Teledermatology: The Use of Ubiquitous Technology to Redefine Traditional Medical Instruction, Collaboration, and Consultation

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ABSTRACT

The seemingly ubiquitous use and acceptance of mobile, Wi-Fi-enabled, camera-ready tablets are offering dermatological clinicians a new telemedicine tool and collaborative learning platform, which may come to replace the traditional practice of forwarding digital still photographs to colleagues for consultation. The decreased cost and the increased ease of use of newer generation tablets are removing some of the participation barriers previously experienced by some dermatology professionals. Prior to full clinical implementation within the authors' practice in 2011, they tested the Health Insurance Portability and Accountability Act-approved Apple FaceTime® videoconference platform and found it to be an affordable, convenient, and effective collaboration and consultation tool that may augment andragogical postgraduate medical learning. (*J Clin Aesthet Dermatol.* 2012;5(11):35–37.)

Teledermatology has traditionally been defined as the use of clinically based, technological communication mediums, such as cellular phones and fax machines, in an attempt to provide or enhance the delivery of dermatological care by accessing available resources in disparate locations. Such telemedical methodologies have been implemented to enhance peer-to-peer (P2P) collaboration and interoffice consultation in the areas of "diagnosis, consultation, treatment, and teaching."[1] Although no one can accurately document the first incidence of telemedical protocols, an antiquated example of such efforts is the use of ship-to-shore radios by land-based physicians to guide and assist the medical intervention efforts of deployed sea captains.[2] Conversely, the practice of dermatology is heavily reliant on visual clues, such as the patient's physical presentation and disease morphology,[3,4] thus electronic-based consultation paradigms that leverage a visual component would appear to be preferable and more advantageous to dermatological clinicians. As such, newer and more familiar technologies, such as digital still cameras, video recorders, camera phones, and electronic messaging platforms (e.g., e-mail and multimedia messaging), have allowed color images of a patient to be obtained and forwarded to colleagues, consultants, or supervising physicians for review and consultation.[5]

Currently, the two predominant protocols in teledermatology are the store-and-forward (SAF) and the live interaction (LI) methods.[6] SAF entails the capture of digital still photos that are electronically forwarded later (i.e., e-mailed) for P2P collaboration.[5] The LI video cameras and audio equipment capture and transmit a live communication feed from one healthcare provider to another.[6] However, SAF protocols require a volley of e-mails and, in some cases, the responses and conclusions may be delayed by hours or even days, while the LI methods require the patient to be repositioned in front of expensive, cumbersome, and nonmobile audio-video equipment. Clearly, these efforts have limited diagnostic and treatment value at the actual point of patient care. Such clinically based electronic healthcare consultation paradigms have been employed for decades in an attempt to enhance the delivery of patient care in any way possible; however, such efforts have always been, and will always be, subjugated to the rate-limiting technology available at the time, as well as the perceived relevance of that technology by practicing clinicians.

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Fortunately, the ease of use with new customizable communication platforms (e.g., Wi-Fi videoconferencing) and the increased affordability of Internet-enabled devices (e.g., tablets) have facilitated the ubiquitous, and almost universal, acceptance of mobile technology in medicine. A recent Manhattan Research study reported that, "Seventy-five percent of US physicians own some form of Apple device."[7] They further revealed that 30 percent of US physicians own an Apple iPad and that "an additional 28 percent plan to purchase an iPad within the next six months."[7] Thus, these products can, and in the authors' opinion will, expand the potential of teledermatology. The implications for developing tablet-based teledermatology protocols and advancing those practices in a way commensurate with the ever-expanding capabilities of web-based technologies, could engender new pedagogical forms of P2P learning and further enhance the reach of specialty-specific consultation, especially to more rural and underserved areas. Moreover, it may come to establish new andragogical platforms for resident physicians and physician extenders.

Soon after the release of the Apple iPad2® device with the preinstalled Apple FaceTime® videoconferencing platform, the authors wanted to implement an interoffice collaboration protocol between their main office and their satellite clinic that would facilitate better electronic communication and consultation between their healthcare providers (i.e., supervising physician and physician assistants). They chose to perform a 20-patient trial exercise to gauge the feasibility, cost, and effectiveness of such an endeavor. The details and outcomes are briefly described.

TELEDERMATOLOGY PARADIGM

Twenty patients with a variety of dermatological conditions were randomly chosen after their customary office visit based on their willingness to participate in a teledermatology protocol. Although not uniformly consistent, the presenting physician assistant tried to ensure variety while choosing cases in an attempt to challenge the technology's ability to aid in electronically based diagnostic collaboration. This, of course, was meant to simulate a real-world scenario, whereby a junior peer may seek consultation with a senior colleague in real time and at the actual point of patient care. Additionally, the dermatologist did not know and did not previously treat the participants. Although proper consent was obtained, no personalized data was transmitted and no recordings or images were produced or archived.

The first half of the patients (Arm 1) were presented by the physician assistant using an Apple iPad 2 with 5x zoom, VGA-quality, dual cameras; FaceTime video conferencing software; and displays with 1024 by 768 pixel resolution at 132 pixels/inch screen resolution.[8] Before the consultation was initiated, the physician assistant, with more than 12 years of clinical experience, recorded a preliminary diagnosis. The consulting dermatologist received the video conference call on an Apple iPod Touch 4® over a secure Wi-Fi server. The iPod Touch 4 utilized a 3.5-inch diagonal screen with 960 by 640 pixel resolution at 326 pixels per inch.[9] After the consulting dermatologist felt that he had seen enough to reach a diagnosis, the video consultation was concluded and his diagnosis was recorded. No recordings, files, or photos were produced or archived.

In the second group (Arm 2), presentation devices and protocols were performed as above; however, the consulting dermatologist now received transmissions on an Apple iPad 2 tablet with a 9.7-inch screen with the same specifications previously noted. Again, a diagnosis was reached and recorded and the real time videoconference was concluded. Both presenter (physician assistant) and consultant (physician) informally noted technological difficulties, patient response, and the time requirements to aid in the overall impression of the exercise.

TABLE 1. Cases of nonconcordance between Physician Assistant and consulting Physician

CASE NUMBER	PHYSICIAN ASSISTANT DIAGNOSIS	PHYSICIAN DIAGNOSIS	DIFFERENCE
2	Milium	Trichoepithelioma	Physician noted small lesion size and poor illumination. Milium was later expressed.
4	Tumid lupus	Discoid lupus	Path showed systemic lupus erythematosus and all labs were negative
9	Atopic dermatitis and lichen simplex chronicus	Stasis dermatitis	Mild pitting edema is patient's baseline and unknown to physician
12	Contact urticaria	Contact dermatitis	Physician noted faint lesion color and transmission instability

RESULTS

In general, the authors felt that the dermatologist's concordance with the physician assistant's preliminary diagnosis was positive in 16 out of the 20 cases, or 80 percent, which is consistent with Eedy and Wootton's teledermatology literature review findings based on previous teledermatology studies.[10] They found face-to-face and videoconferencing accuracy to range between 54 and 80 percent.[10]

The authors focus on the four cases of diagnostic difference, which will later, in future research, facilitate a better discussion of the technology's limitations, such as the difficulty of viewing small or faintly colored disease morphologies. The four cases of diagnostic non-concordance are listed in Table 1.

While comparing both arms of the study, the authors found a concordance in 7 out of 10 cases in Arm 1 where the consulting dermatologist received the video transmission on the 3.5-inch iPod Touch screen. Arm 2 allowed the consulting dermatologist to review the patient's condition on the 9.7-inch screen of the iPad 2 and, as expected, provider concordance increased to 9 out of 10 cases. The dermatologist noted easier viewing, better illumination, and more clarity with the iPad 2 tablet device, resulting in a significantly higher level of user satisfaction during this latter stage.

DISCUSSION

The authors' qualitative exercise was designed to serve as a preliminary research tool for documenting the feasibility of incorporating ubiquitous technology into current teledermatology protocols and to advance those practices within their group. The ubiquitous use and acceptance of newer, mobile, tablet-based technology, coupled with Web 2.0 customizable communication platforms (i.e., Wi-Fi video conferencing), are redefining the traditional expectations and limitations of long-distance medical training, collaboration, and consultation. Further, the expanded capabilities of these communication platforms, their ease of use, and the increasing affordability of the camera-ready devices on which they may be utilized, are removing the barriers previously experienced by some clinicians. Ultimately, the tablet-based consultation paradigm that the authors established clinically within their practice in 2011 may come to serve as a guide for establishing new pedagogical protocols for postgraduate resident learning, mid-level provider consultation, and interdepartmental collaboration.

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