US Army Teledentistry

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Abstract

Two US Army pilot studies have shown that teledentistry can save patient travel and evacuations. As a result, the Army is beginning a large research project to determine the benefits and the costs involved in using telemedicine equipment to provide remote dental diagnosis and treatment. This study will measure the costs and benefits in the areas of dental consulting, referrals for care, home call, telementoring, dentist-laboratory communications, continuing education, and group management. It is expected that this study will provide sufficient data to construct a business case for the implementation of this technology throughout the entire Army.

1. Introduction

First pilot study: Teledentistry is a relatively new field of study within the US Army. The first test of teledentistry in the US Army was conducted at Ft. Gordon in July 1994. In this test, an AT&T STU-3@ secure telephone unit was used in conjunction with an Accucam® intraoral camera to capture color images of a patient's mouth. These images were then transmitted over a 9600 baud modem from the dental clinic at Ft. Mc Pherson Georgia to the Tingay Dental Clinic at Ft. Gordon, a distance of approximately 120 miles. Ft. Mc Pherson is a small army post which is staffed solely with general dentists. They routinely refer specialty patients to Ft. Gordon.

In this test, 15 periodontal patients from Ft. Mc Pherson were referred to Ft. Gordon for periodontal surgery. One week after their surgery, each patient reported to the Ft. Mc Pherson dental clinic for suture removal and intraoral imaging instead of driving to Ft. Gordon as was the routine in the past. At the time of suture removal, color still images were obtained of the

surgical sites and these images were transmitted to Ft. Gordon for examination by the periodontist who performed the surgery. The surgeon then determined if the patient was healing properly or if the patient had to return to Ft. Gordon to correct complications from the surgery.

A questionnaire was filled out by each patient which asked them how they felt about the care they received. In addition, the dentists on each end of the teledental process were asked how comfortable they were with their diagnoses.

The results of this test were that 14 of the 15 patients were saved the return trip to Ft. Gordon. One patient had complications from the surgery that required immediate follow-up necessitating a return to Ft. Gordon. The patients uniformly reported that they had received better care than they normally received and were especially pleased at the elimination of the long trip to Ft. Gordon. The dentists also were comfortable with their ability to make proper decisions and diagnoses using the equipment.

Total savings to the government was estimated to be \$60 for travel and \$134 for one half day's work lost in driving (lieutenant colonel pay grade).

Second pilot study: A second test was performed by dentists deployed to Haiti during December 1995. In this test, a Compression Laboratories Incorporated (CLI) teleconferencing system was used over the International Maritime Satellite (INMARSAT) system allowing the deployed dentists to talk face to face with specialists at Walter Reed Army Medical Center in Washington DC. In addition, a Kodak DCS 420 high resolution still camera was used to capture color still images while a Schick Technologies CDR digital dental x-ray system was used to take radiographs. These radiographs were then transmitted along with the color still images (using JPEG compression) to Walter Reed where they were viewed by the specialists using Adobe Photoshop® software.

This teledentistry system was used to consult with specialists at Walter Reed on a total of seven patients. Results of this test showed that the video quality of the CLI unit operated at 56 Kb/sec was insufficient for dental diagnosis of most pathologic conditions while the Kodak and Schick still imaging combination yielded diagnostic quality still images.

Because of the encouraging results of these two tests, it was decided to expand the scope of the Ft. Gordon test to an actual research project with the goal of gathering enough data to make a business case for the use of teledentistry technology.

2. Southeast Dental Service Support Area project.

Ft. Gordon is the headquarters of the Southeast Dental Service Support Area (DSSA). Included in that geographic area are ten Army posts spread throughout the states of Georgia, Alabama, South Carolina, and Kentucky. Five of these posts have full complements of specialists but five of them have only general dentists. Currently the posts without specialists send patients in need of specialty care to the nearest post where that care is available. The typical distance that a patient from these five posts must travel for this subspecialty care is 120 miles.

For this project, the Army posts of the Southeast DSSA will be networked using desktop videoconferencing equipment and ISDN lines at 128 Kb/sec data rates. This equipment will allow live video consulting as well as the capability to send still images. In addition, whiteboarding, a standard feature on desktop videoconferencing systems, will also be used. Whiteboarding allows users on either end of the conversation to draw on an image while both parties can see the changes and talk about them concurrently.

2.1 Teledentistry focus areas

Three broad areas of teledentistry will be studied. They are: patient care, continuing education, and group management.

2.11 Patient care: In the present Army Dental Care System, a dentist generally must be physically present with a patient to diagnose or treat that patient. This has required either the patient or the dentist to travel for this meeting to occur. In some of the Army's more remote clinics, a patient must travel hundreds of miles to receive specialty care. Often pre-op and post-op visits are required that take only a few minutes of actual appointment time, but require hours of travel by the patient. With the implementation of teledentistry, some of this traveling need not occur.

Five clinical uses for teledentistry have been identified that have the potential to improve the way the Army provides care to its dental patients. These uses are:

Consultations: The quality of care that a dentist renders to a patient is limited by his ability to make the proper diagnosis. When a dental practitioner is unsure of the diagnosis, it is usually in the best interest of the patient for the practitioner to seek another opinion. Within the Army Dental Healthcare System this usually takes place in the form of a consultation between the primary dentist and an appropriate specialist.

When the appropriate specialist is located near the referring dentist, this consultation is usually easily handled. Problems arise when the specialist is far removed from the referring dentist. In this case, the primary dentist may not be able to obtain a consult due to a multitude of factors (e.g. no transportation available, no time available (emergency situation), no specialist available). When this happens, the quality of patient care can suffer.

Teledentistry has the potential to greatly alleviate this problem. Dental consults from remote sites can be conducted using equipment developed for teleconferencing applications. These consults can follow existing consultation patterns or can be done with specialists half a continent away. This capability is especially attractive in the area of oral pathology. Currently, access to oral pathologists is very limited within the Army Healthcare system. With teledentistry consultation capabilities, any patient could be seen remotely by a pathologist.

Referral for care: There are many instances within the Army Healthcare System where the primary dentist must refer his patient to another dentist for additional treatment. The most common instances occur when the patient requires specialty care that the primary dentist is not trained to provide or when the primary dentist is too busy to provide the needed care. In instances such as these, it is common for the receiving dentist to schedule an evaluation appointment before definitive treatment is scheduled. This practice avoids wasted time for the receiving dentist, but is quite wasteful of the patient's time. Occasionally patients must travel hundreds of miles to receive specialty care which keeps the patient from duty for a complete day. These short evaluation appointments, and a majority of the resulting postop appointments, should be achievable through the use of Teledentistry.

Home call: After hours care is an integral part of dentistry. At every Army post there is a mechanism in place to provide after hours emergency care to the supported population. As such, there are always dentists on call. In particular, oral surgeons are on call throughout most of their careers. This requires trips into the hospital or dental clinic at all hours of the night and on weekends. Although a significant percentage of these calls do not require "hands-on" care by the dentist, most dentists go in to see after-hours emergency patients to ensure proper treatment is rendered. With the implementation of a video teledentistry unit in the on-call dentist's home, many of these after-hours visits to the clinic could be

avoided. This would not only save much time on the part of the on-call dentist but would also reduce treatment time for the patient who must wait for the dentist to drive to the clinic.

Telementoring: Telementoring is the remote training of dentists using teleconferencing and teledentistry equipment. One important potential application of telementoring exists within the Dental Corps' residency programs. These programs require a critical mass of residents and mentors to be cost-effective. In addition, American Dental Association (ADA) curriculum guidelines require that residency programs often be affiliated with large hospitals, have a complete mix of specialists, and use modern, state-of-the-art equipment. They must also obtain a sufficient number of patients with the appropriate mix of dental problems to fully train their residents.

To facilitate the accomplishment of these objectives, telementoring allows the Army to send senior residents to another military post where specialty care in the resident's area is not available and where sufficient dental need exists. Through telementoring, this resident helps to meet that Army post's dental needs while at the same time remaining under the close supervision of his mentors. With this technology the resident can still present his cases to his mentors and receive real-time feedback and help when he encounters problems. In addition, he can continue to participate in literature reviews, lectures and demonstrations given back at the residency site.

Dentist-laboratory communications: Occasionally, cases submitted to the dental laboratory have subtle complications or esthetic nuances that require direct contact between the dentist and the laboratory technician. In these instances, the ability to send color images of the patient's teeth and then to talk about the images can help to prevent making improperly constructed appliances, thereby saving time, money, and patient inconvenience.

2.12 Continuing education

Currently, every dental officer is required to earn 50 credit hours of continuing education per year. Presently, the Army Dental Corps conducts week-long courses once a year on various dental subjects. These courses are conducted at Ft. Gordon, Walter Reed, and Ft. Sam Houston. A large percentage of the officers in the Dental Corps are paid to travel to one of these courses each year. These courses, as well as society meetings that the specialists attend, contribute approximately 30 hours of continuing education each year. Each dental officer must get an additional 20 hours through other means.

Within the Army there are ADA-approved training programs in Oral Surgery, Periodontics, General Dentistry, Prosthodontics, and Endodontics. In each of these residency programs, lectures and literature reviews occur weekly. In addition, each month, most of the residency programs have world renown consultants come

to deliver lectures in their respective fields. Through the use of videoconferencing equipment, these lectures could be broadcast to any post where continuing access to dental education is difficult.

2.13 Group Management

Desktop videoconferencing equipment can also be used to perform videoconferences between commanders throughout a given command and between their staffs. This allows more frequent staff meetings since travel time is eliminated.

In addition, application sharing, which is built into most desktop ISDN-based videoconferencing systems, can be employed to facilitate transfer of administrative and logistics data. Application sharing allows personnel at widely separated locations to work simultaneously on the same document. Input made on either computer is instantaneously reflected on the other person's computer while voice traffic is allowed to pass freely.

For example, suppose the comptroller did not understand the budget figures from one of his dental clinics. He could call up the administrative officer at the clinic and ask him to explain his figures. That person may then ask the comptroller to start his financial analysis software. He could then proceed to show the comptroller the figures by speaking and simultaneously manipulating his computer. Since the actions taken on the clinic side are also simultaneously reflected at the comptroller's side, the net effect is similar to having the comptroller "look over" the clinic administrator's shoulder at his computer as he explains his figures. Here instantaneous visual and voice communications allow for more accurate communications and a more timely response.

3. The Fort Gordon DSSA data collection plan

Each of the three areas of teledentistry will be implemented starting with a link between Fort Gordon, GA and Fort Mc Pherson, GA. If favorable results accrue, the experiment will spread to include the entire DSSA. Data collection will include the following:

- Patient surveys to determine if patients feel that they received quality care.
- Provider surveys to measure if providers feel that they had to compromise the quality of care that they delivered.
- Quality of care experiments such as single-blind studies to compare the quality of care rendered using teledental equipment vs. actual direct patient care, and accuracy studies to determine if transmitted radiographs and photographs allow the same accuracy of diagnosis as the original images.

- Direct costs involved to include phone bills, equipment and installation costs, and increased usage of healthcare providers.
- Changes in travel patterns such as increased travel for system maintenance and decreased travel to obtain care, to attend meetings, and obtain continuing education.
- Changes in the way dentistry is delivered that were caused by the implementation of teledentistry equipment.

4. Conclusions

Teledentistry holds promise to improve the care that dentists provide to their patients while reducing the distances that both patients and their dentists must travel to deliver that care. It is our expectation that within one year we will have sufficient data gathered to allow decision-makers to know the merits and shortcomings of this new technology with the hope that its power can be leveraged throughout the entire Army.