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Evaluation of patient satisfaction with an ophthalmology video consultation during the COVID-19 pandemic

Background and objective

Teleophthalmology is a branch of tele-medicine specialized in ophthalmological care using remote digital technologies. Since its first description in the specialist literature in 1975, teleophthalmology has gained enormously in importance in the intervening decades due to rapid digitalization [8]. As a practical and generally accessible approach to patient care, teleophthalmology has been successfully used in the treatment of a growing number of ophthalmological disorders. A distinction is made between asynchronous (store-and-forward) and synchronous (live video consultation) methods of telemedicine. Another method is a hybrid consultation, which combines previous device-based investigations with the subsequent live video consultation. In most countries, teleophthalmological care is based on the asynchronous model, whereby the screening and monitoring of a variety of eye disorders is carried out using diagnostic equipment at an optometrist, who then forwards the findings to the ophthalmologist. Numerous international studies have demonstrated the effectiveness of telemedicine in the screening for and monitoring of diabetic retinopathy (DR) in primary care centers [1, 12]. Modjtahedi et al. concluded that telemedicine is a highly promising method for monitoring patients with suspected glaucoma [15]. The study by De Bats et al. evidenced the successful use of nonmydriatic fundus photography and telemedicine in screening for age-related macular degeneration (AMD) [5]. Ting et al. presented in their study an artificial intelligence (AI)-assisted telemedicine platform for cataract screening and management [20]. Results published by Kern et al. showed that teleophthalmology effectively reduces the number of unnecessary referrals to eye care centers [10]. In addition, improved accessibility to eye care and the promotion of DR screening in rural areas by means of teleophthalmology resulted in high satisfaction among patients as well as medical personnel [22]. The synchronous method of teleophthalmology comprises a live video consultation, during which the patient history is taken and an examination is performed online via video link without a prior examination. The results show that this method of consultation can be reliably used to diagnose and monitor pediatric eye disorders, and that through collaboration between opticians and ophthalmologists using video conferencing technology, it is able to ensure care for under-served groups of the population [16]. In addition, telemedicine can successfully aid surgical procedures via telementoring [19]. This method of teleophthalmology consultation plays an important role in maintaining standards of medical care under complicated circumstances. The United States army successfully established a teleophthalmology concept to ensure appropriate and prompt referrals and, in some cases, avoid unnecessary evacuation [14].

Over the course of the current coronavirus (COVID-19) pandemic, the demand for teleophthalmology solutions has drastically grown. The broad availability of modern communication technology in the population and pre-existing teleconsultation platforms enabled the straightforward and rapid implementation of teleophthalmology. Video consultations (VCs) have been introduced in ophthalmology practices and departments worldwide as an alternative to the conventional consultation, in order to reduce the risk of infection transmission associated with the close contact between patient and physician during the slit-lamp examination, as well as between patients in waiting rooms. The concept is based on live video consultations. In contrast to the asynchronous method, this consultation approach offers entirely contactless patient consultation. As such, this has contributed to achieving the maximum level of infection prevention while ensuring adequate medical care of eye patients. Furthermore, teleophthalmology may provide solutions that enable practices and centers to compensate for the lower number of patient presentations as a result of the pandemic.

This study evaluates the most frequent reasons for patient presentations to a VC, the proportion of patients who, despite

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Table 1 Questions on satisfaction with the video consultation

1.	How would you rate the allocation of your video consultation appointment? (Grade 1–6)
2.	Did your video consultation take place? (Yes/No)
3.	How easy did you find it to access the video consultation? (Grade 1–6)
4.	How stable was the connection in terms of sound and image quality? (Grade 1–6)
5.	How would you rate your overall experience with video-telephony? (Grade 1–6)
6.	Would you recommend a video consultation to someone else? (Yes/No)
7.	Did you hold the video consultation via your cell phone, tablet, laptop, or PC?
8.	If you used your cell phone or tablet for the video consultation, what operating system does your device use? (iOS/Android)

VCs, needed to present to a practice, the practical challenges posed by setting up VCs, and patient satisfaction at an ophthalmology practice (Drs. Kortüm, Ludwigsburg, Germany) during the early phase of the COVID-19 pandemic.

Materials and methods

This retrospective cohort study included patients who signed up at the practice for a VC during the period 20.03.2020–09.04.2020. VCs were held via the video platform https://arztkonsultation.de/, which was chosen following a market analysis of video service providers (certified by the German Association of Statutory Health Insurance Physicians [2]). As a result of the corona crisis, numerous providers have been offering free use of the service. Calls subsequently cost €1.99/call or one can pay a flat fee between €9.90 and €49.

The statutory health insurances were billed using the usual invoice settlement method. When billing, the video consultation case is given the uniform assessment standard (*einheitlichen Bewertungsmaßstab* [EBM]) number 88220 if only a video consultation has taken place and there has been no personal consultation at the practice as yet. For oph-

thalmologists, this code results in a 30% reduction of the basic flat rate, as does the 06225 code for ophthalmologists working on a conservative basis. On the other hand, there is a code for start-up funding (EBM code 01451, €10/patient, maximum of 50 patients/quarter, limited to 2 years), as well as a technology surcharge (EBM code 01450, €4.33/patient, capped at €205.52/quarter).

Patients were informed about the VC via the practice's website, an announcement preceding all phone calls, and a newspaper advert, as well as through personal contact. On the basis of the German (Model) Professional Code for Physicians (*Musterberufsordnung* [MBO]) applicable in Baden-Württemberg, only patients who had previously been treated at the practice were eligible to receive telemedical treatment. In most other German federal states, a new version of the MBO that allows initial treatments has already been adopted.

VC appointments were made by telephone by the practice's medical assistants. Patients needed to provide a cell phone number. During the phone call with the practice, patients received an SMS with access details for the VC. Prior to the video consultation, all study participants were required to sign a consent form and return this to the practice. Patients with acute, new-onset visual deterioration and severe eye pain were not invited for a VC, but were instead told to present to the practice in person. A specialist usually held the video consultation on this platform within 24 h of the appointment being made on the video service provider's website. Video consultations were carried out between a physician at a computer and the patient using a device with a front camera and microphone. It was possible to establish mutual verbal and visual contact. Patient history was taken in a first step; patients were then asked to film their eyes with their device's front camera while looking in different directions of view and lifting their eyelids. In cases in which no visible pathology could be identified or the patient history was unclear, a conventional appointment at the practice was arranged. During the video consultation, all patients were informed that the

option was available to have a conventional appointment in the case of deterioration or persistent symptoms. The authors drew up a questionnaire with eight questions (◘ Table 1). The patients were asked these questions over the phone by a physician (not more than 48 h after the VC appointment). The VC was evaluated using a school grading system on a scale from 1 to 6: (1)—very good, (2)—good, (3)—satisfactory, (4)—sufficient, (5)—poor, (6)—insufficient. Age and gender of study participants were determined from their medical records. The reason for presenting in the VC was noted (postoperative and other). Symptomatic patients were divided into two groups (anterior and posterior segment symptoms) depending on their symptoms. Asymptomatic patients formed a further group. During the observation period of 3 weeks following the preceding video consultation, the authors recorded data on renewed patient presentation in person at the practice or repeated teleophthalmology consultations for the same symptoms. Data analysis was performed using Excel, version 16.36 (Microsoft, Redmond, WA, USA, 2020). Data were represented as a proportional and percentage distribution, as well as mean value.

Results

A total of 29 patients were included in this study. Mean age was 59.3 years; 16 (55.17%) patients were female, and 13 (44.83%) male. The mean age of female patients was 64.7 years, and 52.6 years for male participants. Video consultations were held with 20 of 29 (68.97%) participants, while a video link could not be established with 9 of the 29 (31.03%). The share of successfully conducted video consultations was 9/16 (56.25%) of female and 11/13 (84.62%) of male patients (◘ Table 2).

All study participants graded appointment allocation for the VC with 1.4; the 20 study participants who were successfully consulted via video-telephony gave an average grade of 1.5 for accessing video-telephony, as well as for the stability of the connection in terms of sound and image quality (◘ Table 3; ◘ Fig. 1).

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Evaluation of patient satisfaction with an ophthalmology video consultation during the COVID-19 pandemic

Abstract

Background. We introduced a video consultation (VC) during the coronavirus (COVID-19) pandemic in an ophthalmology practice with eight doctors to ensure continuous ophthalmological care, infection prophylaxis and to compensate a decreased number of patient presentations.
Objective. Evaluation of the most common reasons for patient presentations in the VC, the proportion of re-presentations in the practice despite VC, practical challenges associated with the introduction of VC and patient satisfaction.
Material and methods. Patients with a recent acute visual deterioration and severe eye pain were excluded from the VC. The VC were carried out by a trained specialist in ophthalmology. A questionnaire with eight questions was completed after the VC appointment in order to evaluate the proportion of completed VC and patient satisfaction.
Results. We included 29 (13 male, Ø 52.6 years, 16 female, Ø 64.7 years) patients in this analysis. The VC could be performed with 68.97% of the participants who rated their overall experience with an average grade of 1.6 (1 very good to 6 insufficient) and all of them indicated that they would recommend the VC. Of presentations in VC 70% were related to the symptoms of the anterior eye segment. In 70% of the cases no re-presentations took place in the unit.
Conclusion. Our study represents a significant practical application of VC for the management of non-urgent ocular conditions with maximum infection prophylaxis. The introduction of VC was severely limited by technological or user-related issues by the establishment of video connections. Patient satisfaction with VC was high to very high.

Keywords

Efficiency improvement · Telemedicine · Teleophthalmology · Workflow optimization · Healthcare research

Evaluierung der Patientenzufriedenheit mit einer augenärztlichen Videosprechstunde während der COVID-19-Pandemie

Zusammenfassung

Hintergrund. Wir haben in einer Augenarztpraxis mit 8 Ärzten eine Videosprechstunde (VISP) während der Corona (COVID-19)-Pandemie eingeführt, um eine kontinuierliche ophthalmologische Versorgung zu gewährleisten, eine Infektionsprophylaxe sicherzustellen und eine geringere Anzahl von Patientenpräsentationen zu kompensieren.
Fragestellung. Evaluierung der häufigsten Gründe für die Patientenvorstellungen in der VISP, des Anteils an Wiedervorstellungen in der Praxis trotz VISP, der praktischen Herausforderungen bei der Einführung einer VISP sowie der Patientenzufriedenheit.
Material und Methoden. Es wurden keinen Patienten mit neu aufgetretenen akuten Sehverschlechterungen und starken Augenschmerzen Termine in der VISP angeboten. Die Videokonsultation wurde von einem Facharzt durchgeführt. Um die VISP zu evaluieren, wurde ein Fragebogen (8 Fragen) im Anschluss an den VISP-Termin telefonisch abgefragt.
Ergebnisse. Wir analysierten 29 (13 männlich, Ø 52,6 Jahre, 16 weiblich, Ø 64,7 Jahre) Patienten. Die VISP kam bei 68,97 % der Teilnehmer zustande, die Gesamterfahrung wurde mit der Durchschnittsnote 1,6 bewertet, und alle gaben an, dass sie die VISP weiterempfehlen würden; 70 % der Vorstellungen in der VISP bezogen sich auf die Symptomatik des vorderen Augenabschnittes. In 70 % der Fälle erfolgte keine erneute Vorstellung in der Praxis.
Diskussion. Wir beobachteten eine hohe praktische Anwendungsmöglichkeit der VISP zum Management nicht dringender Augenerkrankungen bei maximaler Infektionsprophylaxe. Die Einführung der VISP war stark durch technologisch- oder benutzerbedingte Problematik bei der Videoverbindungsherstellung limitiert. Die Patientenzufriedenheit mit der VISP war hoch bis sehr hoch.

Schlüsselwörter

Effizienzsteigerung · Telemedizin · Teleophthalmologie · Workflow-Optimierung · Versorgungsforschung

The patients who were consulted gave an average grade of 1.6 for the overall VC experience. All video-consulted patients stated that they would recommend the VC approach to others.

The authors analyzed the devices used by all 29 study participants for the VC. Most study participants (26/29, 89.66%) attempted to establish a video link on their smartphone. The other 3 (10.34%) of the 29 patients used their tablet for this. The majority (16/26, 61.54%) of smartphone users had a smartphone with an Android operating system (Google, Mountain View, CA, USA), while the remaining users (10/26, 38.46%) had an iPhone (iOS operating system; Apple, Cupertino, CA, USA; **Fig. 2**). All tablets were Android. A link could be established on tablets in all cases, while this was possible with most (80%) iPhones and 56% of Android smartphones (**Fig. 3**).

As part of the study, the authors collected information on the reason for patient presentation to the video consultation. Diagnoses were made during the video consultation on the basis of patient history and images from the live video transmission of eyes. This live transmission often made it possible to identify pathology in the anterior eye segment, such as redness, pus, and hemorrhage. The authors found image and sound quality to be sufficient in most cases. The results show that 12/20 (60%) patients attending a VC did so due to symptoms

Table 2 Patient characteristics

Study participants	All study participants	Registered for VC		VC took place		VC did not take place	
Gender	Male and female	Male	Female	Male	Female	Male	Female
Number or patients, %	29 (100%)	13 (44.83%)	16 (55.17%)	11 (84.62%)	9 (56.25%)	2 (15.38%)	7 (43.75%)
Mean age, years	59.3	52.6	64.7	48.3	64.6	76.5	64.9
VC video consultation							

Table 3 Evaluation of the video consultation and average grades

Evaluation of the VC	Average grade
Appointment allocation	1.4
Accessing link	1.5
Stability of the link in terms of sound and image quality	1.5
Overall experience	1.6
VC video consultation	

in the anterior eye segment (conjunctivitis, blepharitis, stye, iritis). In 8/20 (40%) patients, postoperative follow-up was performed (status following intravitreal injection, cataract surgery, retinal surgery); 2/8 (25%) of operated patients presented due to symptoms in the anterior and 1/8 (12.5%) in the posterior eye segment; 5/8 (62.5%) postoperative patients were asymptomatic. The data show that 14/20 (70%) patients did not present again in the practice or in a VC within the 3-week observation period following the previous video consultation, while 6/20 (30%) patients did present again due to persistent symptoms or for further evaluation.

Discussion

The role of VCs in patient management

According to the study by Stagg et al., which was conducted in the USA and included more than 11 million patients, the number of participants visiting an emergency department due to eye problems rose by 30% (per 10,000 participants) between 2001 and 2014, and almost 25% of cases were non-urgent ocular conditions [17]. These results highlight the relevance of teleophthalmology as a potential instrument to optimize patient management. The authors introduced VC in their practice during the

COVID-19 pandemic in order to reduce the number of avoidable patient presentations and thereby ensure adequate infection prevention. According to the results of this study, most study participants (27/29, 93.1%) rated appointment allocation for their VC as very good and good, which suggests high acceptance of video consultations and makes them an attractive alternative for conventional consultations. Furthermore, the study data showed that the majority of patients (70%) presented to a VC due to symptoms in the anterior eye segment, 25% of patients were asymptomatic, and 5% of presentations were due to symptoms in the posterior eye segment. A total of 70% of all video-consulted patients did not present again, neither for a conventional consultation nor a video consultation, within the 3-week period following the previous consultation. The remaining patients (30%) were either called in for further diagnostic work-up or presented voluntarily due to a lack of improvement. This could point to a high level of practical application for VC in the management of non-urgent eye disorders.

Satisfaction with teleophthalmology

Given that teleophthalmology is being used to monitor an increasing number of eye disorders, several studies have been conducted to determine the level of satisfaction with this approach among patients. Most of these studies analyze patient satisfaction with asynchronous telemedicine consultations, whereby findings are recorded using diagnostic devices and then evaluated elsewhere. There are numerous studies demonstrating the successful implementation of these teleophthalmology methods in rural areas, mainly due to fact that these patients are under-served. The study by Host et al. shows a high level of sat-

isfaction with teleophthalmology video consultations among patients in rural Western Australia, where the majority of the 137 participants were either "very satisfied" (69.1%) or "satisfied" (24.5%) with the service [7]. Another study by Tuulonen et al. in northern Finland showed that 96% of 29 patients who received a VC for glaucoma subsequently favored a video consultation at their own healthcare center over a consultation at the university eye clinic [21]. The high level of satisfaction with teleophthalmology among patients living in rural areas has to do with the reduced time needed, easier accessibility of eye care, and lower travel costs. The study conducted in Finland by Lamminen et al. concluded that significant cost savings were made in the period 1997–2009 as a result of teleconsultations with ophthalmology and dermatology patients in primary care centers in rural areas compared to conventional hospital consultations [11]. These technological advances led to a reduction in costs for teleophthalmology equipment during the observation period, making it possible to expand the teleophthalmology services on offer. In turn, this led to lower costs for patients since they did not have to travel so far. Furthermore, the high level of satisfaction with teleophthalmology among patients is linked to the improvements in ophthalmology care, as achieved through the introduction of a number of eye screening programs. The study by Matimba et al. showed that 37% of study patients screened for diabetic retinopathy in Zimbabwe using teleophthalmology exhibited anomalies that would not otherwise have been diagnosed without screening [13]. A study conducted in Israel demonstrated a high level of patient satisfaction with the synchronous method of teleophthalmology (live video consultation); that particular study concluded that 98% of patients
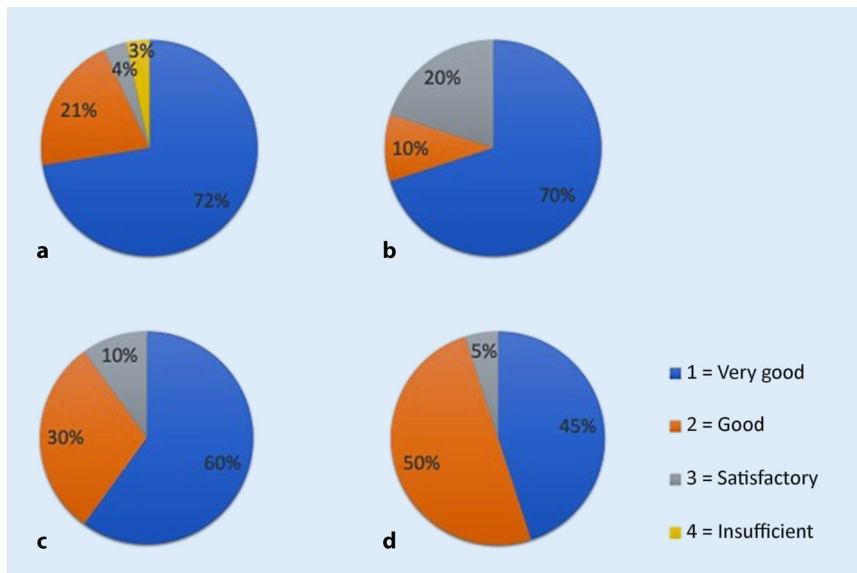
Fig. 1 ▲ Evaluation of the video consultation (VC). **a** Evaluation of appointment allocation for the VC; **b** evaluation of accessing the VC; **c** evaluation of the stability of the connection with regard to sound and image quality; **d** evaluation of the overall VC experience
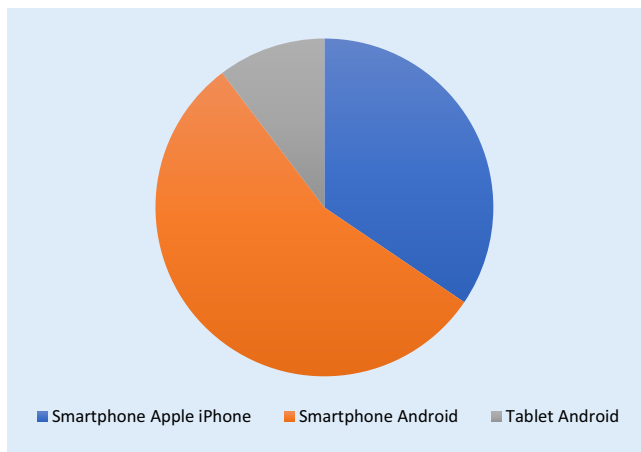
Fig. 2 ◄ Proportion of devices used for the video consultation according to operating system. *iPhone* (iOS operating system; Apple, Cupertino, CA, USA); *Android* operating system (Google, Mountain View, CA, USA).

consulted via VC in the emergency room would favor a VC over a conventional examination on their next emergency room visit [3]. The present study investigated patient satisfaction with the VCs that were introduced into the practice during the COVID-19 pandemic. The results show high patient satisfaction: 95% of patients rated their overall experience with the VCs as good or very good. All study participants stated that they would recommend the VC approach to others.

Challenges establishing video links

In order to achieve high patient satisfaction with VCs, it is also very important to ensure the functionality and good quality of the video link. Despite recent technological advances, video consultations may be interrupted, or indeed not take place at all, due to a number of technical problems. According to the results of a Greek study, technical problems arose in 13 of 56 (23.21%) telemedical examinations [6]. Tan et al. declared that the diagnostic accuracy of a live video examination primarily depends on the quality of Internet speed. Those authors proposed that, as an alternative, it may be beneficial to record relevant clinical information and images before the video consultation in order to minimize the effect of poor Internet connection on the quality of the VC [18]. Furthermore, the study conducted by Johansson et al. in

Sweden emphasized the importance of well-functioning training and a technical support team prior to implementing video consultations [9]. The results of the current study also reveal technological or user-defined challenges associated with VCs, since 9 of 29 (31.03%) consultations could not take place. The rate of unsuccessful connections was higher for users of smartphones and tablets with Android operating system (36.84%) compared to Apple iPhones (20%). One reason for this could be the different policies regarding product updates. For example, the iPhone receives the latest updates for approximately 4–5 years. With Android cell phones and tablets, this is usually the case for only 18 months, with the number and duration of updates varying significantly depending on the manufacturer. Another important aspect is that the range of product quality in the Android sector is far broader, meaning that a greater number of inferior devices may be in use; however, 16/20 (80%) patients who successfully received a VC rated the process of establishing a video link as very simple or simple, and only 4/20 (20%) as satisfactory; 18/20 (90%) patients rated the video and sound quality of the VC as very good or good, and only 2/20 (10%) as satisfactory. These results may suggest that unsuccessful video connections are more likely to be due to individual user problems.

Other technical developments

According to the results of the present study, most study participants (26/29, 89.66%) attempted to establish a video link via their smartphone, while the remaining participants (3/29, 10.34%) used tablets. These data show mobile devices to be powerful platforms for teleophthalmology. Chhablani et al. described the potential to improve the quality of teleophthalmology services by implementing additional diagnostic and therapeutic instruments that patients can access with their portable devices [4]. A variety of apps that have been developed to, e.g., test visual acuity, should yield additional relevant information that could contribute to improving the diagnostic accuracy of video consul-
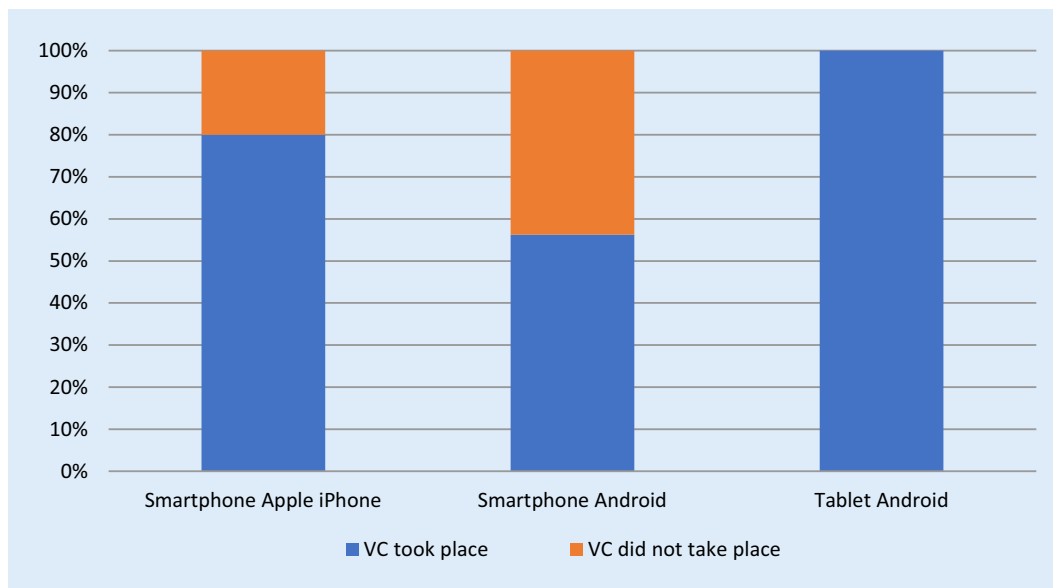
Fig. 3 ◄ Percentage of successful connections according to operating system. *VC* video consultation. *iPhone* (iOS operating system; Apple, Cupertino, CA, USA); *Android* operating system (Google, Mountain View, CA, USA).

tations, while electronic prescriptions should enable faster access to treatment [23]. All of these factors could help increase the attractiveness and user friendliness of VCs, thereby resulting in a further reduction in avoidable patient presentations. Hybrid solutions represent another possibility. With these, better use could be made of existing diagnostic equipment by enabling patients to be examined by practice personnel after consultation hours, in the evenings, or at weekends (e.g., vision, non-contact tonometry, and visual field testing). The results of these express examinations would then be discussed at a later date with a physician in a video consultation.

Limitations

This study is limited by the relatively small number of cases, and larger prospective multicenter studies based on different video consultation platforms should be planned in order to further investigate the use of VCs in ophthalmology practices and centers. Larger studies would also help gauge the effect that patient age and educational level have on accessibility to teleophthalmology. Further studies are also needed to determine the proportion of patients who are interested in video consultations but are unable to make use of these due to a lack of hardware or technical knowhow. It is unclear whether VCs would be associated with the same level of patient satisfaction post pandemic. Further studies are also needed to better define the diagnostic accuracy and therapeutic applicability of video consultations, as well as to analyze the precise technological and user-related causes of unsuccessful video consultations.

Conclusion

During the COVID-19 pandemic, VCs served as a complement in selected cases to conventional consultations at the ophthalmology practice of Drs. Kortüm and helped to maintain ongoing eye care while ensuring appropriate infection prevention. Video consultations were associated with a high level of patient satisfaction; however, they were hampered by a relatively high rate of technological or user-defined challenges in establishing a video link. Continuous user-oriented technological development is crucial for this consultation method to become more widespread.

Practical conclusion

- **Teleophthalmology is being successfully used in the management of a variety of ophthalmological diseases.**
- **Video consultations are attractive and accessible to almost all patients, irrespective of patient age and location.**
- **In selected cases, they offer a comparable alternative to conventional consultations and could help ensure appropriate infection prevention during a pandemic.**
- **Video consultations are associated with a high level of patient satisfaction.**
- **Despite technological advances, a high percentage of video connections are not possible due to technical or user-defined problems.**
- **The quality of video consultations can be improved by using additional equipment in practices and special programs on mobile devices.**

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Compliance with ethical guidelines

standards indicated in each case. Written consent was obtained from all survey participants. Ethics commission approval was not required.

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