Actas Dermosifiliogr. 2007;98:318-24

ORIGINAL ARTICLES

Teledermatology. Review of 917 Teleconsults

S Martínez-García, J del Boz-González, T Martín-González, E Samaniego-González, and V Crespo-Erchiga

Servicio de Dermatología y Venereología, Complejo Hospitalario Universitario Carlos Haya, Málaga, Spain

Abstract. *Introduction.* Teledermatology is been currently introduced as a diagnostic tool in the daily practice of the dermatologist. Many published works regarding teleconsult show the high sensitivity and economic saving of this technique as a diagnostic method.
Material and methods. In this article we report our experience with nearly 1,000 teleconsults carried out in a period of two years, from October 2004 to October 2006.
Results. The majority of the 917 teleconsults performed were for benign lesions, notably seborrheic keratosis in 201 cases; among malignant lesions actinic keratosis appeared in 161 cases and melanoma was diagnosed in 5 cases. Fifty-eight percent of teleconsults have been arranged for a face-to-face consult in order to perform adequate treatment, in 90% of cases, or to confirm diagnosis or carry out complementary exams, in 10% of cases.
Conclusion. The image is the gold standard for dermatological diagnosis. Currently, digital phototography gives us such a high image quality that, based on our experience, it can be stated that a neoplastic lesion that cannot be diagnosed by a high quality digital image with the available technology, rarely could be diagnosed in a face-to-face consult without the aid of complementary exams.

Key words: telemedicine, teledermatology, asynchronous.

TELEDERMATOLOGÍA. REVISIÓN DE 917 TELECONSULTAS

Resumen. *Introducción.* Actualmente el uso de la teledermatología como herramienta diagnóstica está introduciéndose en la práctica diaria del dermatólogo, ya son muchos los trabajos publicados sobre la teleconsulta, donde se demuestra la alta sensibilidad y el alto ahorro económico de esta técnica como método diagnóstico. *Material y métodos.* Presentamos en este artículo nuestra experiencia con cerca de 1.000 teleconsultas realizadas en un periodo de 2 años, desde octubre de 2004 a octubre de 2006.
Resultados. De las 917 teleconsultas realizadas, la mayoría de las lesiones han sido de patología benigna, destacando las queratosis seborreicas en 201 ocasiones, entre la patología maligna destacan las queratosis actínicas en 161 de los casos y se han diagnosticado 5 melanomas. El 58% de las teleconsultas han sido citados para la consulta de presencia física, ya sea para realizar el tratamiento adecuado, en el 90% de los casos, como para confirmar el diagnóstico o realizar pruebas complementarias, en un 10%.
Conclusión. La imagen es el *gold standard* para el diagnóstico dermatológico. Actualmente la fotografía digital nos da tal calidad de imagen que, a la luz de nuestra experiencia, cabría afirmar que la patología tumoral que no pueda diagnosticarse con una imagen fotográfica digital de alta calidad, como las que proporcionan los instrumentos y medios que manejamos, raramente pueden llegar a diagnosticarse en presencia física sin la ayuda de pruebas complementarias.

Palabras clave: telemedicina, teledermatología, asíncrona.

Introduction

In 1998, the World Health Organization described telemedicine as the provision of health services in situations where distance is a critical factor and professionals use information and communications technology for the exchange of information valid for diagnosis, treatment and prevention of diseases or injuries, research and

Correspondence:
Silvestre Martínez García.
Avda. Los Botijos. Urba. Altos de la Sierrezuela, 6 C1-1.
29639 Benalmadena Pueblo. Málaga. Spain
silvestremg@eresmas.net
Manuscript accepted for publication February 7, 2007.

evaluation, and continuing education. The application of this concept to skin diseases is referred to as teledermatology.[1]

In this article we aim to present a new view of teledermatology in which technology helps us in our daily practice, filtering tumors from the health centers to prioritize hospital care and exclude the so-called healthy patients.[2-4]

For this purpose, we review the different types of teledermatology and present the results of our experience with 917 teleconsultations.

Types of Teledermatology

There are 2 types of teledermatology: asynchronous, or store-and-forward, and synchronous, or real-time.[5-8]

Synchronous teledermatology refers to the real-time exchange of data between the sender and receiver. This system has the marked disadvantage that the referring doctor, the patient, and the specialist must all be connected at the same time, with the difficulty that this involves. One of its major advantages is that it enables the dermatologist to take a clinical history. This system equates to videoconferencing.

Asynchronous or store-and-forward teledermatology is the most widely used form of teleconsultation, principally because the specialist does not have to coincide with the patient and primary care physician in space and time.

Asynchronous Teledermatology Systems

We can differentiate between 2 methods for performing store-and-forward teleconsultation, principally determined by the available budget[9-11]:

Basic Teleconsultation

To perform a teleconsultation, it is only necessary to have a camera and an Internet connection. This is the simplest, most inexpensive, and most common method used for performing teledermatology as it is a system that is easy to implement; however, it has disadvantages such as the confidentiality of patient data. This problem is partially resolved by data compression using, for example, win.rar (a software program that compresses the size of photographs and that requires a password in order to view the files). However, these programs have not been supervised by the US Food and Drug Administration (FDA) or validated by the European Union. Other problems with this system include the limited quality of the images, data storage, and the creation of a worklist.[12,13] Although this teledermatology system is effective, technology has now progressed sufficiently for us to have access to much more advanced systems (Table 1).

Advanced Teleconsultation

We now analyze the advances in computer technology currently available in dermatology and applicable to teleconsultation.

Firstly, for image capture, we have compact or reflex digital cameras that with 3 megapixels and above can achieve high-quality photographs without the need for experience in photography. In addition, MoleMax I and II software is available for the visualization, mapping, and storage of dermatology images. The problem with this system is the poor quality of the images, as they have been extracted from video. Finally, we have FotoFinder, which is very similar to the previous system except that the image quality is better; however, this software is more complicated to use for lesion mapping. The FotoFinder and MoleMax systems have revolutionized the digital follow-up of pigmented lesions (Figure 1).

A good image is obviously required in order for teledermatology to work; the availability of one of these systems therefore facilitates the work considerably.

The second front on which teledermatology is advancing is the method through which information from the center sending the images is exchanged and stored. Currently, the hospitals tend to contract medical picture archiving and communication systems (PACS). These are computer servers that store patient information and images. These systems were initially implemented in radiology departments, but the same technology can be used to hold dermatological images. Together with PACS, we also have the radiology information system (RIS), which is a computer program that manages the worklist, where the specialist physicians write their reports and appointments are managed (Figure 2).

Table 1. Basic Teleconsultation

Advantages	*Disadvantages*
Inexpensive system	Security of data
Easy to implement	Limited image quality
Ease of use of photographic cameras	Limited dermatoscopy
	Image storage
	Lack of a worklist

Figure 1. Teleconsultation in a primary care setting equipped with a teledermatology *Fotofinder* and a retinograph for teleophthalmology.

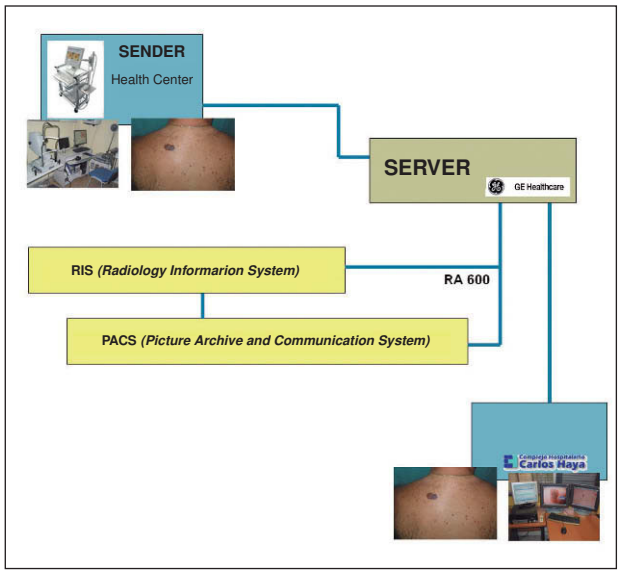

Figure 2. Image flow diagram.

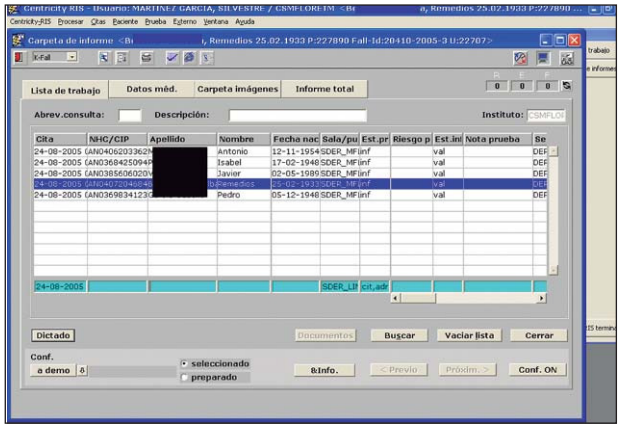

Figure 3. Radiology Information System window (worklist).

RA-600 is a program that integrates information from the worklist in the RIS system with the photographs from the PACS and enables the images to be converted to Digital Imaging and Communication in Medicine (DICOM) format, the international standard for the transmission of medical images.

As an analogy, we would say that these systems are like virtual libraries that store images. The libraries are on servers where the images are stored; these servers do not have to be physically located within the hospital. The library is the PACS. In addition, we have the library administrator, whose job it is to provide us with the images that we request and, after we have studied them, return them to their position; this is the RIS.

Both PACS and RIS are available on the market from various manufacturers, such as General Electric, Philips, Siemens, Canon, Kodak, and DR systems (Figure 3).

At the present time, hospitals tend to acquire these systems for radiology, as it speeds up the professionals' work considerably, not to mention the added advantage of storing the radiological images in digital format.

These images are in DICOM format, equivalent to "jpg" or "tif" format, with the peculiarity that they include data, such as patient information and clinical history.

The advantages that these servers offer are, on the one hand, data confidentiality, as they are approved by the FDA,[14,15] and on the other, that the photographs are not stored physically on the hospital computer but are retrieved from the servers. RIS has a software application that provides a worklist, on which each day it is possible to see the patients whose reports have been prepared and those pending reporting[16-18] (Table 2).

The third area to be evaluated is the visualization of the images. As a minimum, this requires a powerful computer, Office-XP software, and 3 monitors, 1 for the work list (15 inch) and the other 2 for viewing the images (21 inch) (Figure 4).

Material and Methods

The Teledermatology Unit of the Dermatology Department of the Carlos Haya Hospital Complex, Malaga, Spain, has been functioning since October 2004. Teleconsultations are performed asynchronously using the FotoFinder system with a Canon Powershot G5 for image capture in each of the 5 health centers where the system is used. The General Electric PACS system is used for data interchange.

The images captured in primary care are combined with a clinical history directed by the dermatologist (time course, site, size, symptoms, reason for consultation). After the images sent by primary care are received, the

specialist dictates a report that is sent to the primary care physician within 48 hours. If the specialist considers it appropriate, because of the presence of a malignant tumor or suspicion of malignancy, or because the image is not sufficiently diagnostic, a hospital outpatient appointment for within 10 days is booked for the patient and communicated directly by the hospital admissions department.

This project only included tumors, as this involves single, isolated lesions with a limited clinical history, while inflammatory disease presents certain problems for teleconsultation, such as the dermatological history, which can be inadequate in many cases when taken in primary care settings, and the additional need to perform photographic mapping in extensive disease. The distinction between tumors and inflammatory disease was the only criterion on which the decision to undertake teleconsultations was based.

Results

To date we have performed 917 teleconsultations and the results are very satisfactory.

The Palma-Palmilla, Miraflores, and El Limonar health centers pioneered the implementation of this system, with the subsequent incorporation of the La Victoria and Ciudad Jardín health centers, all of which belong to the West Malaga health area (Figure 5).

A large number of malignant tumors were diagnosed in the teleconsultations that were performed, enabling the patients to be seen in outpatients with a very short delay (10 days) in order to confirm the diagnosis and initiate appropriate treatment. In some cases, the patient was even advised to come directly with the preoperative study performed in the health center in order to undergo surgery that same week.

The most common malignant tumors identified in the consultations were actinic keratoses on 161 occasions and basal cell carcinomas on 73 (Figure 6). In addition, 18 cutaneous horns, 13 keratoacanthomas, 10 squamous cell carcinomas, 6 dysplastic nevi, 5 cases of actinic cheilitis, and 5 melanomas (Figure 7) were diagnosed.

Of the benign tumors diagnosed by teleconsultation (Figure 8), it is noteworthy that we identified 201 seborrheic keratoses (Figure 9). These are very common and usually give rise to certain diagnostic doubts in primary care settings as they are pigmented tumor lesions that occasionally cause symptoms such as pruritus. However, they do not usually present diagnostic difficulties for specialists. The other common diagnoses were acquired melanocytic nevus (147), solar lentigo (44), dermatofibroma (26), port-wine stain (14), viral

Tabla 2. *Advanced Teleconsultation*

Advantages	Disadvantages
Data confidentiality	Expensive
Image quality	Difficult to implement
Worklist	
Technical staff involved	

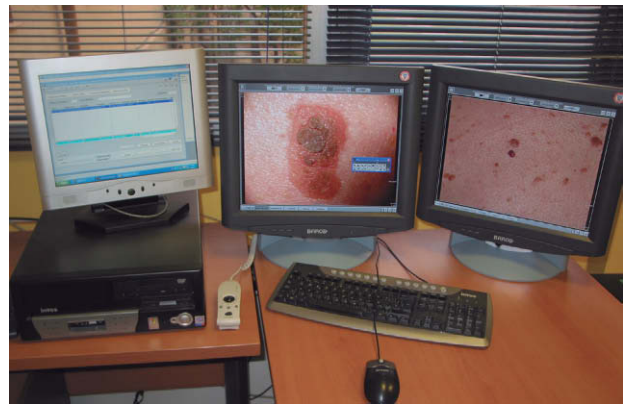

Figure 4. Teleconsultation workstation.

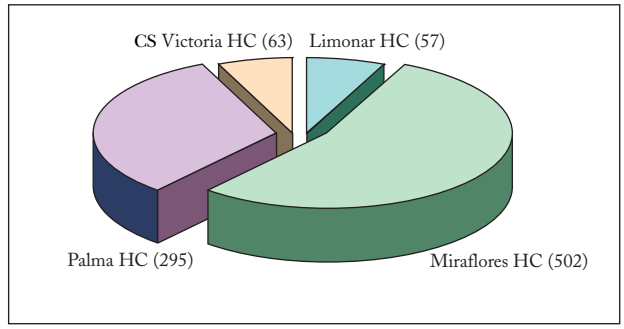

Figure 5. Health centers with facilities for teleconsultations. Abbreviation: HC, health center.

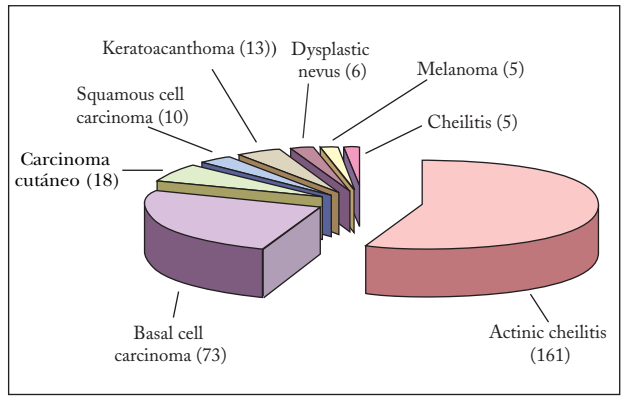

Figure 6. Malignant tumors.

Figure 7. Melanoma diagnosed by teleconsultation.

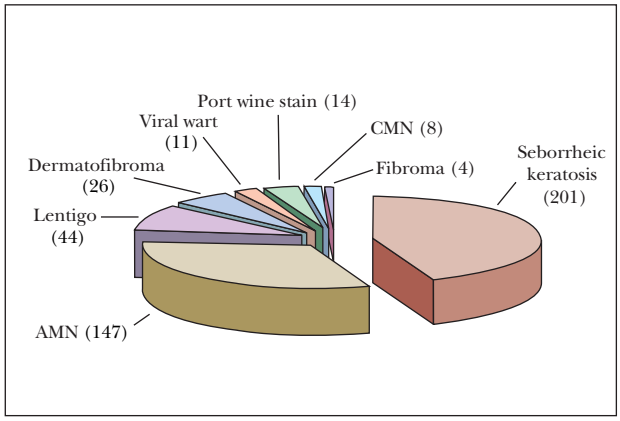

Figure 8. Benign tumors. Abbreviations: AMN, acquired melanocytic nevus; CMN, congenital melanocytic nevus.

Figure 9. Seborrheic keratosis.

warts (11), congenital melanocytic nevus (8), and fibroma (4), while isolated cases of blue nevus, molluscum contagiosum, and keloids were also identified. There were even sporadic referrals of some cases of psoriasis, acute eczema, vitiligo, and alopecia areata that, despite being inflammatory diseases, do not present diagnostic uncertainty.

This system is not intended to substitute face-to-face consultation, and this can be requested by the physician or patient instead of teleconsultation whenever they wish.

A diagnosis could not be made in only 62 of the 917 consultations performed using this system. In 25 of those consultations the photos were out of focus and half of the remaining cases required complementary tests to reach the diagnosis; the remaining patients were referred to other specialists.

In our study, 58% of the cases attended a face-to-face consultation. This can be explained by the high sensitivity with which the system is used, since in the event of the slightest diagnostic doubt, the patient is seen in person to confirm the diagnosis.

Discussion

There is absolutely no doubt that telemedicine is effective in certain situations, although it will not achieve its full potential unless health organizations implement strategies to promote its development.

In the infancy of teledermatology, there were a number of areas for debate: firstly, the difficulties inherent in the technology (speed of data transmission, image clarity, price, etc), secondly whether teleconsultation would excessively reduce the demand for face-to-face consultation, and finally, whether this form of medicine would be well accepted by the patient.[18-20]

Currently, teleconsultation is exceeding all expectations. Technological developments have resolved the first problem, since image quality, implementation of information technology in hospitals, and the incorporation of technology as an essential tool in daily work have allowed teleconsultation to focus on new objectives, such as the follow-up of inflammatory disease, filtering of surgical pathology in health centers, and presurgical consultation.

As with other recently developed techniques such as laser therapy and epiluminescence, we can choose to ignore telemedicine, although this is probably not an advisable attitude. As occurs with so many things, it all depends on the use one makes of it.

In terms of the effect on specialist posts, we have seen a 3-fold rise in the demand for specialist consultation from the health centers due to the speed and efficacy of the system.[21-23]

From the patients' point of view, acceptance has been very good,[22] as this system is much more personal than it might appear to be. Since we know the patients' pathology before they come to consultation, we are sometimes awaiting them, as in the cases of melanoma.

Among the teleconsultations performed, the diagnosis of malignant tumors using this system was particularly important. As mentioned, this enabled the patients to be seen in outpatients with a very short delay (maximum 7 days) to confirm the diagnosis and initiate the appropriate treatment. In some cases, the patient was even advised to come directly with the preoperative study performed in the primary health care center in order to undergo surgery that same week. Notably, the melanomas diagnosed during this period underwent surgery with a delay of not greater than 5 days.[24]

Few studies have evaluated the advantages and disadvantages of synchronous and store-and-forward teledermatology. Recently, the DERMATEL study compared those systems and found that teleconsultation was highly effective and that store-and-forward teleconsultation offered advantages over synchronous consultation with audio.[25]

The image is without doubt the gold standard for diagnosis in dermatology. Currently, digital photography gives us an image of such quality that, in our experience, it could be considered that tumor pathology that cannot be diagnosed with high-quality digital photographic images, such as those provided by the equipment and means at our disposal, can rarely be diagnosed in face-to-face consultation without the aid of complementary tests.

Teleconsultation applied as a screening method for malignant tumors is certainly a useful technique that could be incorporated into dermatology consultations as one more tool for day-to-day practice.

Conflicts of Interest
The authors declare no conflicts of interest.

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