

## ORIGINAL ARTICLE

## Digital photography

J S Windsor, G W Rodway, P M Middleton, S McCarthy

Postgrad Med J 2006;82:688–692. doi: 10.1136/pgmj.2006.044990

See end of article for authors' affiliations

Correspondence to:  
J S Windsor, Centre for  
Aviation, Space and  
Extreme Environment  
Medicine (CASE), Flat 2 St  
James's School, George's  
Road, London N7 8HD,  
UK; jswindsor@doctors.  
org.uk

Received 6 January 2006  
Accepted 11 April 2006

**Objective:** The emergence of a new generation of "point-and-shoot" digital cameras offers doctors a compact, portable and user-friendly solution to the recording of highly detailed digital photographs and video images. This work highlights the use of such technology, and provides information for those who wish to record, store and display their own medical images.

**Methods:** Over a 3-month period, a digital camera was carried by a doctor in a busy, adult emergency department and used to record a range of clinical images that were subsequently transferred to a computer database.

**Results:** In total, 493 digital images were recorded, of which 428 were photographs and 65 were video clips. These were successfully used for teaching purposes, publications and patient records.

**Conclusions:** This study highlights the importance of informed consent, the selection of a suitable package of digital technology and the role of basic photographic technique in developing a successful digital database in a busy clinical environment.

Over the past 25 years, digital cameras have revolutionised the way photographs and video images are recorded. With recent improvements in small "point-and-shoot" digital cameras, detailed clinical images can now be recorded more quickly and more easily than ever before. This technology not only has the potential to improve documentation and diagnosis but can also "change the face of the classroom" by enhancing presentations and widening the dissemination of information across the world wide web. In addition, several medical specialities now use digital images in clinical trials to assess the response of patients to treatment. As practising doctors, we are privileged to witness an enormous range of clinical conditions and procedures during our working lives. Provided suitable consent is obtained, digital images of appropriate cases can be an invaluable resource to patients, relatives and health professionals alike. This paper intends to summarise 3 months of digital photography in an adult emergency department and from its findings provide information to those who wish to record, store and display their own medical images.

## METHODS

This study used a Sony Cybershot DSC P100 point-and-shoot digital camera in conjunction with a Sony Vaio VGN A115M laptop computer. Digital information was transferred from the camera via a Universal Serial Bus 2.0 port and processed through Sony Picture Package software. Adobe Photoshop 2.0 Elements and Adobe Premiere software were used to edit the images. These images were subsequently stored on a Thumbsplus database. The camera contained a 256-MB memory card, which was capable of recording a range of 1–5 megapixel images or 6 min of continuous video footage. The camera was worn on a belt during each 12-h shift for a 3-month period and used to record digital photographs and video footage in an adult emergency department in Australia (fig 1). Selected images were presented to medical staff on Microsoft Office PowerPoint 2003 software at regular meetings. Any image that featured the appearance of a patient was only obtained with written consent.<sup>2</sup> A consent form was designed for the project (Appendix 1).

The database created from this project was for strictly non-commercial means and the images used solely for medical records and education.

This project was completed with ethical approval from the Human Research Ethics Committee—Eastern Section, Sydney, New South Wales, Australia.

## RESULTS

Over the course of 3 months, 428 digital photographs and 65 video clips were recorded, processed and stored on the database. Of these images, 207 contained all or part of the patient's appearance and were obtained with written consent. Table 1 presents a break-down of these images. The remaining images included printed results and investigations of the patient, medical equipment and simulated procedures using volunteer health professionals as subjects.

Electrocardiograms, radiographs, ultrasound scans, computed tomograms and magnetic resonance images were the most common examinations recorded. In addition, printed and handwritten information, such as phlebotomy and



Figure 1 The camera worn on a belt loop during a clinical shift.

microbiology studies, with handwritten patient records and reports were also obtained.

Thirty two video clips and photographs of clinical procedures were recorded, and are summarised in box 1.

**DISCUSSION**

At present, digital photography is widely used in clinical practice to improve documentation and direct treatment. This has applications for both acute (eg, the resolution of anaphylaxis and angioedema) and chronic (eg, treatment of burns, venous ulcers and localised cellulitis) conditions when written documentation may prove inadequate. Digital imaging also has a far wider application, informing and educating a large audience, and enhancing “the physician’s ability to communicate with their peers, patients and public”.<sup>3</sup> Until recently, conventional 35-mm photography was used to satisfy all these requirements; however, this has often meant that doctors have had to rely heavily on the technical expertise of medical photographers and technicians to record and process the images they required.<sup>1</sup> Such dependence has proved expensive and time consuming, and has led to a wealth of medical conditions and procedures going unrecorded in a busy clinical environment.<sup>4</sup> Today, detailed video images and photographs can be recorded on small, lightweight cameras that can be viewed, edited and transmitted widely within minutes. This has, no doubt, encouraged the appearance of several sites on the world wide web, which display clinical images of interest to the doctor. Unfortunately, these resources have their limitations. Images can be slow and costly to download, their quality and subject matter may be limited, and issues of consent and confidentiality may remain in doubt. Although photographs are widely available on the world wide web, access to video footage is limited. Video footage of brief disorders such as transient ischaemic episodes, seizures or abnormal movements can provide an invaluable addition to a patient’s medical record. Moving images can also detail rare (eg, Chvostek’s sign in hypocalcaemia) or poorly understood (eg, raised jugular venous pressure) clinical signs, as well as a wide range of short procedures (eg, joint aspiration) and acute presentations (eg, calf squeeze test in a ruptured Achilles tendon), far better than a still photograph or the most eloquent textbook description. The authors of this project have found that when used with a suitable computer and compatible software, it is possible to create a comprehensive database of digital photographs and video images in a short period of time, which may well satisfy the educational and clinical needs of doctors, without having to rely on outside sources.

The experience gained from this project has led the authors to conclude that three important factors are necessary to create a successful medical images database: (1) a process for obtaining informed consent; (2) the use of appropriate technology; and (3) the successful application of basic

**Box 1: Examples of clinical procedures recorded as either digital photographs or video footage in the emergency department**

- Lumbar puncture
- Basic and advanced airway management
- Chest drain insertion
- Manipulation of fractures and dislocations
- Intra-arterial cannulation
- Joint aspiration
- Central venous cannulation
- Suprapubic and urethral urinary catheterisation
- Application of casts
- Use of a slit lamp for ophthalmic examination
- Fibre-optic endoscopy
- Peripheral nerve block
- Insertion of a nasogastric tube
- Management of epistaxis
- Peritoneal aspiration

**Table 2** Consent choices made by patients (n (%)) in this study

|                                                                                   |           |
|-----------------------------------------------------------------------------------|-----------|
| Consent for use in confidential medical records, medical teaching and publication | 190 (92%) |
| Consent for use in confidential medical records and medical teaching only         | 15 (7%)   |
| Consent for use in confidential medical records only                              | 2 (1%)    |
| Refusal of consent                                                                | 7         |

photographic techniques. These factors are discussed in more detail.

**Consent**

Many patients will have had considerable exposure to digital technology before their arrival at hospital. A large proportion will either have their own digital camera or will have at least featured in a digital image, whereas a few will be carrying a camera with them, usually incorporated into their mobile phone. During our research, the sight of a digital camera was often greeted with either invitations (“Go on, I’ve already taken a photo of it myself” or “You’ll want a photo of this”) or considerable interest (“Can you show me some pictures?”). In the process of recording images, many patients suggested suitable poses or camera angles, whereas others insisted on checking each image on the digital display and altering their dress and make-up accordingly. Several patients also showed a wider understanding of the medium by requesting copies of images to be sent to them by email. Despite large numbers of enthusiastic and informed volunteers, there will always be those who are either unwilling or unable to give suitable consent. This group may include a “potentially vulnerable population that may feel overtly or implicitly coerced” into providing consent and need very careful consideration.<sup>5</sup> As health professionals we are obliged to ask ourselves the question, “Am I coercing this patient into providing consent?” When the answer is “yes”, it is often clear from the outset that these patients are unable to comprehend what is being asked of them. This may be due to features in a patient’s presenting complaint, comorbidity or social situation, which should be identified in the early stages of a consultation. However, when the answer may seem to be

**Table 1** A summary of 207 clinical signs recorded during 3 months in an adult emergency department

|                                                                                                                                                                                                |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Bone and soft tissue injuries<br>Including fractures, joint dislocations, tendon, ligament and muscle injuries                                                                                 | 94 (45%) |
| Superficial masses and cutaneous lesions<br>Including both medical (ie, dermatological, rheumatological and endocrine) and surgical (ophthalmic, maxillofacial, ENT and general) abnormalities | 76 (37%) |
| Examination of an abnormal system<br>Including respiratory, cardiovascular and neurological systems                                                                                            | 37 (18%) |

**Table 3** Important features of a digital camera in the clinical setting

|                                    |                                                                                                                                                                                                                                                                                                                      |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Portable                           | A camera should be compact and light enough to be carried comfortably on a waistband or belt strap. A small stand, charger and an alternative memory source should also be available                                                                                                                                 |
| User friendly                      | Recording, transferring and storing still photographs and video images should be a swift and straightforward process. Data processing should need only the most basic computing skills and all software should include a short training package for new users                                                        |
| Viewfinder and digital display     | Both must be present. The digital display must be of sufficient size (minimum 3×3 cm) for the operator and participant to view photographs and video footage                                                                                                                                                         |
| Focus and exposure                 | These automatic features should be quick to adapt to a variety of lighting conditions and subjects. In addition, there should be the option to over-ride both in certain circumstances (eg, controlling the overexposure possible when recording x rays)                                                             |
| Flash feature                      | All cameras should be fitted with a range of flash features, with an "anti-red eye" function                                                                                                                                                                                                                         |
| Zoom                               | An optical zoom of ×2–3 magnitude is sufficient. This should not be confused with a digital zoom, which is part of the camera's own software and can cause the final image to become distorted                                                                                                                       |
| Macro function                     | This allows the camera to record images from a distance of only 10 cm from the subject, and is especially useful for images recorded through a slit lamp, microscope or fibre-optic endoscope                                                                                                                        |
| Detail                             | To publish or present data, images will need to have a pixel density of ≥200 pixels/inch.                                                                                                                                                                                                                            |
| Memory                             | A camera should be equipped with at least 256 MB of memory (either inbuilt or through a removable storage system)                                                                                                                                                                                                    |
| Transfer, storage and presentation | A Universal Serial Bus (USB) connection offers the quickest and most economical way to transfer large amounts of data. Further software will be needed to edit (eg, Photoshop or Premiere), store (eg, Thumbsplus) and present (eg, PowerPoint) digital images and should be included in any database project budget |

"no" to the question of coercion, it is still conceivable that we might be overlooking several patients who believe that by refusing a request for consent, they may in turn receive inferior medical treatment. It is therefore vital that the patient is reassured, their symptoms controlled, and a clear plan of management described and implemented before any requests are made. To reduce the risk of coercion still further, an opportunity to withdraw consent at a later stage should be offered. The consent form devised for this project provided patients with a telephone contact, with email and postal address that allowed them an opportunity to change their consent status for up to 2 weeks after the image was recorded. Many patients will be aware of how easily digital images can be distributed across the world wide web, and may only consent to providing digital images if the results remain wholly within their confidential clinical records. By adapting a template now commonly used in a range of medical journals, we found it possible to provide a consent form that allowed patients to specify exactly how their image should be used.<sup>2</sup> Like most medical publishers, this project sought consent from anyone whose body appeared directly in the image and emphasised the fact that anonymity and confidentiality could not be guaranteed when used outside of their medical records.

The choices made by our patients are summarised in table 2.

### Technology

Faced with an overwhelming amount of ever changing technology, the process of selecting and purchasing suitable equipment for a digital database can at first seem daunting. However, by identifying the features that are needed in

### Box 2: Examples of conditions with clinical signs suitable for video recording

- Ankylosing spondylitis
- Bulbar and pseudo-bulbar palsy
- Cerebellar syndrome
- Choreoathetosis
- Cranial and peripheral nerve palsies
- Ehlos Danlos syndrome
- Motor neurone disease
- Myasthenia gravis
- Myotonic dystrophy
- Ocular palsies
- Parkinson's disease
- Rheumatoid arthritis
- Speech disorders
- Systemic sclerosis
- Thyroid disorders

clinical practice, it soon becomes possible to narrow the search for equipment and focus on a much smaller range of digital technology.

For most of the images taken in the clinical arena, a modern point-and-shoot camera will be satisfactory. Although a digital single-lens reflex camera can offer an enormous range of functions, point-and-shoot models are usually smaller, more affordable and easier to use. But despite these advantages, point-and-shoot cameras vary enormously and therefore before purchasing, it is worthwhile "test driving" several models first and to see if they satisfy the requirements listed in table 2.

### Technique

Once informed consent has been obtained and suitable technology is in place, a photograph or video image can be recorded. Regardless of the technology used, it is worth bearing in mind that "good lighting, composition and photographic technique are as important as the camera".<sup>1</sup> Although modern editing software can contribute to the final image, much still depends on the experience and knowledge of the operator for success.

The first decision that must be made when recording images on a modern point-and-shoot digital camera is whether to record video footage or a still photograph. Most images, which rely on movement, such as the patient with myasthenia gravis tiring with repetitive exercises, should be recorded on video (box 2). Alternatively, stationary subjects, such as patients with skin lesions, are better suited to still photography. Despite obvious differences in subject matter, the process of recording suitable photographs or video images shares several common principles. Although a complete description of photographic techniques is beyond the scope of this article, it is possible to outline many points that should be considered when obtaining an image in the clinical environment. Above all, the photograph or video clip image should always be kept as simple as possible. The subject should be well lit and in focus, and the background should primarily act as a means of drawing attention towards the subject. This can be done in several ways. Contrasting colours, patterns and textures can all add emphasis to the subject of an image. In most clinical settings, a rich source of backgrounds is available, ranging from the patient's own clothes and belongings to fluorescent spinal boards and surgical towels found in an emergency department. Alternatively, straight lines can be used, such as walking



- 2 **Hood CA**, Hope T, Dove P. Videos, photographs and patient consent. *BMJ* 1998;**316**:1009–11.
- 3 **Prasad S**, Roy B. Digital photography in medicine. *J Postgrad Med* 2003;**49**:332–6.
- 4 **Johnson D**, Johnson M. Digital video. *Clin Orthop Relat Res* 2004;**421**:17–24.
- 5 **Marco CA**, Larkin GL, Silbergleit R. Filming of patients in academic emergency departments. *Acad Emerg Med* 2002;**9**:248–50.
- 6 **Andres BM**, Khanna J, Wenz JF, et al. A comparison of digital cameras – features essential for the orthopaedic surgeon. *Clin Orthop Relat Res* 2004;**421**:10–16.