those living closer to the healthcare center. This was the same we concluded; we recorded better satisfaction with EV among patients living at a distance of more than 100 km away from the hospital, and this was statistically significant. Literature documented that the educational level has a direct impact on the preference to use the Internet and social media as a method of communication [22,30,33].

Consistent with our results, statistically significant better satisfaction with EV was recorded among patients with high educational levels. Patients with less educational levels may be confused or have difficulty interpreting questions they received [34]. We found no significant importance of sex, postoperative time, occupation, and social status on patient's satisfaction with either method of follow-up suggesting that none of these factors has an impact on patient's preference of method of follow-up.

The security of patients' data is a great challenge, and it may be a cause of many medicolegal problems [35]. When we started this study, we paid great attention to this issue. To overcome this, all patients were asked to resend the answered questionnaires and their radiology on the private account of the surgeon to ensure confidentiality and avoid unnecessary sharing of information.

Certain limitations were present in the current study. We investigated a group of patients in a certain subspecialty (i.e. hip arthroplasty) for a short time, and we cannot guarantee that this level of satisfaction will be maintained, so we recommend more research as regards other subspecialties. In addition, we did not study the financial expenses of this method in comparison to the usual methods of follow-up. Also, patients' preferences or satisfaction may be changed with the end of this pandemic. However, this work may give a guide to the use of social media in the field of orthopedic, especially at the time of the current pandemic.

Conclusion

WhatsApp application could be an acceptable tool for the follow-up of patients after primary THA with high satisfaction and could be an alternative to usual clinic visits at the time of the pandemic. In the future, we hoped for more progress in technology to allow better interactive communications between surgeons and patients.

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Conflicts of interest

No conflicts of interest.

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