Teledermatology: Digital revolution in the management of skin disease

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Abstract: - Telemedicine offers benefits to many patients, such as a shorter wait time or treatment without travelling to a remote clinic. Teledermatology, dermatology application of telemedicine, is one of the most often applied telemedicine applications worldwide. It has been practised both in real-time through the use of videoconferencing (synchronous), and as store-and-forward systems (asynchronous). Teledermatology has generally demonstrated high levels of concordance in diagnosis and management plans compared with face-to-face consultations. With the rapid evolution of communications technology leading to decreasing equipment costs, teledermatology holds great potential for revolutionizing the delivery of dermatologic services, especially among rural and remote communities. Potential uses include a supporting role for primary care physicians, more accurate triage of dermatology patients, or an ‘advice only’ service. High patient satisfaction with teledermatology appears to be a recurring theme throughout a number of studies [1-3]. Clinicians have also generally reported positive experiences with teledermatology. Moreover teledermatology has proved to be a convenient mode of education, academic and research activities and a tool of interaction between Dermatologists at a national and international level. Security concerns have been expressed with regards to maintaining privacy and confidentiality of patient data transmitted via the World Wide Web, encryption however of all sensitive medical information minimises risk. Future studies that focus on cost-effectiveness and patient outcomes will help further define the potential of teledermatology as a means of dermatologic healthcare delivery.

Key-Words: Telemedicine; teledermatology; store-and-forward systems; cost-effectiveness.

1 Introduction
Telemedicine is an emerging field within medicine with potential to revolutionize the delivery of health care. It is defined as the use of telecommunication technologies to transfer medical information. We can undoubtedly expect the continued improvements of technologies to facilitate a more accurate, timely and affordable teledermatology service across all fields, which translate perfectly to teledermatology due to its visual nature. Dermatologists were early adopters of telemedicine because their consultations are primarily about taking a careful history and visual inspection. With the current under-provision of dermatology service in the UK and the waiting list targets set by government, teledermatology systems have been proposed as a possible solution. Some teledermatology trials have not shown teleconsultations to be faster or more economical than conventional consultations, although evidence suggests that low-cost store-and-forward systems of teledermatology may reduce waiting times for some patients [4-5].

2 Teledermatology technology
The research and delivery of a teledermatology service has usually been by means of teleconferencing equipment or store-and-forward, computer-based, systems. Each modality has its advantages and disadvantages and existing information indicates that both store and forward and real time interactive technology result in reliable diagnostic outcomes when compared with clinic-based evaluations [6-7]. Whether using interactive or store-and-forward teledermatology, it is essential to ensure privacy, security of data and technology that is accurate, reliable and simple to use. In general, the patient’s express informed consent is necessary. Teledermatology protocols should be carefully prepared and followed to protect the patient.

2.1 Videoconferencing
Modern videoconferencing equipment allows real-time consulting between two or more parties. This
equipment enables the dermatologist to see the patient through the video link, while the patient has contact with the dermatologist through a small digital camera mounted on the videoconferencing unit. This allows direct interaction between the dermatologist, the patient and the person conducting the video imaging. During a video session, the patient needs someone to explain the process beforehand and to facilitate the consultation. The personnel involved should be adequately trained, but they do not have to be medical practitioners. Nursing staff and other non-medically qualified health care professionals are routinely involved in remote consultations across the UK. Real time video consultations have some significant clinical and educational benefits, but are inconvenient and time consuming for the clinicians.

2.2 Store-and-forward systems

The advantage of these systems is that they avoid the logistical difficulties of setting up videoconferencing consultations, and allow the dermatologist to evaluate large numbers of captured images quickly. PCs with modern processor speeds and 256MB of RAM are adequate for most routine image handling and short term storage. Larger (17-21 inch) monitors with better quality screens yield the best images and allow for multiple images and text to be reviewed simultaneously. Access to the internet is usually through ISDN, ISDN2 or Broadband and these facilities are needed to download images without undue delay. Telephone lines should not be on the National Health System net (NHSnet) and a separate encryption process is necessary for patient identifiable material. Normal telephone lines are unacceptably slow for large image files. Access to network for back up or alternatively a CD or DVD writer within the PC is essential. In order to make a diagnosis, certain demographic details are required, including the patient’s age, sex, ethnicity and geographic residence. The referral should outline the suspected diagnosis, location and distribution of the lesion/eruption, duration, size, features, aggravating and relieving factors, and any previous treatment. General medical information should include significant concurrent and past health problems, prescribed and non-prescribed medications and allergies, and the family history. Results of investigations such as mycology and skin biopsy may be important. In addition, the reason for referral should be indicated. The dermatologist should be able to obtain further information if required [8].

3 Diagnostic accuracy

As with the implementation of any new intervention or technique, demonstrating the equivalence of teledermatology with the current best available practice (face-to-face clinical review) is essential. Recent studies have directly addressed the issue of clinical outcomes achieved via teledermatology. The data suggest that teledermatologists reviewing store and forward consults achieve accuracy comparable to that of clinic based dermatologists [9], however such studies cannot determine whether patients experience equivalent or improved outcomes in terms of morbidity, mortality, or quality of life. More studies evaluating similar clinical outcomes must be performed before this information is accepted by physicians and patients.

4 Cost-effectiveness

Teledermatology is more likely to be widely adopted if it is reliable, efficient and can demonstrate economic viability. Recent studies [10-12] comparing the cost-effectiveness of real-time teledermatology with conventional hospital outpatient appointments showed advantages for the patients in terms of time off work, loss of income to the patient or productivity by the employer as well as time and expense of travelling to hospital. Real-time interactive dermatology has traditionally been found to be more costly than standard care because of the need for 2 providers and complex videoconferencing equipment. In the opinion of several authors [4-5], store and forward teledermatology could be more cost-effective than real-time consultation due to its speed and convenience. It avoids the high provider and equipment costs of real time interactive service, while still being less time consuming for patients.

5 Doctor satisfaction

In the U.K., GPs reported very high levels of satisfaction (> 80 %) with real-time consultation and stated that 75 % of teleconsultations were of educational benefit [7]. In a larger study, GPs estimated the knowledge transfer effect of real-time consultation to be the equivalent of 6 days training per year [10]. Dermatologists are generally enthusiastic and report that they can achieve good rapport with patients using real-time technology. In a study using high bandwidth videoconferencing, where image quality is likely to have been better, dermatologists were highly satisfied with the interpersonal aspects of video consultations and
tended to be surer of their diagnoses [1]. A majority also believed that teledermatology was just as thorough as clinic visits. Criticisms were usually concerned with picture quality and inability to palpate lesions or carry out diagnostic tests.

6 Patient satisfaction
Most patients are pleased that their condition is being diagnosed and treated as soon as possible and almost 90 % [3] agreed that a teleconsultation saves time and expenditure in travelling to hospital. A certain number of patients would still prefer a face-to-face consultation, with one study reporting that 40 % felt ‘something was missing’ when the dermatologist was not seen in person [13]. Generational differences may also exist amongst patients, with those in younger age groups more accepting of the new technology than the elderly [14]. Patients who probably are less tolerant or do not do so well include the elderly, small infants, those who are shy and embarrassed at being videoed, and those with genital rashes [15]. Regardless of consultation modality, patients want rapid access to an accurate diagnosis and an effective treatment plan [16]. They also want to receive individualized personal care [13, 17]. When these aspects of service are considered, comparably high satisfaction ratings can be achieved with either teledermatology or conventional care.

7 Teledermatology for education
Another valuable use of teledermatology is the provision of dermatology training and education to physicians and support to patients. Teledermatology can be used to train dermatology residents and teach undergraduate medical students. Increasing numbers of hospital departments and universities arrange regular interactive tutorials and case discussions by videoconference. In the current UK health system the majority of patients with dermatological problems are initially managed by their General Practitioner who might have had some or no training in dermatology over the years, making it essential for dermatologists to reach out to their colleagues and ensure they have access to support and educational resources to enable the best diagnostic and management decisions to be made. In addition communication technology can be used for discussion between a GP and the dermatologist; however it is likely that in the future, subsequent applications could involve direct communication between dermatologists and patients. Dermatology patients with chronic skin conditions, such as psoriasis for example, may also benefit from teledermatology applications, such as online information leaflets, online forums etc, which can provide patients with educational information and a supportive environment where they can communicate with others about the stresses associated with their chronic dermatological conditions.

8 Security and legal issues
Dermatologists have expressed concerns that teledermatology is risky in a medico-legal sense. The legal implications of telemedicine have been extensively debated and are not specific to dermatology. Most legal and ethical issues are the same as those of medicine in general [18]. Breaches in the confidentiality of sensitive medical information could cause distrust in telemedicine generally [19]. Patients should, at the very least, know what information is being collected about them how it is going to be transmitted, to whom, and how it is going to be used [20]. It would be considered good practice to obtain written consent for storing and transmission of patient information, and certainly this is mandatory when the data collected are to be used for research [21]. It is expected that when patients consent to a teledermatology consultation, they understand that there can be a difference in diagnostic accuracy and diagnostic certainty between a face to face consultation and teledermatology.

9 The future
With the rapid evolution of communications technology and decreasing equipment costs, several new applications of teledermatology have emerged, such as mobile teledermatology, teledermoscopy and teledermatopathology.

9.1 Mobile teledermatology
Studies have already begun to focus on the role of mobile phones and personal digital assistants (PDA) in areas such as remote patient monitoring, triage and follow-up of patients with chronic skin disease. Mobile devices have the ability to send data and images from remote areas where internet connection is not available.

9.2 Teledermoscopy
Dermoscopy is a non invasive method to evaluate the skin surface. The dermatoscope is the simplest
and best recognized piece of equipment used to perform a dermoscopy examination. A camera can be used to photograph the images seen with a dermatoscope. These images can then be sent to other specialists for evaluation, diagnosis and recommendations. Teledermoscopy can be also used to provide images to remote teledermatologists for teaching and training.

9.3 Teledermatopathology
Teledermatopathology refers to the transmission of images of histopathologic sections (either static or real time) for telediagnosis. In current practice, teledermatopathology is not used to replace diagnosis by conventional microscopic examination. It has the potential however to provide a diagnosis to patients in areas of the world where dermatopathologists are not available.

10 Conclusion
Teledermatology has been advocated as a mode of health care delivery that may diminish inequalities in the provision of an overstretched service and improve access to dermatological care, especially for remote or isolated communities, currently denied specialist attention. For widespread sustainable adoption of teledermatology practice to occur, efficacy, acceptability and economic viability must all be demonstrated. Further research into the outcomes and limitations of teledermatology is required in order to demonstrate the value of this service for health care providers and patients.

References: