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Smartphone-based videoconference visits are easy to implement, effective, and feasible in Crohn's disease patients: a prospective cohort study

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ABSTRACT

Aim: Crohn's disease patients require life-long follow-up resulting in frequent hospital visits. The benefits of telehealth have been established in the remote management of Crohn's disease but the role of mobile technology is missing. Our goal was to determine the feasibility and effectiveness of smartphone-based real-time video visits.

Material and Method: We followed 139 patients with either traditional (FTF) or online clinics (OLV) at a university hospital between May 2020- December 2020. We measured patients' satisfaction, disease activity, visit outcomes, socioeconomic parameters, and travel expenses to assess the effectiveness and acceptance of OLV.

Results: Satisfaction scores were significantly higher at OLV compared to FTF (89.58±9.93 vs 70.85±18.51, p<0.001). The Cronbach Alpha reliability coefficient of the VSQ9 scale was 0.878. A median of 47 km travel distance with a median travel time of 49 minutes per visit were saved with OLV. In terms of travel costs there was a potential saving of an average of US$12.24 per appointment. Eighty-five percent of the patients were successfully managed with online visits and did not require face-to-face visit.

Conclusion: There was a high level of acceptance for Smartphone-based real-time video visits in the distant management of Crohn's disease. The telehealth model was easy to implement, effective, with significant savings in travel costs and time.

Keywords: Crohn's disease, telehealth, COVID-19, cost of care

INTRODUCTION

Crohn's disease is an incurable chronic disease characterised by abdominal pain, diarrhea, fatigue and extra-intestinal manifestations. Patients often experience flares and remissions and require treatment across their lifespan. The burden of IBD (Inflammatory Bowel Disease) is rising in the Western World (1) with approximately 1 million individuals in the USA and 3.0-3.5 million in Europe.

Despite effective treatment options, a significant proportion of patients have suboptimal short and long-term outcomes. The obstacles for effective treatment include insufficient monitoring of symptoms, difficulty in getting timely access to a gastroenterologist, (2) and lead time, defined as the time interval between Crohn's disease-specific symptom onset and the establishment of a final diagnosis, to effective treatment (3).

Traditionally, healthcare providers (HCP) monitor and manage their patients face to face at in an office or outpatient setting. Travel time to the hospital, long waiting lists for outpatient appointments, difficulty in making an urgent appointment during disease flares, and need for prescriptions are possible barriers to getting quality care. Furthermore, the SARS COV-2 pandemic raised concerns among IBD patients, especially those on immunosuppressants or biologic agents, with possibly causing treatment delays (4).

Telehealth refers to remotely delivered healthcare between doctors and patients via telecommunication technologies, either with audio or video calls. Close monitoring of a patient's symptoms and adherence to medications can foster more rapid initiation or change in treatment, improve disease outcomes and QoL compared to standard medical care (5). Previously, a telehealth

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system consisting of a computer, a web-based clinician portal and a support server was found to be practical, acceptable to patients and led to improvements in patient satisfaction(6). A remote consultation program for underserved areas via a secure online platform reduced the time patients needed to wait to consult gastroenterologists (7).However, knowledge on the use of teleconference visits with smartphone as a telehealth tool is lacking.

The aim of the study was to evaluate the feasibility, acceptability, patient satisfaction and economic benefits of smartphone video-based telehealth in the management of Crohn's disease patients.

MATERIAL AND METHOD

Overview and Settings

The study was a prospective cohort study conducted at Kocaeli University's Faculty of Medicine. Once the COVID-19 virus breakthrough was declared a pandemic, the Turkish national security institution announced that virtual visits would be reimbursed to prevent viral contamination. Therefore, we initiated a smartphone-based real-time video visit in patients with Crohn's disease parallel to traditional visits between May and December 2020. Patients voluntarily chose to be included either in face-to-face (FTF) or online visits (OLV). We prospectively collected data to evaluate the effectiveness of online visits.

Inclusion and Exclusion Criteria

The study group included patients with documented Crohn's disease, based on clinical, endoscopic, and histologic findings who had been receiving treatment for more than six months. Participation in the study was offered to all consecutive patients over the age of 18. For patients without access to a smartphone, we provided one with an internet connection but patients were excluded from the study if they were unable to use smartphones due to visual challenges, deafness or mental disorders.

Description of the Study Groups and TELE-Health System

Patients were examined by two gastroenterologists (HY, AED) either at a video conference-based visit or FTF visit in the outpatient clinic. As a telehealth tool, we used the WhatsApp business application, which is freely available and encrypted end to end.

The online visit format was the same as that of a traditional FTF visit except for the physical examination. The national online medical information management system "e-nabız" was used to review laboratory, radiologic and pathology reports. Prescriptions were issued using the electronic prescription system "e-reçete," which allowed patients to receive their medications from the nearest pharmacy with the unique passwords provided at the OLV. (As compared to a traditional phone call visit, real-time video visits with smartphones enable the physician for a global assessment of the patient and allow patients to share their physical? Examination results instantly.) Face to face clinic patients were seen at the hospital outpatient clinics where standard of care was provided. Participants received a phone call from the administrative personnel the day after the visit, and a questionnaire about satisfaction and patient perceptions/preferences was applied. Participants received a phone call from the administrative personnel the day after the visit, with a questionnaire regarding satisfaction and patient perceptions/preferences. The patients informed that they would remain anonymous.

Outcome Measures

We used a validated, publicly available visit–specific satisfaction instrument (VSQ-9) to determine patient satisfaction. The VSQ-9 Questionnaire consisted of nine items to evaluate physician-patient relations, including the patient perception of the HCP's, technical skills and personal manner, the amount of time spent on the visits, waiting time for obtaining an appointment, waiting time at the office, accessibility of the office location, and quality of telephone service (8).

Disease activity was evaluated with the Harvey Bradshaw Index (HBI), where scores below 4 meant quiescent disease, and over 5 indicated active disease (9).

The distance and travel time between patients' homes and the hospital was calculated using the Google Maps application, taking into account the means of transport. We assessed levels of education, household environment, video quality, communication preferences and duration of visits, all of which might influence the use of telehealth technology. Parameters such as current medication, smoking status and, visit outcomes that can affect the course of Crohn's disease were recorded.

Sample Size and Statistical Analysis

Power analysis was performed using Gpower 3.1 to confirm a sample size of 52 detecting 80% power and alpha with 0.05 for telehealth outcomes between OL and FTF visits. All statistical analyses were performed using IBM SPSS for Windows version 20.0 (SPSS, Chicago, IL, USA). Numeric variables were presented depending on a normal distribution with either mean±standard deviation, or median (IQR). Categorical variables were summarised as counts (percentages). Responses to VSQ9 which consists of a five-level scale was transformed linearly as the original study suggested(i.e., poor=0%; fair=25%; good=50%; very good=75%; and excellent=100%) (8).

Comparisons of numerical variables between groups were carried out using independent samples t-test or the Mann Whitney U test. The association between two categorical variables was examined by the Chi-square test. All statistical analyses were carried out with 5% significance, and a two-sided p-value<0.05 was considered statistically significant. Cronbach alpha, Factor Analysis (FA), and Bartlett's test statistics were used to determine the construct validity of the VSQ9 scale.

Ethical considerations

This study was performed in keeping with the principles of the Declaration of Helsinki. All participants were informed and signed the informed consent. The protocol was reviewed and approved by the Kocaeli University Ethical Committee of Clinical Researchs (Date:12.5.2020 Decision No:2020/123).

RESULTS

Baseline Demographics

Between May 2020 and December 2020, 180 patients were enrolled in the study (**Figure 1**). However, 36 (40%) participants from the FTF group and 5 (5%) from the OLV group were lost to follow up after recruitment. The reason for high drop out in the face-to-face group was concern by the patient of coronavirus contamination and unwillingness to complete the study questionnaires. Of the 139 patients included in analyses, the mean age was 45.41±13.33 (range 20-79), 52.5% were women (n=73). There was no significant difference between the clinical characteristics and disease activity between the OLV and FTF groups. Patients in the FTF group had significantly more Crohn's disease complications (p<0.001). Baseline descriptive features of the study population are presented in **Table 1**.

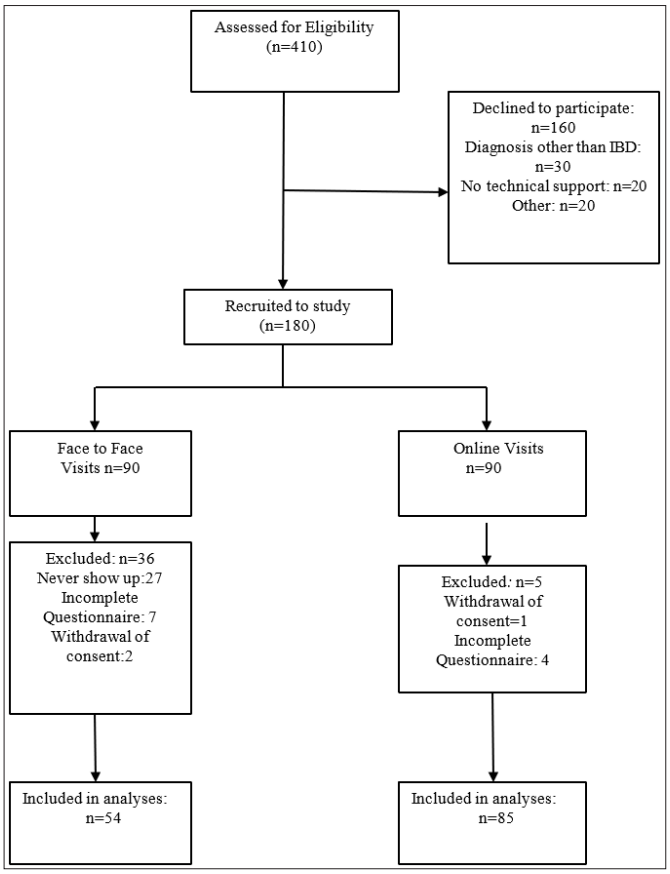

Figure 1. Flowchart of the study

Satisfaction Scores

The mean VSQ9 patient satisfaction score of the study population was 86,61±19.25. The mean VSQ9 satisfaction score was significantly higher in the OLV group (89.58±9.93) compared to FTF (70.85± 18.51) (p<0.001). Patients in the OLV group were more satisfied in terms of being able to contact the office by phone (OL vs. FTF, 90.77±19.04 vs 47.34±37.37; p<0.001), waiting time for the visit (84,62±19,61 vs. 51,06±25.51;p<0.001), getting an appointment (79,44±20,50 vs 58,51±;p<0.05), time spent with the HCP (91,15±16,78 vs 76,60±24,11; p<0.001), explanation of what was done at the visit (91,92±17,17 vs 80,32±23,27; p<0.05) , technical skills (93,85±12,52 vs 79,79±23,68 p<0.05) and the personal manner of the provider (93,08±14,99 vs 86,17±17,13; p<0.05) (**Figure 2**). The Cronbach's Alpha reliability coefficient of the VSQ9 scale was 0.878. Confirmatory Factor Analysis (CFA) was calculated as $\chi 2$=33,294 (sd=26; p=0.154) and RMSEA=0.051. It was determined that the scale had a high degree of internal consistency as it was valid as well as reliable.

Table 1. Baseline demographics of the study population (n=139)

	OLV (n=85)	FTF (n=54)	P Value
Age[a]	46.37±13.60	43.89±12.87	0.290
Gender, female	45 (52.9%)	28 (51.9%)	1.000
Active disease	27 (31.8%)	23 (42.6%)	0.264
Education Level			
Low	41 (48.2%)	26 (48.1%)	0.862
High	44 (51.8%)	28 (51.9%)	
Household Income			
Low	36 (42.3%)	18 (33.3%)	0.343
Middle	34 (40%)	29 (53.7%)	
High	15 (17.7%)	7 (13%)	
Smoking Status			
Non smoker	36 (42.4%)	15 (27.8%)	0.196
Smoker	29 (34.1%)	21(38.9%)	
Quitter	20 (23.5%)	18 (33.3%)	
Current Medication			
Amino salicylate	42 (49.4%)	24 (44.4%)	0.116
Steroid	34 (40%)	28 (51.8%)	0.164
Azathioprine	48 (56.4%)	36 (66.6%)	0.391
Anti -TNF	17 (20%)	18 (33.3%)	0.067
Complications	7 (8.2%)	19 (35.2%)	0.001
Disease Duration[a]	7.40± 5.91	5.43±4.98	0.038

Anti-TNF: Anti tumor necrosis factor, a: Mean (±SD)

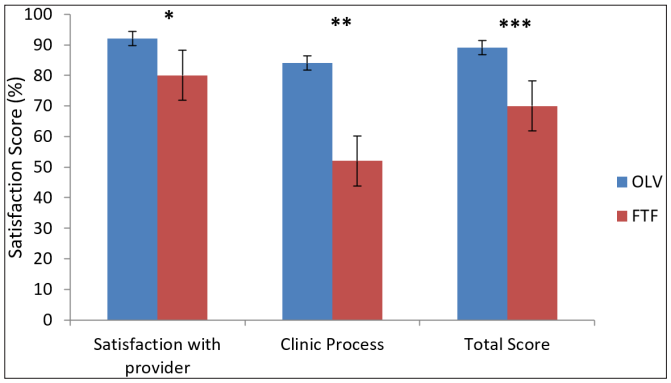

Figure 2. Mean VSQ-9 Satisfaction Scores
OLV: Online visits FTF: Face-to-face visits * p=0.001, ** p< 0.001, *** p< 0.001

Factors related to the Use of Technology

Participants were asked about their communication activities when using these communication devices. Text messaging 78 (91%) and video conference calls with friends and relatives 74 (87%) were the most common activities. Thirty-two per cent of the patients reported that they could not undertake video conference visits with their personal computers because of either non-availability of a PC (personal computer) or no confidence to operate. Smartphone ownership rates were not different between OLV patients and FTF patients (82% vs 86% p=0.253).

Patients rated voice and audio quality as good 72 (85.7%), fair 7 (8.3%), and bad 3 (3.6%). Video conference failed in 2 (2.4%) patients due to poor video and audio quality, where it was impossible to communicate, so it was converted to phone visits.

Visit Outcomes

Online visit outcomes were not significantly different from traditional visits. The median visit duration was 12 minutes (Median IQR: 10-14) in the OLV group and 15 (Median IQR:10-20) minutes in the FTF group. (p<0.05). The outcomes of the visits are summarised in **Table 2**. Thirteen patients (15.3%) in the OLV group were asked to come for physical examination due to the following symptoms severe abdominal pain 10 (11.8%), perianal disease 2 (2.4%), and uveitis 1 (1.1%). Sixty-one (71.7%) patients required required counselling regarding the impact of the Covid19 pandemic on Crohn's Disease during visits. Several OLV group patients asked whether if they still needed to come to a traditional outpatient clinic after online visits. Seventy-two (85.7%) participants reported no perceived need.

Economic Benefits of the Online Clinic

OLV and FTF participants reported that during the last year, they had presented to the hospital for Crohn's disease a median of four times (OLV vs FTF, 4 (IQR: 2-5 vs 4 (2.25-6); p=0.205). In our study population, 10 (7.5%) patients had even changed their residence to be closer to a hospital because of frequent visits. Neither median travel distance to the hospital from patients postal addresses (47 km (IQR: 24-108.5) vs 53 km (IQR (28.5-116.0) , p=0.686) nor the travel time (49 minutes (IQR: 33.50-98.50) vs ,59 minutes (IQR:36.50 -99.5) p=0.818) was different between OLV and FTF groups. Altogether, the online visits undertaken in the course of the study saved a total travel distance of 10,404 km and 8266-minute travel time compared to traditional visits. An average travel expense per visit of US$12.24 was saved, which is roughly 3% of the 2021 monthly minimum wage (US$385.80) in Turkey.

Table 2. Outcomes of the visits

	OLV (n=85)	FTF (n=54)	P value
Medication Dose Arrangement	11 (12.9%)	5 (11.1%)	ns
Medication Alteration	5 (5.9%)	3 (5.6%)	
Prescription for Refills	23 (27.1%)	12 (22.2%)	ns
Smoking Education	29 (31.7%)	20 (37.1%)	ns
Laboratory Tests	10 (24.7%)	14 (25.9%)	ns
Colonoscopy	4 (4.7%)	3 (5.5%)	ns
Hospitalisation	1 (1.2%)	2 (3.7%)	na

ns: non specific na:not applicable

DISCUSSION

In the present study, we demonstrated that smartphone-based real-time video visits offered a high-level of satisfaction and acceptance, were easy to implement and decreased travel cost and time.

Given the duration of Crohn's disease among the study's participants, their disease activity, percentage of Crohn's disease complications, socioeconomic spectrum and levels of education, our study population can be regarded as quite representative, and satisfaction results can be generalised.

Patient satisfaction with video visits was significantly higher than that of FTF visits. Furthermore, satisfaction scores with the provider and clinical process were found to be greater with online visits. Previously, Krier et al. (10) also reported high patient satisfaction and acceptance of videoconference telemedicine, but they found no difference in terms of satisfaction with a PC based telehealth system compared to regular outpatient clinics. Our results differed from the previous trial, possibly because of the use of a more flexible and commonly available technology. We believe that OLV were more user-friendly because of the ease of access to a physician possibility of obtaining a prescription by their phone instead of travelling to a hospital. Despite any special clinic time settings, the OLV group had a high satisfaction score with getting an appointment. Mobile technology may give patients more flexibility to connect to a hospital anywhere securing an

appointment. This form of making appointments may be more satisfying for patients. In fact, eHealth technologies such as web or text messages are mostly artificial. Online real-time communication with a health care professional is more realistic and hence increase acceptance.

Cooperation with technology is one of the most prominent hurdles of implementing telehealth. It is critically important to choose the right technological instrument when designing a telehealth model. Ninety-eight per cent of adults in Turkey use a mobile phone, while 77% use smartphones. Among smart telephone users, WhatsApp is currently available on 87.1% of them (11). Con et al. (12) evaluated IBD patients' eHealth perspectives and revealed that patients under 30 years old reported higher levels of confidence in using information and communication technologies. There was an inverse correlation between age and the use of smartphone apps. Additionally, computer anxiety was found to have a strong negative effect on the acceptance of telehealth services among seniors aged 50 or more (13). The mean age of our study population was slightly over 40 with the oldest patient was 69 years old. However, we were able to perform online visits successfully with both young and old patients. Entering data with a computer or smartphone app could be challenging, especially for older patients, but real-time video communication to physicians was effortless. The potential loss of privacy with a PC during work time might be another difficulty for the working age population. On the contrary, mobile technology is usable anytime and anywhere.

The online clinic led model of care was also found to be beneficial for socioeconomically disadvantaged patients. Patients with both lower levels of education and low incomes successfully completed the online visits. In contrast to Cross et al. (14) recent remote management model for IBD patients, which required a technical support line for participants and providers. participants in our study required neither theoretical and practical education nor technical support to conduct their visits. Real-time videoconferencing using a smartphone was found to be both feasible and easy to implement.

Online clinics saved an average of 47 km travelling distance and a median of 49 minutes travelling time per visit. When we add the waiting time at the office, and the interview itself, patients in the OLV group saved at least half a day. Our results were consistent with the findings of Ruf et al. (15). They also reported that the video conference clinic model reduced the travel distance (mean 310 km) and time per visit (314 minutes) in a rural setting and saved US$36 per visit. However, we do not believe telehealth is only efficient for rural populations. Our telehealth model also showed economic and logistic benefits for patients living in crowded metropolitans. Some patients reported that they moved their home closer to the hospital because of frequent hospital visits, which indicates that travelling is a burden. Costs related to the caregiver, food and parking costs, as well as indirect costs like missed work, should also be taken into account. According to one meta-analysis, one-third of the telehealth services using real-time video communication increased costs for the service provider (16). Telehealth technology consisting of a webpage and provider PC requires elements installed in the patients home. It has considerable costs for designing and operating a webpage. However, since we were able to take advantage of existing resources, there were no set-up expenses for our video visit model, such as website design, video conference software and hardware, technical equipment or physical space.

In our study, 15.3% of the patients had to come to FTF for physical examination or infusion therapy. İn such cases, OLV could not be considered an alternative to traditional visits. The combination of FTF and OLV may be the best practice and can reduce the burden on outpatient clinics.

Our study has some limitations. It was conducted under the extraordinary circumstances of the COVID-19 pandemic. Since the online clinic model can prevent virus dissemination, patients might express greater satisfaction, resulting in selection bias. Once the pandemic is over, patients' satisfaction perspectives may change. A hybrid visit model which combines online and traditional visits could be a solution for the demands of patients after COVID-19. One of our study's weaknesses was the absence of follow-up, but its primary aim was to evaluate acceptance, feasibility, and economic benefits. Future studies are needed to determine the long-term effects of OLV on disease activity QoL and medication adherence.

CONCLUSION

A smartphone-based video conference telehealth model does not require home installation or additional costs for implementation; it is accessible anywhere and is easy to use. This clinic model yielded widespread acceptance and good satisfaction rates. OLV also brought economic benefits to the patients. However, the long-term effects on disease activity and course need to be determined. We hope that this study will inspire others to implement telehealth to overcome barriers and deliver quality health care for patients with Crohn's disease.

ETHICAL DECLARATIONS

Ethics Committee Approval: The protocol was reviewed and approved by the Kocaeli University Ethical Committee of Clinical Researchs (Date: 12.5.2020 Decision No: 2020/123)

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: Hasan Yılmaz has been a speaker at educational symposia sponsored by The Ferring Pharmaceuticals and consulted on the advisory board of The Arena Pharmaceuticals. Ali Erkan Duman has educational support and has been a speaker at educational symposia sponsored by The Ferring Pharmaceuticals. This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

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