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Original article

Satisfaction and feasibility of videoconsultation (VC) in orthopaedic and trauma surgery in the context of the COVID-19 pandemic: Prospective study of 783 patients

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ABSTRACT

Background: The COVID-19 pandemic has required that specialists use videoconsultation (VC) to maintain continuity of care. As in-person consultations (IPCs) and surgical procedures were cancelled, VC became the tool of choice. No recent French study has assessed VC as the main consultation modality. The objective of this prospective study was to evaluate: 1) patient satisfaction, 2) access to and the future of VC, 3) and the reasons for VC refusal in the setting of the pandemic.
Hypothesis: Patients responded favourably to VC.
Patients and method: We conducted a prospective, single-centre, observational study of consecutive patients who were invited to switch from IPC to VC during the lockdown of March 16 to May 11, 2020, when IPCs were not available. All patients were included in the study, regardless of whether they accepted the VC. The reasons for refusal were recorded at the time of the invitation. The surgeons sent the patients who accepted an emailed satisfaction questionnaire after the VC.
Results: Of the 783 patients with scheduled IPCs, 291 (37.2%) accepted a VC instead, 408 (52.1%) refused the VC, and 84 (10.7%) could not be contacted by telephone and were therefore excluded. The VC acceptance rate was 37% (291/783). Of the 291 VC patients, 233 (80.1%) returned the satisfaction questionnaire, although 2 questionnaires had too many missing data to be included, leaving 231 patients for the analysis. The VC was the first consultation with the surgeon for 66 (28.6%) patients. Of the 165 (71.4%) other patients, 51.6% (85/165) were receiving post-operative follow-up. On a 0-5 scale, the global VC experience was scored 4.3 ± 0.8. Of the 231 VC patients, 161 (69.7%) felt that the VC was equivalent to an IPC, 18 (7.8%) that it was poorer, and 7 (3%) that it was better than an IPC; 45 (19.5%) had no opinion on this point. If choosing between a VC or an IPC had been possible during this first lockdown, 168/231 (72.7%) patients would have chosen an IPC. In contrast, 198/231 (85.7%) patients said they would choose an IPC after the lockdown. The group that refused the VC had a significantly older mean age (57.8 ± 16.4 years vs. 48.0 ± 14.4 years, $p < 0.0001$) and lived closer to the institution ($p < 0.0001$), whereas the sex distribution was comparable, with 42.9% of males (175/408) refusing and 46.8% (108/231) accepting the VC ($p = 0.39$). The main reason for refusal was a wish for an in-person encounter with the surgeon (268/408, 65.7%). Patients aged ≥65 years were more likely to refuse due to technical considerations (access to electronic equipment and to the Internet), whereas patients ≤35 years were more likely to wait for an IPC.

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Conclusion: The rate of satisfaction with the VC was high. Satisfaction was not significantly associated with the reason for the consultation (joint involved, degenerative or post-traumatic condition, first VC, first consultation, or follow-up before or after surgery). Although most patients who accepted the VC felt that this modality was equivalent to an IPC, many remained desirous of an in-person encounter with the surgeon, notably among the youngest individuals. Outside the setting of a pandemic, the IPC remains the consultation modality of choice for most of our patients.
Level of evidence: V, prospective study without a control group.

1. Introduction

The scarcity of specialists in some regions and the geographic features of some countries led healthcare systems to start developing teleconsultations in the late 1990s [1–4]. In recent years, information technology equipment has improved in terms of both quality and ease of use, while becoming less expensive. These changes have allowed the development of videoconsultation (VC) as an alternative to in-person consultation (IPC). The Internet (4G, ADSL, fibre) and digital devices (smartphone, digital tablet) are now readily accessed by a large part of the population. In France, however, orthopaedic surgery remains an in-person specialty in which the physical examination is at the centre of the physician-patient relationship, so that the use of teleconsultation remains rare. Elsewhere, due to the long distances that often separate patients from specialists (e.g., Australia and Norway), the use of VC has long been crucial to the organisation of healthcare. Recent prospective studies demonstrated high satisfaction rates among patients and major cost savings in the fields of orthopaedics and surgery [5–9]. Since the start of the COVID-19 pandemic in early 2020, specialists have been forced to use VC to provide indispensable follow-up visits, as IPCs and surgical procedures were cancelled to limit the transmission of the virus. VC was the only authorised tool allowing physicians to ensure the continuity of clinical services. In France, as part of the measures associated with the state of emergency instituted by the government, the statutory health insurance system fully reimbursed all VCs [10]. Thus, 5.5 million VCs were reimbursed in March and April 2020, and up to 1 million VCs occurred each week during the peak of the pandemic.

In all the available studies, VC was an alternative to IPC [11,12]. The current crisis and the uncertainties surrounding its future course create a pressing need for an assessment of the role for VCs in the everyday practice of orthopaedic surgeons. No recent French study in the field of orthopaedic and trauma surgery has evaluated patient satisfaction with VCs as the only consultation option. Therefore we performed a prospective study aiming to evaluate:

- patient satisfaction;
- access to and the future of VC;
- and the reasons for VC refusal in the setting of the pandemic.

Our working hypothesis was that patient responded favourably to VC in this setting.

2. Material and method

2.1. Patients

We conducted a prospective, single-centre, observational study of consecutive patients receiving follow-up at the private Saint Omer hospital (Hauts de France) during the lockdown that lasted from 16 March to 11 May 2020.

As soon as the lockdown was announced and in compliance with the recommendations of the government, all patients with an IPC scheduled during the lockdown (first consultation or follow-up consultation before or after surgery) and related to orthopaedic surgery on the upper or lower limb were offered a VC instead. Patients who refused were scheduled for an IPC at a later date. Patients who required an IPC on an emergency basis were allowed to visit the hospital's emergency room.

All contacted patients were included into the study, regardless of whether they accepted the VC. The VCs were performed by 5 orthopaedic surgeons specialised in the upper and lower limb (post-traumatic and degenerative conditions). No specific protocol was applied by these surgeons for the virtual physical examination. Non-inclusion criteria were unwillingness to participate in the study; mental, visual, or auditory disability; and age under 18 years. In compliance with French law, no prior authorisation from regulators was required.

3. Methods

The patient and surgeon agreed on a date and time for the VC. The surgeons conducted the VC in the office where they usually had their IPCs. The patients remained at the place where they were in lockdown. They were asked to create a calm environment. A dedicated platform for appointment scheduling and VC was used. The patient could transfer any documents necessary for the proper conduct of the VC onto the platform.

3.1. Assessment methods

The patients who accepted a VC were told by the surgeon that they would be asked to complete an anonymous satisfaction questionnaire at the end of the consultation. A link to the questionnaire was sent by email and the patient completed the questionnaire on line (*appendix 1*). Satisfaction was assessed using numerical rating scales from 0 to 5 to explore various dimensions including surgeon knowledge and courtesy, length of the VC, appropriate response, and ability to speak freely. Four other sections of the questionnaire collected information on demographics, the reason for the VC, the limitations of the VC, and any technical difficulties encountered in participating in the VC.

For patients who refused the VC, after obtaining their agreement, demographic data and the reasons for the refusal were collected during the telephone call. The data were processed and interpreted by an independent observer (L.N.).

3.2. Statistical methods

The R programme (version 3.6.1) was used for the statistical analyses. Qualitative variables were described as number (%) and quantitative variables as mean ± SD. For comparisons of the groups that accepted vs. refused the VC, the Mann-Whitney-Wilcoxon test was applied for age, which was not normally distributed, and the chi-square test for sex and distance from the hospital. Correlations

between overall patient satisfaction with the VC and quantitative variables were evaluated by computing Spearman's correlation coefficient (ρ), given the non-normal distribution, with its 95% confidence interval (95%CI). The correlation was interpreted as very good if ρ was strictly greater than 0.8, good if ρ was between 0.61 and 0.8, fair if ρ was between 0.6 and 0.41, and poor if ρ was lower than 0.41. Associations linking overall patient satisfaction with the VC to qualitative variables were evaluated using the Mann-Whitney-Wilcoxon test, or the Kruskal-Wallis test if there were more than two modalities. Values of p smaller than 0.05 were taken to indicate a significant difference. No sample size estimation was performed, given that the analysis of the primary outcome measure was strictly descriptive. For this pragmatic study, we sought to include all the patients with IPCs scheduled during the lockdown.

4. Results

4.1. Results in the overall population

Among the 783 IPCs scheduled to occur during the lockdown, 291 (37.2%) were changed to VCs. The VC was refused by 408 (52.1%) patients. The remaining 84 (10.7%) patients could not be contacted by telephone and were therefore excluded. Fig. 1 is the patient flow chart. The VC acceptance rate was 37.2% (291/783).

Of the 291 patients who had VCs, 231 sent back complete questionnaires. Two questionnaires had many missing data and were therefore excluded and 58 patients failed to complete the questionnaire, leaving 231 patients for the analysis. The questionnaire participation rate was thus 80.1% (233/291) (Fig. 1).

4.2. Patients who had a VC

The VC was the first consultation with the surgeon for 28.6% (66/231) of the patients. Of the remaining 165 (71.4%) patients, 85 (51.6%) were receiving post-operative follow-up.

On average, the group that accepted the VC was younger by about 10 years than the group that refused the VC (48 ± 14.4 years vs. 57.8 ± 16.4 years ($p < 0.0001$)), whereas the sex distribution was similar in the two groups (46.8% [108/231] of males in the VC group vs. 42.9% (175/408) in the group that refused the VC). Table 1 reports the data on the patients who had a VC and Table 2 compares the profiles of the patients who accepted VC vs. refused the VC.

4.2.1. Satisfaction

The mean score for the overall VC experience was 4.3 ± 0.8 on a 0-5 scale (Table 1); 2.6% (6/231) of patients gave a score equal to or lower than 2/5 and 86.1% (199/231) a score greater than or equal to 4/5. The analysis of factors associated with satisfaction showed that age had no effect (ρ=0.06; 95%CI, [-0.08; 0.18]). In contrast, there was a good correlation for recommending a VC to a friend (ρ=0.72; 95%CI, [0.63; 0.8]).

Satisfaction was never influenced by the health condition whether categorised by individual joint involved (shoulder 4.2 ± 0.8, elbow 4.8 ± 0.4, hand 4.2 ± 0.9, hip 4.5 ± 0.5, and knee 4.3 ± 0.7 ($p = 0.07$)), by group of joints involved (upper limb 4.3 ± 0.8 and lower limb 4.3 ± 0.7 ($p = 0.67$)), or by type of disease (degenerative 4.3 ± 0.8 and post-traumatic 4.2 ± 0.8 ($p = 0.37$)) (Table 3).

Among the patients who had not had surgery, we compared satisfaction between the patients for whom the VC was the first consultation (N = 66/231) and the other patients (N = 165/231). We found no significant difference (4.3 ± 0.8 vs. 4.3 ± 0.7 ($p = 0.66$)).

In the 85 patients for whom the VC occurred after surgery, we found no significant correlation between satisfaction with the VC and satisfaction with the outcome of the surgical procedure (ρ=0.27; 95%CI, [0.06; 0.48]).

When we compared patients who had the VC before the decision about the appropriateness of surgery and those who had the VC after surgery, we found no significant difference regarding satisfaction with the VC (4.3 ± 0.7 vs. 4.2 ± 0.8 ($p = 0.45$)).

Satisfaction was not higher among the patients who had prior experience with VC compared to the other patients (4.1 ± 0.9 vs. 4.3 ± 0.8 ($p = 0.34$)). In contrast, problems and technical difficulties encountered during the VC were significantly associated with satisfaction with the VC ($p < 0.0001$) (Table 3).

4.2.2. Accessibility and future

A smartphone was used only slightly more often than a computer: 53.2% (123/231) vs. 46.8% (108/231). Most patients had no problems with the equipment used for the VC (157/231, 68%). However, 9.1% (21/231) experienced an unstable audio connection, 12.1% (28/231) an unstable video connection, and 3% (7/231) an inability to upload their imaging studies. The vast majority of patients had no difficulties (185/231, 80.1%) but 8.7% (20/231) had trouble positioning the camera properly and 10.4% (24/231) found it difficult to image the painful area. Few patients asked others to help them conduct the VC (34/231, 14.7%) although 31.2%(72/231) were accompanied by another person during the VC.

When asked which modality they would choose had that been possible during the lockdown, 72.7% (168/231) of patients said they would choose an IPC. Also, 85.7% (198/231) said they would choose an IPC after the lockdown ended.

4.3. Patients who refused the VC

Mean age of this group of patients was 57.8 ± 16.4 years, and 42.9% (175/408) were male. The main reason for refusing the VC was a desire for an in-person encounter with the surgeon (268/408 (65.7%)). Access to the Internet was unavailable to 12.3% (50/408) of patients, and 21.8% (89/408) of patients did not have the necessary equipment (Table 4). These three reasons for refusal were significantly associated with age (Table 5):

- older patients (≥ 65 years) most commonly gave unavailability of Internet access or equipment, i.e., material reasons, as the reason for refusal;
- younger patients (≤ 35 years) more often gave scheduling conflicts as the main reason and preferred to wait for an IPC.

5. Discussion

The pandemic setting with a legally enforced lockdown makes our study unique. Given the absence during the lockdown of any alternative to a VC, we were able to assess various aspects related to the VC under real-life conditions. We were also able to record the reasons for refusal, which heretofore had not been assessed. Overall patient satisfaction with the VC under lockdown conditions was very high. VC allowed the management of all orthopaedic conditions except those involving the spine, with a very high overall satisfaction rate that was independent from the health condition being treated. These findings are consistent with the recent literature [11–13].

The main factors that negatively influenced patient satisfaction were technical and material problems and difficulties. These are the main limitations to the proper conduct of a VC. They prevent good communication between the patient and physician, sometimes leading to tensions during the VC. Thus, the quality of the engagement between the patient and physician is dependent on the availability of a reliable, stable, and efficient means of communication. Positioning the camera to show the painful area, audio or video fade-out while explaining the symptoms, and an inability to download imaging studies are problems specific of the VC

Table 1
Main features of the patients who accepted the videoconsultation (VC) and completed the satisfaction questionnaire (N = 231).

Variable	Modalities	Missing data	Number (%)
Overall experience of the VC (scored from 0 to 5)	0	0	0 (0%)
	1		0 (0%)
	2		6 (2.6%)
	3		26 (11.3%)
	4		92 (39.8%)
	5		107 (46.3%)
Sex	Male	0	108 (46.8%)
	Female		123 (53.2%)
Distance from the hospital	0-20 km	0	122 (52.8%)
	20–50 km		83 (35.9%)
	50 km or more		26 (11.3%)
High school diploma	No degree	0	62 (26.8%)
	Secondary school/high school graduation		80 (34.6%)
	2 years further education		45 (19.5%)
	3 years further education		9 (3.9%)
	≥ years further education		35 (15.2%)
Use of ITE for work	Yes	0	155 (67.1%)
	No		76 (32.9%)
Means of communication used for the VC	computer	0	108 (46.8%)
	smartphone		123 (53.2%)
Asked for help from another person to conduct the VC		0	34 (14.7%)
Asked another person to provide the equipment needed for the VC		0	16 (6.9%)
1st consultation with the surgeon		0	66 (28.6%)
Health condition	Shoulder condition (tendinitis, rotator cuff, OA...)	0	73 (31.6%)
	Elbow condition (tendinitis, OA...)		17 (7.4%)
	Hand condition (carpal tunnel, Dupuytren's contracture, trigger finger...)		33 (14.3%)
	Hip condition (OA..)		24 (10.4%)
	Knee condition (OA, ACL or PCL tear, meniscal tear...)		47 (20.3%)
	Upper limb fracture (shoulder, arm, elbow, forearm, hand)		15 (6.5%)
	Lower limb fracture (hip, femur, knee, leg, ankle, foot)		22 (9.5%)
Level of urgency of the consultation	Low	0	95 (41.1%)
	Moderate		109 (47.2%)
	High		27 (11.7%)
Reason for the consultation	Before deciding whether to have surgery	0	146 (63.2%)
	After having surgery		85 (36.8%)
1st experience of VC		0	207 (89.6%)
Waiting time	0-15 min	0	213 (92.2%)
	15-30 min		16 (6.9%)
	30-45 min		2 (0.9%)
Transport time had it been necessary to go to the hospital	<30 minute	0	141 (61%)
	30 to 60 min		71 (30.7%)
	1 to 2 h		19 (8.2%)
Evaluation of the VC vs. an in-person consultation	No opinion	0	45 (19.5%)
	Not as good		18 (7.8%)
	The same		161 (69.7%)
	better		7 (3%)
After this experience, if you could choose, you would prefer	IPC	0	168 (72.7%)
	VC		63 (27.3%)
After the lockdown, if the surgeon suggests a consultation, you will choose	VC	0	33 (14.3%)
	IPC		198 (85.7%)
Was accompanied by another person during the VC		0	72 (31.2%)
Problems encountered during the VC	None	0	157 (68%)
	Choppy video		28 (12.1%)
	Choppy sound		21 (9.1%)
	Interrupted by someone in the home		2 (0.9%)
	Downloading imaging studies was difficult or impossible		7 (3%)
	Poor Internet connection (insufficient coverage or low of Internet connection)		16 (6.9%)
Difficulties encountered during the VC	None	0	185 (80.1%)
	Difficulty positioning the camera properly		20 (8.7%)
	Difficulty imaging the painful area with the camera		24 (10.4%)
	Difficulty understanding the manoeuvres requested by the surgeon		2 (0.9%)

VC: videoconsultation, ITE: information technology equipment; OA: osteoarthritis; ACL: anterior cruciate ligament; PCL: posterior cruciate ligament

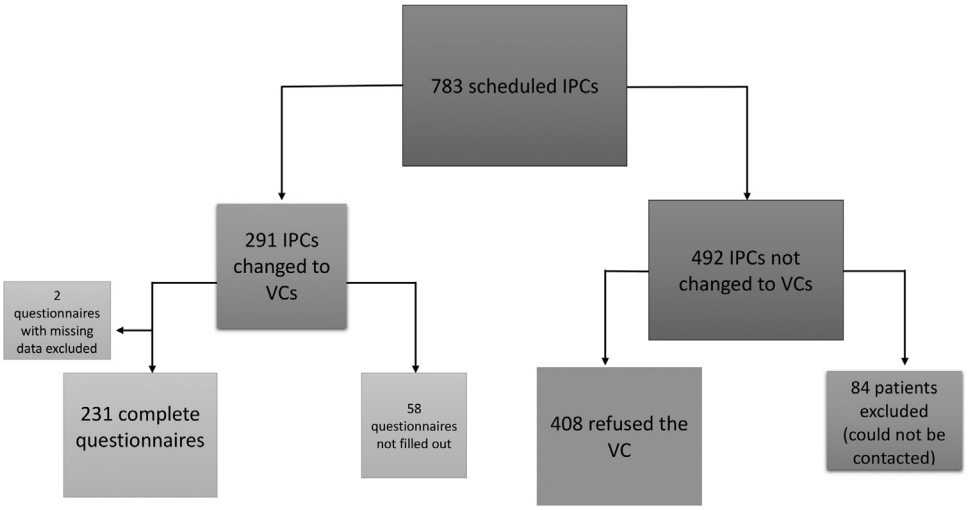

Figure 1. Patient flow chart. From 16 March to 11 May 2020, 783 in-person consultations were scheduled and all these patients were offered a videoconsultation (VC) instead.

Table 2
Comparison of the profiles of the patients who accepted (N = 231) vs. refused the videoconsultation (VC) (N = 408).

		Missing values	Overall population	Refused the VC	Accepted the VC	*p* value
N			639	408	231	
Age (years)		0	54.2 ± 16.4	57.8 ± 16.4	48 ± 14.4	< 0.0001
Sex	Male	0	283 (44.3%)	175 (42.9%)	108 (46.8%)	0.39
	Female		356 (55.7%)	233 (57.1%)	123 (53.2%)	
Distance from hospital	0-20 km	0	383 (59.9%)	261 (64%)	122 (52.8%)	< 0.0001
	20–50 km		226 (35.4%)	143 (35%)	83 (35.9%)	
	50 km or more		30 (4.7%)	4 (1%)	26 (11.3%)	

VC: videoconsultation

that can severely impair its good conduct and may constitute the main obstacle to its future development. To facilitate VCs, protocols have been established for performing the clinical examination and accurately measuring range of motion of each joint [14,15].

VCs can therefore be used for all types of orthopaedic conditions, whether they affect the upper or lower limb and are degenerative or post-traumatic in nature. Despite these encouraging results, the vast majority of patients would not choose VCs in the future. Although VCs helped patients and physicians remain clinically engaged, they were not considered by the patients to be as satisfactory as an IPC. In a randomised controlled trial in the US, Sathiyakumar et al. [16] found no significant difference in satisfaction between VCs and IPCs. The patients reported that the time saved was important, as it avoided having to miss a day of work. In contrast to our patients, a considerable majority (75%) wanted to continue using VCs for their follow-up. In a comparison of VCs (N = 34) and IPCs (N = 44) for post-operative follow-up after elbow arthroplasty, Sharareh et Schwarzkopf [17] demonstrated that satisfaction was higher and absenteeism lower with the VCs. A vast (N = 389) randomised controlled trial by Buvik et al. [6] also showed excellent outcomes in favour of VCs. Nevertheless, the VCs occurred inside a doctor's office, and the patient was accompanied by a nurse. Most patients chose a VC for their next consultation. In our study, the conditions were less comfortable for the patients, who did not receive help from specially trained personnel to establish effective communication. This point may explain why most of our patients would choose an IPC for their next consultation.

Several studies done in various countries have reported on the organisational changes required by the measures taken during the lockdown [18–21]. To deal with the COVID-19 pandemic, governments temporarily lifted several restrictions applying to telemedicine and provided additional funding to support VCs. In France, the surge in the use of VCs was made possible by a decree issued on 10 July 2020 and published in the official journal of the French Republic N°0170, which ensured full coverage of VCs by the statutory health insurance system [22]. This framework relies on two strong principles: telemedicine is used within a coordinated healthcare pathway, with initial referral by the registered general practitioner if the VC is with another physician; and prior knowledge of the patient by the general practitioner (or the specialist) who conducts the VC.

Despite all these measures taken to facilitate VCs, most of our patients (268/408, 65.7%) preferred to wait for an IPC rather than accept a VC. This reason for refusing the VC was, surprisingly, most common among patients younger than 35 years of age. As expected, absence of access to the equipment needed was common among the elderly patients. Young patients, despite their massive consumption of digital technologies, do not seem particularly receptive to the use of remote consultations in the field of health. Thus, a survey conducted in 2018 [23] demonstrated their predilection for IPCs, as over 9 of 10 individuals younger than 30 felt that in-person encounters were crucial in the area of health. Furthermore, younger individuals can move around more easily and feel less threatened by COVID-19 than do the elderly. Thus, they probably preferred to wait for IPCs to resume before receiving medical care. The official data reported by the French statutory health insurance on VCs for all specialities pooled support this tendency. Before the lockdown, patients younger than 50 years were proportionally more likely to use VCs, notably those in the 30 to 40 year age bracket. After 50 years of age, the use of VCs decreased sharply in proportion to increasing age. During the lockdown, the opposite was observed. Patients younger than 30 were proportionally less likely to accept the VC, with a drop from 32% before the lockdown to 19% during the lockdown. In contrast, patients older than 70 years–who were far less likely to use VCs before the lockdown (8% of billed consultations)–familiarised themselves with this modality during

Table 3
Factors associated with satisfaction with the videoconsultation (VC) (N = 231).

Variable	Modalities	N	Mean ± SD	Median [IQ]	*p* value
Age	< 40	54	4.2 ± 0.8	4 [4; 5]	0.51
	[40; 60[	137	4.4 ± 0.7	4 [4; 5]	
	≥60	40	4.2 ± 0.9	4 [4; 5]	
1st consultation with the surgeon	No	165	4.3 ± 0.7	4 [4; 5]	0.59
	Yes	66	4.3 ± 0.8	5 [4; 5]	
Reason for the consultation	Before deciding whether to have surgery	146	4.3 ± 0.7	4 [4; 5]	0.45
	After having surgery	85	4.2 ± 0.8	4 [4; 5]	
Health condition	Shoulder condition (tendinitis. rotator cuff. OA...)	73	4.2 ± 0.8	4 [4; 5]	0.07
	Elbow condition (tendinitis. OA...)	17	4.8 ± 0.4	5 [5; 5]	
	Hand condition (carpal tunnel. Dupuytren's contracture. trigger finger...)	33	4.2 ± 0.9	4 [4; 5]	
	Hip condition (OA..)	24	4.5 ± 0.5	4.5 [4; 5]	
	Knee condition (OA. ACL or PCL tear. meniscal tear...)	47	4.3 ± 0.7	4 [4; 5]	
	Upper limb fracture (shoulder. arm. elbow. forearm. hand)	15	4.2 ± 0.9	5 [3; 5]	
	Lower limb fracture (hip. femur. knee. leg. ankle. foot)	22	4.2 ± 0.6	4 [4; 5]	
Category of health condition	Degenerative + post-traumatic upper limb	138	4.3 ± 0.8	5 [4; 5]	0.67
	Degenerative + post-traumatic lower limb	93	4.3 ± 0.7	4 [4; 5]	
Location of health condition	Degenerative upper + lower limbs	194	4.3 ± 0.8	4 [4; 5]	0.37
	Post-traumatic upper + lower limbs	37	4.2 ± 0.8	4 [4; 5]	
Level of urgency of the consultation	Low	95	4.3 ± 0.8	4 [4; 5]	0.63
	Moderate	109	4.3 ± 0.7	4 [4; 5]	
	High	27	4.4 ± 0.8	5 [4; 5]	
Time spent in the virtual waiting room before the VC	0-15 min	213	4.3 ± 0.8	4 [4; 5]	0.13 Only for the comparison of 0-15 min vs. 15-30 min
	15-30 min	16	4 ± 0.9	4 [4; 4.2]	
	30-45 min	2	4 ± 0	4 [4; 4]	
Transport time if the patient had had to go to the hospital	<30 minute	141	4.3 ± 0.7	4 [4; 5]	0.65
	30 to 60 min	71	4.4 ± 0.8	5 [4; 5]	
	1 to 2 h	19	4.2 ± 0.9	5 [3; 5]	
Problems encountered during the VC	None	157	4.5 ± 0.7	5 [4; 5]	<0.0001
	Choppy video	28	3.9 ± 0.9	4 [3; 4.2]	for the comparison of all modalities, except for the "interrupted at home" group with only 2 patients
	Choppy sound	21	4 ± 0.9	4 [4; 5]	
	Interrupted by someone in the home	2	4 ± 0	4 [4; 4]	
	Downloading imaging studies was difficult or impossible	7	4 ± 0.8	4 [3.5; 4.5]	
	Poor Internet connection (insufficient coverage or loss of Internet connection)	16	3.9 ± 0.6	4 [3.8; 4]	
Difficulties encountered during the VC	None	185	4.4 ± 0.7	5 [4; 5]	<0.0001
	Difficulty positioning the camera properly	20	3.7 ± 0.7	4 [4; 4]	for the comparison of all modalities except for the group with difficulty understanding the manoeuvres, with only 2 patients
	Difficulty imaging the painful area with the camera	24	3.8 ± 1	4 [3.8; 4.2]	
	Difficulty understanding the manoeuvres requested by the surgeon	2	4 ± 0	4 [4; 4]	
1st experience with VC	No	24	4.1 ± 0.9	4 [4; 5]	0.34
	Yes	207	4.3 ± 0.8	4 [4; 5]	

VC: videoconsultation; OA: osteoarthritis; ACL: anterior cruciate ligament; PCL: posterior cruciate ligament

Table 4
Features of the population that refused videoconsultation (VC) (N = 408).

	Modalities	Missing values	N of patients (%)
Sex	Male	0	175 (42.9%)
	Female		233 (57.1%)
Distance from hospital	0–20 km	0	261 (64%)
	20–50 km		143 (35%)
	50 km or more		4 (1%)
Did not have the equipment needed	yes	0	89 (21.8%)
Did not have Internet access	yes	0	50 (12.3%)
Not urgent, preferred to wait for an IPC		0	268 (65.7%)
Did not attend to appointment		0	0 (0%)
Follow-up consultation		0	273 (66.9%)
New patients		0	135 (33.1%)
Health condition	Upper limb	0	124 (30.4%)
	Foot		44 (10.8%)
	Hip		83 (20.3%)
	Knees		157 (38.5%)

IPC: in-person consultation

Table 5
Associations between age and reasons for refusing the videoconsultation (VC) (N = 408).

	Overall population	≤ 35 years	36-65 years	≥ 65 years	*p* value
N	408	45	210	153	
Did not have the necessary equipment	89 (21,8%)	2 (4,4%)	30 (14,3%)	57 (37,3%)	< 0,0001
Did not have access to the Internet	50 (12,3%)	3 (6,7%)	21 (10%)	26 (17%)	0,064
Not urgent–preferred to wait for an IPC	89 (21,8%)	2 (4,4%)	30 (14,3%)	57 (37,3%)	< 0,0001

IPC: in-person consultation

the lockdown (20% of billed consultations). Since May 2020, this tendency seems to persist: although elderly patients remain proportionally less likely to use VCs compared to younger patients, they still contribute 19% of VCs. This tendency may be ascribable to a desire of older individuals to avoid displacements and risks of contamination due to their greater vulnerability to severe COVID-19.

This study has several limitations.

- Selection bias occurred, since the population was recruited at a single centre. Therefore, our findings cannot be generalised to the entire French population. Among patients living less than 20 km away from our hospital, a larger proportion refused the VC. Conceivably, in other parts of France where orthopaedic surgeons are less numerous, interest in VCs may be greater.
- Selection bias also occurred due to the low VC acceptance rate. Nevertheless, we had a sufficient number of patients who accepted the VC, and among them participation in the questionnaire survey was very high.
- The absence of randomisation decreases the level of evidence provided by our study. In the setting of an extraordinary health crisis, VC was not an alternative to IPC but instead became the consultation modality of choice. The only IPCs that took place at our centre occurred in the emergency department for patients that required an in-person examination. Randomisation was not feasible under these conditions. Our observational study therefore focused on a pragmatic and exhaustive approach including all patients who were offered a VC during the lockdown. Consequently, no sample size estimation was done to determine the statistical power of our study, particularly as our practice modalities were severely disrupted almost from one day to the next.
- Although our population is heterogeneous, it is representative of the profile of the patients managed on an everyday basis. As expected, the patients who accepted the VC were significantly younger. Informatics technology equipment, although increasingly present throughout the population, is often not available to elderly patients living in rural areas. To avoid this source of bias, public access to the equipment or the equipment itself would have had to be supplied to the study participants. This was not feasible given the suddenness of the health crisis.
- Another source of selection bias is the heterogeneity of the reasons for the consultations. Some patients were having their first consultation, whereas others were receiving pre-operative or post-operative follow-up, and the health conditions were either degenerative or post-traumatic. Nonetheless, we found no statistically significant association linking satisfaction to the reason for the consultation (pre-operative/post-operative) or to whether or not the VC was the first consultation in patients who had not had surgery.
- Finally, we evaluated satisfaction in the patients but not in the surgeons. The surgeons were the nexus that was crucial to the organisation and conduct of the VC. It would be of interest to have information on the satisfaction of the surgeons with the VC and their opinions about the indications in which VCs are most appropriate and the means needed to ensure the conduct of VCs.

However, the number of surgeons in our study (n = 5) was not sufficient to obtain relevant results. We believe it would be more informative to organise a nationwide survey of the satisfaction of French orthopaedic surgeons with VCs. This will be the specific focus of a new study.

6. Conclusion

During the lockdown, VCs gained an unprecedented level of popularity. The satisfaction rate was high. Satisfaction was not significantly influenced by the reason for the VC (joint involved, degenerative vs. post-traumatic condition, first VC vs. follow-up before or after surgery). VCs allowed the continuity of care while respecting distancing recommendations under good conditions. Although most patients felt the VC was equivalent to an IPC, the population, notably those in the younger age brackets, preferred to have an in-person encounter with the surgeon during the consultation. VCs will again surge in popularity if IPCs become impossible due to a further health crisis, but outside these exceptional circumstances the IPC remains the modality preferred by the vast majority of our patients. Inasmuch as VCs are rendered indispensable by the current health situation, a study of the satisfaction of surgeons with VCs may be relevant in the future.

Disclosure of interest

The authors declare that they have no competing interest.

In a manner unrelated to this work, Alexis Perrin is a consultant for Medicrea, Marc Limousin is a consultant for Exatech, and Frank Remy is a consultant for Zimmer Biomet. None of the other authors has any conflicts of interest to declare.

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Contributions

Alexis Perrin conceived the study, wrote the article, revised the article for important intellectual content, and submitted the article.

Nicolas Mainard contributed to write the article and revised the article for important intellectual content.

Marc Limousin, Eric Meyer, Guillaume Strouk, and Franck Remy revised the article for important intellectual content.

Laurene Norberciak performed the statistical analysis and revised the article for important intellectual content.

Pierre-Emmanuel Ridon contributed to conceive the study and to write the article and revised the article for important intellectual content.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.otsr.2022.103345.

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