

Teledermatology

Telemedicine is a healthcare practice using interactive audio, visual and data communications (1-4). The aim is to facilitate diagnosis, consultation, treatment, education, transfer of medical data, as well as to improve the consistency and competence of health care (1-4).

Radiology, psychiatry, cardiology, pathology, obstetrics, surgery and nursing have embraced and utilized the advent of telemedicine. The inherently visual nature of dermatology makes it easily applicable to virtual medicine. Therefore, teledermatology has been the forerunner in the use of communication technology.

Teledermatology, a subset of telemedicine, provides dermatology services at distance, and is a common method of healthcare delivery, particularly when a specialized referral center is not accessible (1-4). Moreover, it has a supporting role for primary care and for dermatologists working in private practices. The additive value of a second opinion service between academic institutions of different size and with a different range of experience is an additional advantage, as demonstrated in a study by Lozzi *et al.* in the management of patients with challenging inflammatory and neoplastic skin diseases (5). Special emphasis in teledermatology usage is on clinical dermatology, clinicopathologic correlation, and evaluation of pigmented skin lesions and dermoscopy (6-12).

Teledermatology technical systems or consult modalities are real-time (RT) and store-and-forward (SAF) systems (2,4,13,14). RT system is a videoconferencing system in which the referring clinician interacts with another one in real time *via* a videoconferencing link. The videoconferencing monitor provides dynamic visual images; the patients and dermatologists are separated by space but not by time. The dermatologist directly questions the patient in a manner similar to a traditional clinic-based encounter. It has been shown to be

an effective tool for in-person consultation but it is time-consuming and expensive as it requires more sophisticated and costly videoconferencing technology.

SAF systems use digital images. These images are sent by e-mail or shared on a web-based application, and reviewed at different times. A dermatologist normally reviews a SAF consult several hours to several days after it has been generated. Therefore, when SAF technology is used, dermatologists and patients do not interact with one another. The basic hardware and software requirements are personal computers, communication lines, image viewing software, and a digital camera.

It is increasingly likely that teledermatology will prove to be a significant tool in the provision of dermatology services in the future. These services will probably be provided by SAF digital image systems, real-time videoconferencing being used for case conferences and education.

Moreover, the development of user-friendly technology has brought personal digital assistants (PDA) such as palmtops, hand-held computers and pocket computers, and mobile telephones into everyday use. Feasibility of the PDA has mainly been tested in teleradiology. PDA in dermatology was first employed in a pilot study by Massone *et al.* In the pilot study, the telediagnosis of consultants agreed with the face-to-face diagnosis in 79% of cases, while most expert teleconsultants reached a level of 90%. Study results showed mobile teledermatology using PDA to be reliable for teledermatology (14). Moreover, PDT and mobile phones with high-resolution cameras might become a filtering or triage system allowing for a more rational approach to the management of patients with skin diseases (14,15).

However, prospective, randomized clinical studies are needed to test and standardize the

proposed mobile triage system for pigmented skin lesions.

In 2003, McColl studied dermatology education on the web, and in 2004 Oztas *et al.* studied the reliability and feasibility of the SAF system of tele-dermatology diagnoses made using a web-based application (16).

Telederm.org, www.telederm.org, is a unique medical application for medical students, physicians and healthcare workers interested in dermatology featuring on-line discussion of interesting and unusual cases in clinical dermatology and dermatopathology (17). This teleconsultation service is based on the transmission of digital images following the SAF method. Every user can submit clinical and dermatopathologic cases to the "discussion forum" visible to all users.

Telederm.org was initiated in 2002 by H. Peter Soyer, Rainer Hofmann-Wellenhof, and Gerald Gabler, with the vision of providing and sharing user-generated dermatologic knowledge at the worldwide level. The basic goal of the project was to create a user-friendly platform for providing teleconsultation services and for discussing challenging and unusual cases in clinical dermatology, dermatopathology and dermoscopy, with special emphasis on the diagnosis, differential diagnosis, and treatment. The new version called 2.0 will bring new features, and a mobile version to consume the content of the Community for Teledermatology via a mobile phone.

Other web sites offering free dermatology education and information are:

- Open Access Teleconsultation in Dermoscopy of International Dermoscopy Society (<http://www.dermoscopy-ids.org/discussion/>)

- Dermatlas of the Johns Hopkins University (<http://dermatlas.med.jhmi.edu/derm/index.cfm>); designed by Bernard A. Cohen, MD, Division of Pediatric Dermatology, and Christoph U. Lehmann, MD, Division of Neonatology, Johns Hopkins University School of Medicine, for educational use by healthcare professionals, parents and patients.

- Global Skin Atlas (www.globalskinatlas.com); The International Atlas of Dermatology and Dermatopathology which is a joint effort of doctors in various countries to cover the spectrum of skin diseases in all skin colors and races.

- Australian educational web sites which are login/password protected and include Dermcon-

sult (<http://www.dermconsult.com.au/>) and Skinconsult (<http://www.skinconsult.com.au/index.cfm>). These sites offer a virtual clinical meeting where dermatologists and general practitioners can post interesting cases with clinical data and images for consultation and discussion.

- The Virtual Grand Rounds in Dermatology (<http://www.vgrd.org/index.html>) is a gathering place for dermatologists from all over the world to meet one another and share interesting cases and challenging patients.

- Studentskinconsult (<http://www.studentskinconsult.com/>) is an online course for medical students in the diagnosis and treatment of skin diseases.

The perceived benefits are novel or enhanced access to care, economic advantages, and improved clinical outcomes. To date, the quantity and quality of research to support these assertions have been variable. Although teledermatology is one of the best-studied disciplines in telemedicine, several of these issues remain unresolved and require further investigation. The current issues are diagnostic reliability, diagnostic accuracy, clinical outcomes, patient and clinician satisfaction, and its cost-effectiveness. The basic computer literacy is a prerequisite for performing teledermatology consultations, but expertise and knowledge in dermatology remain most important.

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