Mobile Phone-Based Teledermatologic Compliance Management – Preliminary Results of the TELECOMP Study

Dieter HAYN a,1, Silvia KOLLER b, Rainer HOFMANN-WELLENHOF b, Wolfgang SALMHOFER b, Peter KASTNER a, Günter SCHREIER a

a Department Safety and Security, AIT Austrian Institute of Technology GmbH, Graz, Austria
b Department of Dermatology and Venereology, Medical University Graz, Austria

Abstract. A mobile phone-based telemonitoring system for long-term psoriasis therapy is described, intended to increase patients’ compliance by optimizing the patient-physician communication. Patients themselves can acquire health parameters and take photos of their psoriasis lesions. The data are sent to a monitoring centre, where they are provided to the patients’ physician who returns a feedback message. The system is currently tested in a study with 20 patients. Preliminary results prove the feasibility and usability of such a system and indicate that it is useful for optimizing psoriasis-therapy.

Keywords. telemedicine, dermatology, eHealth, mobile communication

1. Introduction

Psoriasis is a common chronic skin disease, affecting about 2% of the population worldwide [1–3]. The typical course of the disease is identified by periodic acute episodes and remission phases [3]. Though psoriasis can be treated in several ways, no healing is known [4] and, therefore, long-term therapy is needed. Biologics such as Adalimumab (Humira), Etanercept (Enbrel), Efalizumab (Raptiva) or Infliximab (Remicade) are often the most effective therapy. Unfortunately they are expensive, have to be injected subcutaneously or by infusions, and they can cause adverse effects.

Previous studies showed that the mean patient compliance to psoriasis therapy is about 60% [5]. There are several reasons for discontinuing the therapy, among them medical reasons (bad response to the therapy, adverse effects, appearance of exclusion criteria), and personal reasons such as business, forgetfulness, or lack of motivation. By improving the patient-physician communication with a teledermatologic monitoring system it might not only be possible to early detect adverse effects and other therapy relevant events, but also to enhance the patients’ compliance to therapy.

Teledermatology has already successfully been used for telediagnostic of skin cancer and wound treatment [6–9]. Dermatological pathologies that cannot be diagnosed with high-quality digital photographic images can rarely be diagnosed in face-to-face consultation without the aid of complementary tests [10]. The systems
Figure 1. System overview. Data are acquired by the patient using a mobile phone, and sent to the Remote Monitoring Centre at the Austrian Research Centers. The patient can view these data and – if necessary – adjust the patient’s therapy. Additionally, feedback and reminders can be sent to the patient’s mobile phone.

provided so far are used for taking pictures at one location (e.g., general practitioner) and transmitting them to another location (e.g., dermatologist). The dermatologist analyzes the photos and sends his diagnostic findings back to the general practitioner. Data acquisition is done with normal photo cameras or even with the cameras of mobile phones. In most studies data acquisition is done in a hospital or at a medical practice. Lavanya et al. describe an approach, where data acquisition was done at the patient’s home by the nursing staff [11]. Still, no teledermatology system is in routine use today which involves the patients themselves. Hence, continuous monitoring of the evolution of dermatological diseases – as needed for optimized psoriasis treatment – is not available on a telematic basis so far.

It is the aim of the present work to provide an easy way for documenting the course of psoriasis during acute episodes as well as during remission phases by the use of an electronic therapy diary. The system is intended to help patients and physicians to optimize the therapy with a biologic and to increase the patients’ compliance.

2. Materials and Methods

In the course of the TELECOMP study (TELEmedical COMpliance Management system for patients with Psoriasis) 20 patients with psoriasis treated with the biologic Raptiva will be equipped with a mobile phone for six months (Sony Ericsson K770i or K800i, London, UK). These phones feature a 3.2 megapixel camera that can be activated from within a Java 2 Micro Edition (J2ME, Sun Microsystems, Inc, Santa Clara, CA 95054, USA) application. Once a week – 2–3 days before they inject the biologic – the patients are asked to acquire therapy relevant parameters and take photos of their lesions. After one and three months intermediate follow-ups are done at the hospital. The study protocol was approved by the ethics commission and all subjects have to provide written informed consent.

Figure 1 gives an overview of the system. Special telemonitoring software has been installed on mobile phones, guiding the patient through the data acquisition process. Images of the data acquisition process are shown in Figure 2. Firstly, known adverse effects of the biologic are enquired (e.g., fever, night sweat, cough). Next, body
weight, quality of life, current body temperature (optional), comment (optional), and Self Administered Psoriasis Area and Severity Index (SAPASI [12], optional) are entered. Finally, the patient declares whether he injected the biologic.

Thereafter, the mobile phone’s camera is started and the patient is asked to take photos of up to five lesions. Reference markers of defined size and colors are put close to their lesions in order to a) help the physician analyze the lesions, b) help the patient evaluate the picture quality and c) theoretically allow for automated size and color correction (not implemented yet). For each lesion, the patient is asked whether he was assisted while taking the photo, if the lesion has grown smaller or larger since the last recording and if the infiltration has changed.

All data are stored on the mobile phone. Up to 20 sets of parameters can be saved. Once the 21st set is recorded, the oldest set of data will be deleted. After saving, the data are securely transmitted to a monitoring centre via UMTS. In case of connection problems, sending is retried later on automatically. At the monitoring centre, the data are transferred to a relational database (PostgreSQL Global Development Group) and the images are stored on a file server. Data handling and processing is done using an application server (Zope Corporation, Fredericksburg, VA 22401, USA).

Figure 2. Data capture using mobile phones. Left: Screenshot of a data entry form. Since all parameters shown are mandatory, they are all marked by red asterisk. Middle: Screenshot of the display right before starting the camera – indicating the location of the next lesion to be photographed. Right: Photographs of lesions are made using a common mobile phone with integrated high-resolution camera.

Figure 3. Lesion evolution as seen by the physician via the web browser. On the right side, data concerning the lesion as entered by the patient are listed for each photo.
The physician can examine the data via a web-browser and e.g., visualize the evolution of a lesion over time (Figure 3). A username and password-based identification and authorization concept has been implemented to guarantee privacy. In case a patient reports adverse effects or other complications an alert is sent to the dermatologist. A dedicated messaging system allows for sending feedback messages to the patient, e.g., for admitting the patient to the clinic or for pausing the medication in case of fever etc.

All data transmissions are done securely via SSL connections. Only reminders sent when a patient did not transmit data for more than eight days and notifications to new feedback messages from the physician are sent as plain text via SMS (the feedback messages themselves are transmitted securely).

3. Results

At the time this paper was finished (January 2009), 18 patients (6 f, age 46.3 ± 12.3 y) have been equipped with mobile phones. Nine patients were still monitoring their lesions, two more were planned to be included in 2009; nine patients had already finished the six months study.

All patients managed to handle the system and to submit photos with sufficient quality. Acquisition of one set of data including five images took about ten minutes, data transmission about two minutes. Up to now, 282 sets of data including 956 photos and 240 feedback messages were transmitted. In several cases immediate transmission was impossible due to a lack of network service, but since all data was stored on the mobile phone and transmission was retried later on, no data were lost so far.

From the physicians’ point of view, the transmitted data was useful for monitoring the psoriasis therapy. When asked for the advantages of the teledmedical setting, the physicians answered: a) It simplifies the patient-physician communication. b) It shortens the mean duration of a regular outpatient follow-up. c) It facilitates individual therapy adjustment based on the availability of photos from lesions in regular intervals.

4. Discussion

Continuous monitoring of psoriasis can only be realized in an efficient way, if the data needed are acquired by the patients themselves. Especially, photos of the patients’ lesions are useful for monitoring the course of the disease. The preliminary results of the TELECOMP study show that all patients do succeed in taking photos of their own lesions with sufficient quality. Some patients take the photos themselves, others are assisted, e.g., by family members. Thus, even lesions e.g., on the patient’s back (which are difficult to photograph by the patients themselves) could be monitored. In most cases, the image quality was sufficient for assessing the therapy progress.

Usability of the system is limited, since especially taking photos using the mobile phone is a rather difficult task for (elderly) patients. Therefore, instructing the patients in how to use the software was rather time consuming and took in between about 20 and 45 minutes. Anyway, during the study all patients succeeded in using the software.

The results presented are preliminary – a detailed statistical analysis has not been done yet and will be part of the final evaluation of the study. Since 18 of 20 patients have been recruited so far and since all of them were able to learn how to submit data
and since data transmission was possible for all 18 patients, it is expected that the final data analysis will indicate usability and feasibility of the system.

By using Multimedia Messaging Service (MMS) for transmitting images, no additional software would have to be installed on the phone. However, data transmitted in the course of the present work are personalized health data and since MMS does not support end-to-end encryption it is not suitable for medical purposes. Additionally, using a special application offers the advantage of keeping control of the whole monitoring procedure by leading the patient screen by screen through the workflow.

5. Conclusion

Preliminary results indicate that mobile phone-based acquisition of images of dermatological lesions by patients themselves is feasible with sufficient quality for therapy assessment. The presented method may thus offer a way to teledemically monitor and adjust psoriasis therapy with biologics.

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References


