

Teledermatology update: Mobile teledermatology

Feroze Kaliyadan

Feroze Kaliyadan, Department of Dermatology, College of Medicine, King Faisal University, 31982 Hofuf, Saudi Arabia
Author contributions: Kaliyadan F solely contributed to this paper.

Correspondence to: Feroze Kaliyadan, MD, DNB, MNAMS, Assistant professor, Department of Dermatology, College of Medicine, King Faisal University, 31982 Hofuf, Saudi Arabia. ferozkal@hotmail.com

Telephone: +966-5-4471068 Fax: +966-3-5800000

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Core tip: Mobile teledermatology is emerging as a feasible and cost-effective method for teledermatology practice. Mobile teledermatology is useful in diagnosis, screening and triage of skin lesions including skin cancers. It is also useful as a tool to follow up patients with chronic dermatological problems. However more studies are required for standardization of mobile teledermatology protocols.

Abstract

Mobile teledermatology is a relatively recent modification of teledermatology, which involves using mobile platforms like cellular phones to transmit images and data for the purpose of teleconsultations. With the rapidly improving quality of smart phone cameras combined with easier access to mobile internet, mobile teledermatology is emerging as a feasible and cost-effective method for teledermatology practice. Mobile teledermatology has shown good results in concordance studies comparing it to face-to-face consultations. Mobile teledermatology can be used for most types of clinical dermatology cases. Mobile teledermatology has been found to be useful in diagnosis, screening and triage of skin lesions including skin cancers. It is also useful as a tool to follow up patients with chronic dermatological problems like psoriasis and chronic wounds. The obvious advantage of mobile teledermatology is its cost-effectiveness and the fact that access to expert dermatology care is made easier for patients especially in remote areas. Further research is however required to standardize protocols for mobile teledermatology. Collaborative research among people working in this field would be very useful in this standardization and would help in optimizing the opportunities provided by this interesting tool. This article gives a brief overview of mobile teledermatology including definitions, tools involved, indications, limitations and future applications.

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INTRODUCTION

Dermatology is a visual specialty and this makes it the most apt for remote diagnosis using patient's images. Teledermatology has been shown to be an effective method for diagnosis and triage of dermatological conditions. Research in this field has grown extensively over the last decade. One particular area which has received increased interest in the last few years is "mobile teledermatology". This article focuses mainly on this newer area of teledermatology^[1-3].

DEFINITIONS AND CLASSIFICATION

The WHO definition of telemedicine is: "The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the

continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities”^[4]. The application of the principles of telemedicine to dermatology is generally referred to as “teledermatology”^[2]. A teledermatology tool is the specific technology or modality used to deliver dermatology care and the application of teledermatology tool to actually deliver dermatology care is referred to as teledermatology practice (TP)^[5].

The TP is traditionally classified into three broad groups: (1) Video based or “real time” consultations-The advantage of real-time consultations is that the expert can clarify gaps in the history directly with the referring physician or the patient. This disadvantage is that video quality is often not clear enough to make accurate diagnosis of skin lesions^[2]; (2) Image based or Store and forward teledermatology (SAFT)-is the most used method of teledermatology, where the concerned images are forwarded to the expert who offers an opinion by e-mail or by a follow up real time consultation. The advantage is that clear visualization of the skin lesions can be done. The disadvantage is that gaps in history are more difficult to address. A modification of the SAFT is the online discussion groups where multiple experts can comment on cases which are difficult to diagnose or manage. Nowadays the common JPG format is used for a lot of SAFT based consultations. The Digital Imaging and Communications in Medicine format is another standard format used medical image handling and storing in the context of teledermatology, especially when the images are linked to electronic patient medical records^[2]; and (3) Hybrid teledermatology, where a combination of video and image files is used. This is probably the most ideal method of teledermatology provided that both the referring side and the expert have the requisite equipment for good quality video consultations along with a effective and standardized image transfer protocol^[2,6].

All the above are based on stationary platforms. In contrast with advances in mobile technology it has become feasible to use mobile phones as a medium to transmit dermatological images-clinical and dermoscopic, for diagnosis, triage and follow up purposes. Using such non-stationary platforms for data transmission, primarily in the form of mobile phones for teledermatology is generally referred to as teledermatology. Tablet computers and other hand held devices can also be used for mobile teledermatology. It should be understand that most mobile teledermatology consultations are basically a modification of SAFT^[3,5,7]. The first effective used of mobile phones for teledermatology in the follow up of wound care was described by Braun *et al*^[8]. A modification of the mobile teledermatology system is when the patient or the referring physician sends the images *via* the mobile phone to a fixed internet portal where the expert can log in and give his comments^[9]. The images in mobile teledermatology can be sent directly through internet protocols or through the mobile phone service itself in the form of multimedia messaging services (MMS)^[10].

ADVANTAGES OF MOBILE TELEDERMATOLOGY

The obvious advantage of mobile teledermatology is the mobility factor. The consulting dermatologist and the referring physician (or the patient) does not need to be at a particular location for transmitting and receiving data. Moreover, with time mobile teledermatology has become cost effective with the decreasing cost of smart phones, increased capability of mobile phone cameras and mobile broadband services. A number of feasibility studies have suggested that mobile teledermatology is a useful tool in diagnosis, triage and follow-up of dermatological cases. Ultimately an effective mobile teledermatology system could help in significant cost cutting in patient care, especially in the context of cancer screening, follow up of chronic skin conditions^[11-17].

SPECIFIC CONTEXTS OF APPLICATION OF MOBILE TELEDERMATOLOGY

The application of such mobile teledermatology systems would be particularly useful in resource poor and remote areas^[13,15,18]. One of these studies was conducted in human immunodeficiency virus (HIV) positive individuals in Botswana and Overall, mobile teledermatology consultations were well accepted by HIV-positive patients. Most patients in the study felt that mobile teledermatology consultations for all parts of their body would be acceptable. Facial lesions were also not a problem as long as it was ensured that personal recognition was not possible^[15]. Another study from Egypt also found a good concordance between face-to-face clinical diagnosis and mobile teledermatology consults using a 5 megapixel mobile phone camera. This study also showed the feasibility of mobile teledermatology for clinical diagnosis, though this study had a limitation of a small sample size^[13].

There are a number of studies which have tried to evaluate the use of teledermatology in screening for skin cancers. Mobile teledermatology has also been shown to be effective in diagnosis and triage of skin cancer. A study by Lamel *et al*^[16], showed a good concordance between mobile teledermatology consultation and face-to-face consults for screening and management of skin cancers. Combining mobile teledermatology with dermoscopy (teledermoscopy) can further increase the diagnostic efficacy of mobile teledermatology in the context of screening for skin cancers. Mobile teledermoscopy can be essentially implemented as a triage screening tool for malignant tumors to facilitate early detection and diagnosis, which in turn would lead to improved patient outcomes. At the same time this would lead to a reduction in the cost burden for skin cancer screening programs^[14,19-21].

The other major indication of mobile teledermatology is in the follow up of chronic patients. Studies have shown that mobile teledermatology is feasible in following up patients with chronic skin conditions like psoriasis^[17,22] and for wound follow up^[8].

The suitability of cases for teledermatology consultations has been addressed by various studies including our own studies^[6,23]. Logically most cases suitable for teledermatology in general would be suitable for mobile teledermatology also. In our previous study^[6], we found that certainty of diagnosis was more in cases like viral warts, herpes zoster, acne vulgaris, irritant dermatitis, vitiligo, and superficial bacterial and fungal infections. In some cases like papulosquamous diseases, chronic granulomatous conditions, autoimmune vesiculobullous conditions and vasculitis the certainty of diagnosis was relatively lower. However in our study the utility of teledermatology as a screening and triage tool was evident.

We have also been using mobile teledermatology over the last two years (using mobile phones at both ends of the consultation) and have found a high level of satisfaction among the patients for this model of teledermatology. This probably reflects the high levels of satisfaction in general with teledermatology that has been reported by various studies in the past^[24-26].

PROBLEMS AND DISADVANTAGES

Most of the problems inherent to SAFT exist in the case of mobile teledermatology also-these include legal, ethical and cultural issues-especially in the case of genital and facial lesions. Like in SAFT the referring physician should have a general idea of which lesions to focus on and should have a basic understanding of dermatological nomenclature to really effectively convey the patient history. Standardization of the images is another issue. The referring physician should be familiar with the basic of dermatological photography and ideally both ends of the teledermatology consult should have the same type of mobile equipment. Mobile internet connectivity is another issue especially in resource poor regions. Mobile dermoscopy is another valuable addition to mobile teledermatology, but equipment for the same is limited and costly at present. Another issue that should be understood that for a given value of megapixels, the resolution for a mobile phones tends to be less than that of a proper digital camera, essentially because the size of the sensor tends to be smaller in a mobile phone. Also the macro mode for taking close-up images of skin lesions does not work as well in mobile phones as in a dedicated camera. Previous studies have mentioned a lack of support among administration and clinicians in general for implementation of teledermatology services. This could be a hindrance in the development of mobile teledermatology programs also^[27]. The lack of proper rapport with the patients is an inherent problem with SAFT and the same applies to mobile teledermatology also^[28,29].

THE FUTURE AND CHALLENGES IN MOBILE TELEDERMATOLOGY

With the advent of various tools which can convert smart phones into dermoscopes, mobile teledermoscopy

combined with the normal clinical images could definitely lead to more effective diagnosis and triage for dermatological diseases especially malignancies. Self monitoring mobile based protocols to assess melanomas and further refinement of mobile dermoscopy for melanoma screening are being given increasing importance. However it is suggested to exercise some amount of caution in diagnosis of melanoma risk analysis while using mobile teledermatology considering the lack of proper standardization at present^[30-32].

Options for transferring histopathology images to mobile phone and transmit it along with clinical and dermoscopic images would be another exciting possibility in the future. Teledermoscopy has already proven to be an effective triage tool for melanomas. Often clinical images are insufficient for accurate diagnosis of melanoma. Combining the clinical images with dermoscopy has shown to significantly improve diagnostic accuracy for melanomas. The development of a standardized and cost effective method for teledermoscopy would enhance the effectiveness of teledermatology in screening for skin cancers^[33-35].

Electronic medical records are gradually becoming the norm the world over including dermatology^[36]. Designing electronic medical records which are adapted for the mobile phone will also help in better documentation of mobile teledermatology consultations.

Mobile teledermatology could be a very useful tool in dermatological and aesthetic surgery, in the future. This could be especially useful in patient follow up for wound care thus avoiding unnecessary direct visits for follow up after minor procedures. Nurses and other allied health professionals may also be trained for follow of cases of dermatological surgery. The future might also see more of patient initiated mobile teledermatology^[37-48].

Standardization of dermatological imaging for teledermatology and the legal aspects associated with transmission of medical images will require a lot of streamlining and clarity in the context of mobile teledermatology. The person at the referring end should be able to take good quality images for proper training for this will be an essential pre-requisite for effective mobile teledermatology^[49-52].

Finally we can expect to see more of hybrid mobile based consultations where initially clinical or dermoscopic images are sent to the expert and later followed up by a real time/video consult where any gaps in history can be addressed.

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