REVIEW

e-Health and telemedicine implementation in facial paralysis: challenges and pitfalls

Elijah E. Sanches [1] · Frank W. de Jongh [1,2] · Koen J. A. O. Ingels [3] · Sjaak Pouwels [4]

Abstract

During the current Covid-19 pandemic, a lot of changes had to be made in the care of patients with facial nerve paralysis (FNP). FNP is a life-changing condition with effects on both physical (both esthetic and functional) and psychological aspects of the patient's life. Telemedicine could be a suitable alternative in the therapy for these patients, since it is often not possible to travel to outpatient clinics or to have normal face-to-face appointments with treating physicians because of pandemic restrictions. This review provides an overview of the current literature in the treatment of FNP during the pandemic and the role of telemedicine/e-Health. Secondly, we will discuss the challenges and pitfalls of implementing e-Health and telemedicine applications in clinical practice.
Level of evidence: Not ratable

Keywords Facial paralysis · Facial plastic surgery · Telemedicine · Mobile application · Digital · e-Health · Mobile health

Introduction

A lot of things changed during the current Covid-19 pandemic. One of the most important changes that occurred in the medical world is the enormous rise in the application of "Telemedicine." According to the WHO, telemedicine is literally "healing at a distance," meaning any application of Information Communication Technology (ICT) that can improve patient outcomes by increasing access to care and medical information [1]. There is already a lot of evidence proving the benefits of ICT applications in patient care, especially the positive effects of telemedicine. These positive effects of telemedicine are related to easy accessibility, higher levels of compliance, and improvement in quality of life [2].

Due to several (social distancing) measures during this outbreak, it was impossible for physicians to see patients in the same way as before [3]. Governments advised their inhabitants to stay 1.5 m (the distance differs in several countries) apart to stop the spread of the disease [4]. Therefore, an increasing need in telemedicine applications arose [5]. In some fields of medicine, telemedicine is already well-developed and patients will get almost the same quality of care that they are used to [2]. The question is: are telemedicine applications, in any form, suitable/applicable on patients afflicted by facial nerve paralysis (FNP). This review provides an overview of the current literature in the treatment of FNP during the pandemic and the role of telemedicine/e-health. Secondly, we will discuss the challenges and pitfalls of implementing e-Health and telemedicine applications in clinical practice.

✉ Sjaak Pouwels
  Sjaakpwls@gmail.com

1 Department of Plastic-, Reconstructive and Hand- Surgery, Haaglanden Medical Center, The Hague, The Netherlands

2 Department of Cardiothoracic Surgery, Haga Hospital, The Hague, The Netherlands

3 Department of Otorhinolaryngology, Head & Neck Surgery, Radboud University Medical Center, Nijmegen, The Netherlands

4 Department of Intensive Care Medicine, Elisabeth-Tweesteden Hospital, P.O. Box 9051, 5000, LC Tilburg, The Netherlands

Telemedicine

Telemedicine is a relatively new way of practicing medicine which increases in use with ever-growing technical possibilities, which could be very promising, but the reliability of these applications in patients with a facial paralysis needs to be established. Telemedicine has shown promising results and could be a great tool to overcome several barriers that patients face when visiting the hospital, such as geographical and temporal factors [6].

The compliance rates after telemedicine are higher in groups undergoing pulmonary rehabilitation and in patients with chronic obstructive pulmonary disease (COPD); there were less emergency department visits and lower hospitalization rates in combination with a decrease in length of stay [7, 8]. The quality of life after telemedicine is equivalent to the standard care or even better in some cases [8]. In very specific groups (patients with medically unexplained pain (MUP)), telemedicine (Internet-based) could decrease the pain intensity, anxiety, stress, and depression [9].

Teleradiology is already part of telemedicine in otolaryngology and this works very well [10]. It is used to exchange radiographic and (relevant) clinical information between, for example, the emergency physicians and the otolaryngologists (who are not present at the hospital) to assess whether there is a clear indication for surgery [10]. Brucoli et al. conducted a retrospective study where 467 patients were triaged in accordance to the abovementioned technique [11]. The CT images were sent to the otolaryngologists for assessment, and of the 467 patients, 223 had no surgical indication, 176 had a possible indication, and 68 had a surgical indication [11]. After clinical assessment, all the surgical and non-surgical patients were in concordance with the teleradiological assessment, and of the possible surgical group, just 27 patients were advised to undergo surgery [11]. There are also several mobile device applications for patients with facial trauma that need an emergency department consult [12]. These applications facilitate remote consulting software, which means that the patients are given the opportunity to consult the emergency department clinicians, without a real-time visit [12]. This could be done by videoconferencing using the camera from the smartphone and/or tablet or by specific software connected to the application [12]. There were several positive aspects in comparison to real-time visits like a 5-fold quicker response time in comparison to in-person consultations, an overall congruence of treatment recommendation (90.5%), and there was also an improvement in patient satisfaction rates [12].

Clinicians (both plastic surgeons and otolaryngologists), who treat patients with FNP, use subjective parameters, outcomes, and descriptions to describe patient condition [12]. Often, this non-validated/subjective information is supplemented with nonstandard (medical) photographs [12]. The House-Brackmann scale, often used for FNP patients, was initially developed for patients recovering from vestibular Schwannoma extirpation [12]. That means that there could be errors when applying this method to other diseases causing FNP [12]. Thus, also before the Covid-19 era, there was a problem with adequately assessing the progress of the facial function in patients with a FNP.

Banks et al. developed an application to objectify facial function on a smartphone/laptop/desktop scale use [12]. The result is a useful, objective, visual assessment of FNP that could lead to a universal understanding among clinicians [12]. Since the application is made for several devices, it could be very useful for both patients and their treating physicians during this pandemic, and since the application is portable, it can be used from anywhere to communicate with their treating physician to interpret the data. Lee et al. stated that an automated, zone-specific facial analysis application could be better than clinical subjectivity and this will be the standardized assessment of FNP [13]. It is possible that in the (near) future, the role of automatic/digital assessments of the progress of FNP in patients could be much larger and even be a part of the standard treatment.

Facial nerve paralysis and the application of e-health

Facial palsy (paralysis) can be caused by several factors, e.g., viral, iatrogenic, neoplasms, traumatic, and inflammatory [14]. Only in one-third of the cases an exact diagnosis is found [14].

When the seventh cranial nerve (facial nerve, n. facialis, or NVII) is damaged, a form of facial nerve paralysis (FNP) could occur [6]. The facial nerve is responsible for the innervation of the mimic muscles, the secretomotor function of several glands (palatine, nasal, salivary, and lacrimal), and the gustatory organ [14]. The most evident symptom of the FNP is facial asymmetry, but FNP also presents with decreased saliva production, changes in taste, dysarthria, and synkinesis (happens when voluntary movements causes involuntary movements of muscle fibers due to erroneously regrowth of the nerve fibers after the initial damage) [14]. Corneal damage and difficulties regarding food manipulation and oral continence can be the consequence [15–23]. FNP also affects the patients psychologically, and this can cause a decrease in self-esteem, reduction of quality-of-life (QoL), anxiety, and depression [15–23]. The impact of a FNP on a patient's life is enormous.

There is also a significant change in facial appreciation in patients with FNP [14]. The symptoms of FNP could have a serious negative effect on patient quality of life [14, 24]. Tieman et al. try to explain several hypotheses about, among others, the facial appreciation of patients with FNP [14].

The House-Brackmann grading scale is used to scale the clinical severity of the disease on a six-point scale [14, 25]. Besides the House-Brackmann grading scale, there are two more systems that are used for the clinical evaluation of FNP. Firstly, there is the Sunnybrook facial grading system [26]. This system composes a 100-point scale based on the patients resting symmetry, synkinesis of the patients face, and 5 predetermined facial movements (forehead wrinkle, gentle eye closure, open mouth smile, snarl, and lip pucker) [26]. The third rating system is predominantly used in the Oceania area [26]. The Sydney system assesses the five facial nerve branches and their voluntary movements and synkinesis [26].

Due to the Covid-19 pandemic, there is a transition from traditional way of care to more modern ways. Due to all measurements that are taken to protect public health, there is an enormous rise in the application of telemedicine and especially e-health [26–28]. Eysenbach et al. stated that e-health is "an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies" [29].

m-Health (mobile health) is a component of e-health and is defined by the Global Observatory for e-Health (GOe) as medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices [30].

In plastic surgery, there are already several studies done to evaluate the effects of telemedicine/e-Health/m-Health [30–35]. In the systematic review by Vyas et al., the conclusion was that telemedicine improved postoperative monitoring, while lowering the costs. Besides this, it also increased the possibility to access expertise [35]. Telemedicine is now used in several disciplines in plastic surgery like wound management, burn management, trauma, free-flap care, cleft/palate repair, hand surgery, and maxillofacial. In the field of FNP, there are several forms of telemedicine used, but the results are still varying [6]. Tan et al. mentioned that in the specific field of FNP and telemedicine, there were not a lot of (large) studies conducted and most of the literature is on clinicians who implemented the techniques, without formal studies [6]. Therefore, Tan conducted an exploratory study to compare the reliability of the House-Brackmann, Sunnybrook, and Sydney facial grading systems in real life vs assessing pre-recorded videos [6]. The study concluded that the reliability of the three facial grading systems was mostly similar in the assessment of both groups, except for assessing synkinesis, on which the second group scored worse [6]. Although the videos were of 2D quality and the real-life assessment was of 3D quality, this did not bother the comparison [6]. However, both ways of assessing are mostly reliable; the differences are clinically too relevant to state that FNP patients could use telemedicine as substitute for real-life consultations [6].

Attempts have been made to assess facial asymmetry in a fast and non-invasive way using the VECTRA M3 stereophotogrammetric system, providing viable quantitative information in diagnosing, treatment planning, and evaluation [36]. Since 2D pictures do provide information on movement, 2D video lacks the anterior-posterior axis, there are now commercially available 3D video cameras which are important in judging faces [37–42]. Ten Harkel et al. [26] explored the possibility of an economically viable telemedicine 3D imaging system for home use. The RealSense F200 4D camera was chosen for its portability, its relatively low cost, and its ability to capture the anterior-posterior axis in facial movement [26, 43].

In 2014, the eFACE application was designed and validated by Banks et al. [12, 44]. This is a comprehensive, electronic, and clinician-graded facial function scale that assesses a visual scale of facial function using 3 parameters consisting of 5 static, 7 dynamic, and 4 synkinesis items [12, 44]. It uses smartphone or pc technology and provides relevant data to all practitioners involved. The authors found that the eFACE scores demonstrated very high inter-rater and intra-rater reliability in experienced facial nerve clinicians and that its ease in utility and continuous disfigurement scale provides a tool for facial palsy research and treatment [12, 44]. This was then tested whereas facial nerve clinicians to score and rescore these clips, providing positive results, since the participants were eager to apply the application in clinical practice, tested 30 FNP patient videos [44].

Challenges and pitfalls

Like all new techniques, telemedicine also has challenges or aspects that could be improved in the (near) future. In the next part of this review, the current challenges and pitfalls of the (an accelerative) implementation of telemedicine will be addressed.

Pitfalls that are present when the implementation is rushed

This is the first time that the world faces a pandemic of this magnitude, but during the earlier outbreaks, SARS-CoV, MERS-CoV, Ebola, and Zika were already experimented with a conceptual framework for telemedicine [27]. The first version was published in 2015. Ohannessian et al. [27] made a new framework especially for the Covid-19 outbreak. In the ideal situation, telemedicine is implemented when there is high-speed Internet available and there is a high number of smartphone ownership in the country [27]. However, a lot countries do not have a regulatory framework to implement (authorize, integrate, and reimburse) telemedicine quickly, particularly in emergency or outbreak situations [27, 45].

A problem that could arise with technology used for telemedicine is that if healthcare workers use free and convenient solutions for video calls like WhatsApp, Facetime, Zoom, or Skype; there is no control on national health data and privacy.

Another pitfall is the reimbursement, because not all countries reimburse telemedicine, while this is an essential part for the implementation of e-Health [27].

Besides the previously mentioned aspects, the following points need to be taken into account: (1) a data sharing network between telemedicine providers and epidemiological surveillance, (2) scientific evaluation of the telemedicine framework, (3) a campaign to inform the population on the use of telemedicine [27].

Bashshur et al. [46] stated that because of the rapid implementation of telemedicine, the technology is not optimal and therefore care is also suboptimal. Both patients and caregivers are not familiar with this medium of communication, and this suboptimal knowledge of the system will have a negative effect on the quality of care [46].

Current ICT-network and applications

Since telemedicine is "Internet-based," connectivity, video resolution, and sound quality should be guaranteed at all times. This provides difficulties in especially rural and low-income communities [47]. In those areas, there is not enough network accommodation because of low financial benefits, lack of legal requirements, and the lack of incentive for the private providers [47]. The use of smartphones is still rising and even "older" smartphones can be used for the implementation of e-Health (mobile-Health or m-Health). In The Netherlands and the USA, currently (2018) 87% and 81% of the population own a smartphone, respectively [48–50]. So, this could be an outcome for people living in rural areas, because there are no big differences in smartphone ownership in urban and rural areas, 83% vs 73%, respectively [48].

There is also a group of patients that could face difficulties with the implementation of widespread e-Health. This group are the (ICT)-illiterates [47, 51]. These groups have trouble reading and/or using any ICT tools, which could lead to "medical-isolation" [47, 51]. If this group visited the treating physician at an outpatient clinic, there were less barriers and less chance at medical isolation. This is especially true for the elderly patients.

Also, for some disabled patients, difficulties arise to have the same standard of care in telemedicine, because of the accessibility could be worse if you look at screen reader, magnification, colors and contrast, and sign language [47]. Devices used by FNP patients with other disabilities therefore require customization options, such as proper tele-evaluation through cameras or other measurement devices [47].

In some countries, there are also regulatory barriers that have been eased during the pandemic, which could be revoked when the pandemic ends [47]. Maybe those barriers could make it harder to implement telemedicine.

Imbursement and legal aspects

There are three main rights that patients have been looking at telemedicine [52]. Patients have the right to be reimbursed, the right of access to the report, and the opportunity to check the quality of services [52]. Basically, the same rights need to apply when going to the local healthcare facility.

The EU legal framework for telemedicine is revised. Several rights were added in comparison with the earlier legal framework, such as "The right to be forgotten," "The right that the needs to minimal," and the "Right not to be anonymised." Next to these rights, patients always have the right to demand that all their personal information need to be erased [52]. See Table 1 for a clear overview of the current legal framework in the European Union regarding telemedicine [11, 53, 54].

For telemedicine information, the same standard holds as for regular medical information, namely that patient's

Table 1 Overview of the current legal framework in the European Union regarding telemedicine [11, 53, 54]

Current EU legislation to telemedicine
1. "Telemedicine is both a health service and an information society service."
2. "Freedom for recipients of the healthcare service to seek and receive medical treatment from another member state, regardless of how the service is delivered, i.e., also by telemedicine."
3. "If member states adopt new laws, regarding technical regulations and information services (e.g., telemedicine), they are obliged to notify the European Commission."
4. "Professional-to-professional telemedicine services are conducted to the laws of the country of the sending professional. Professional-to-patient telemedicine services need to be according to the law of the country of the patient (recipient)."
5. "The definition of a medical act is a matter for the member states. As a general principle, it is stated that the telemedicine equivalent of the conventional medical service (e.g., teleradiology vs radiology) needs to adhere to the same requirements as the conventional service. Otherwise, it would be possible that poorly regulated telemedicine equivalents would replace the highly regulated conventional methods."
6. "Regarding the handling of personal data and the protection of privacy, there are the same requirements as all other interactive on-line services."
7. "In addition to the abovementioned point regarding personal data and privacy, there are specific requirements for the providers of electronic communication services to ensure confidentiality of communication and security of the network."
8. "There are criteria for specific professions with qualifications in one member state, so that they could gain access (via telemedicine) in other member states to the same profession."

information only can be send or shared with (explicit) consent of the patient [52]. Patients have the right to check the quality of the service, and for this reason, the name of the physician who's involved with the telemedicine procedure needs to be included in the report [52].

Conclusions

Telemedicine will probably never completely replace the "old-fashioned"/ conventional way of practicing medicine, but it will be a proper complementary tool to elevate the levels of patient care. Telemedicine is relatively new, and it will take time to let it work properly in all types of specialties. Looking at the FNP, there are some promising tools for the near future that could be used during this pandemic, the possible 2nd wave and probably the time after everything is returned to normal. It could be a way to lower the healthcare costs and to make healthcare more accessible for a larger group of patients. Despite the fact that most of the techniques are still in their infancy, they could very promising in the (near) future. The current pandemic provides momentum to prove the ever-increasing capabilities of telemedicine and should be used to provide adequate evidence so telemedicine remains a growing field of study even after the pandemic ends.

Declarations

Ethics approval   For this type of review study formal consent from a local ethics committee is not required.

Conflict of interest   Elijah E. Sanches, Frank W. de Jongh, K.J.A.O. Ingels, and Sjaak Pouwels declare no conflict of interest.

Informed consent   Not applicable

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