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**Basic digital photography in dermatology**

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**Abstract**

Digital photography has virtually replaced conventional film photography as far as clinical imaging is concerned. Though most dermatologists are familiar with digital cameras, there is room for improvement in the quality of clinical images. We aim to give an overview of the basics of digital photography in relation to dermatology, which would be useful to a dermatologist in his or her future clinical practice.

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**Full Text****Introduction**

With the advent of new generation digital cameras more and more dermatologists are using digital images in their regular practice.

The dramatic reduction of the cost of digital photography as compared to conventional film photography is one of the reasons for the rapid large scale acceptance of digital photography as a part of medical imaging. Digital photography improves the physician's ability to communicate with peers, patients, and the public. This article aims to make dermatologists familiar with the basics of digital imaging in the context of dermatology.

Basic science of a digital photograph

Basically a digital camera, just like a conventional camera, has a series of lenses that focus light to create an image of an object. But instead of focusing this light onto a piece of film, it focuses it onto a semiconductor device that records light electronically. A computer then breaks this electronic

information down into digital data. In other words instead of film, a digital camera has a sensor that converts light into electrical charges.

The image sensor employed by most digital cameras is a charge-coupled device (CCD). Some cameras use complementary metal oxide semiconductor (CMOS) technology instead. Both CCD and CMOS image sensors convert light into electrons. Both of these have their own relative advantages and disadvantages. [1]

How many pixels?

The amount of detail that the camera can capture is called the resolution, and it is measured in pixels. Basically, the more pixels a camera has, the more detail it can capture. Also as the pixels increase, larger prints can be made without losing detail.

Example:

640x480 - Relatively lower resolution. This resolution is ideal for e-mailing pictures or posting pictures on a web site. 1216x912 - This is a "megapixel" image size -- 1,109,000 total pixels -- good for printing pictures. 1600x1200 - This is "high resolution". Good quality prints of 4 X 5 inches can be obtained 2240x1680 - Found on 4 megapixel cameras this allows even larger printed photos, with good quality for prints up to 16x20 inches. [1]

The question of what is the ideal resolution for dermatological photography has been an often-discussed topic. Some authors like Siegel point out that for all practical purposes in clinical dermatology, the current technology with regard to resolution has already gone beyond the needs of the clinician. Siegel's article using freeware and commercially used software, offers proof that a single megapixel (MP) image is adequate for on screen evaluation and publication purposes. [2] Bittorf et al . have suggested that a resolution of 768 X 512 (with 24 bit color) i.e. around 0.4 mega pixel may be sufficient for routine dermatological purposes. [3] Miot et al . in their article suggest that a camera resolution of 1.3 MP (1280 X 960) is adequate for dermatological photography. [4] However, in the same article, Miot et al . point out that prior to taking the photograph whenever we know that the image will need editing to remove an undesirable aspect or to concentrate attention solely on one element of the photo, a greater than standard resolution should be used considering that a significant quantity of pixels will be discarded. [4]

Virtually all of the new cameras available in the market at present have resolutions starting from at least 3 megapixel. Therefore resolution is unlikely to be a major issue in the future as far as digital photography in dermatology is concerned.

Compact (point -and -shoot) cameras or digital SLR (single lens reflex)?

As far as the quality of photos is concerned, the digital SLRs undoubtedly outscore the common point-and-shoot varieties. However for all practical purposes, including publication and PowerPoint presentations the image quality of the compact cameras are more than sufficient. Besides, the exorbitant cost of digital SLRs is another prohibitive factor. The one disadvantage of most compact cameras is a limitation in manual adjustments specifically in relation to controlling factors like aperture size, shutter speed, flash intensity etc. However, there are intermediate, 'prosumer' or 'bridging' cameras available these days which have functional capabilities between a simple compact camera and a digital SLR. Most of these are quite affordable compared to a digital SLR. [1]

## Background and Materials

One of the basics of clinical photography is to stress on the lesion /area of interest. There should be an emphasis on removing any kind of clutter or other distracting elements from the background. Most experts recommend a plain light blue or green non-reflective surface, like a linen cloth. Make it a point to remove items like ornaments, which unnecessarily divert focus from the lesion of interest. Other accessories, which would come in handy, are measurement tapes and skin markers. [5]

### Lighting and flash

Lighting is often a tricky issue in dermatological photography. Ideally broad daylight or a naturally lit room, if available would be the best; however, many times we have to take our photographs indoors with the use of flashes or other accessory light sources. All compact digital cameras have inbuilt flash units. Unfortunately most of the compact units do not have options for controlling the intensity of the flash. The most important thing while using an inbuilt flash is to avoid getting too close as the distinctive features of the lesion may get washed off. Also it would be advisable to vary the 'white balance' on the camera depending on the primary lighting (e.g. adjust the white balance to fluorescent if shooting under predominantly fluorescent light). External light sources can be useful in taking very close shots with the 'macro' feature turned on (Using the flash while taking extreme close-up tends to cast a shadow of the camera head over the image). Another enhancement which might help for very close shots is a 'ring' flash. However, this too may reflect from the surface of the skin lesion being photographed, particularly if the distance between the camera and the lesion is small, and wash away all the surface details.

### Macro photography

One of the very evident advantages of digital cameras compared to the film cameras is the ability to produce extremely good close up shots. Though routine dermatological imaging for publishing or presentation does not really require extreme close ups, macro photography can give stunning detail to the close-up images of skin lesions. Most digital compacts offer macro shots from distances of 2 cm to 5 cm without any lens attachment. To put it simply, these cameras can shoot images at distances of as close as 2 to 5 cm and the image projected on the digital sensor is close to the same size as the subject itself. The universal symbol for the macro mode is a flower [INSIDE:1]. The quality of the macro shots can be enhanced with macro lenses which can be attached to the digital SLRs and some bridging cameras. However for all practical purposes, dermatological photography does not require the use of specific macro lenses.

### General recommendations and tips

Always take the patient's consent before photographing, especially if the shots are taken during a surgical procedure when the patient may not be aware of the same. A written informed consent would be the best and is a must if one is planning to use the photograph for publications. Include the patient's hospital card, tag or number in all or at least one of the images of a series so as to enable easy identification later. Always try to take before and after photographs in the same settings with respect to patient positioning, background, lighting and camera settings. Use auto-focus as often as possible, use manual controls only if you are well versed with them. Select the 'macro' mode for close-up shots. Use flash as often as possible when the available lighting is poor, but avoid getting too close to the lesion as the over exposure may wipe out the details. For very close shots oblique views may be preferred. Try to add some shots of areas you expect to be involved in some of your differential diagnoses, but are apparently free of involvement in the particular case (eg. nails in psoriasis). Eliminate distractions from the background. Try taking all photographs with a plain non-reflective blue or green background.

### Framing tips

For different body areas certain standard framing patterns are followed. Detailed instructions on these

can be found in an article by Pak [5]

For all lesions make it a point to take at least 2 shots from each point of focus. Minimal blurring may not be obvious in the LCD screen and may be noticeable only after the images are viewed on the monitor. It is always better to have an extra copy from every focus point so that the best image can be selected.

Always try to capture distinctive elements like typical representative lesions, particular configuration or distribution patterns.

For generalised lesions take shots from at least three ranges:

A complete vertical view of the patient showing the extent and distribution of the rash  
A medium distance shot showing the arrangement and configuration of the rash.  
A close up view highlighting a representative lesion

For localised lesions take shots from at least two points:

A medium view showing the rash /lesion with respect to location and configuration

(always include a recognizable body landmark so that the location is obvious. eg. For lesions on the abdomen include the umbilicus in the medium distance shot)

A close up view of the representative lesion

For isolated lesions it is also advisable to include a discernible landmark in one of the shots. For the close up shots use a measuring tape in the frame to demonstrate the size of the lesion. It would be advisable to take the close up shots from more than one angle and include oblique shots. Shots with and without flash may be taken and the best shot selected for storage.

Basic microscopic photography

Another interesting adaptation of compact digital cameras is in recording basic light microscopy images e.g. hair microscopy, scabies or pediculosis [Figure 1],[Figure 2]. The front of the camera lens can be placed on to the eye piece and the image taken either in the auto mode or with a fast shutter speed. Actual skin histopathology images ideally require the use of dedicated camera units integrated with the microscope.

Children and infants

While photographing very young children and infants make sure that the subject is comfortable and not anxious. Children tend to be fidgety and getting blurred images because of the movement is a common problem. A small toy or a pen would come in handy, though this should not be included in the frame. If your camera has an option of adjusting shutter speeds a fast shutter speed would be useful in shooting photographs of children. Also use the flash as often as possible. Avoid pointing the flash directly into the eyes, especially in the case of infants.

Oral /Dental images

Proper imaging of the oral cavity requires the use of good quality dental mirrors. However satisfactory images can be obtained by using a very good point light source. The 'auto-illuminator' feature available in most modern cameras also helps in obtaining a good shot of oral mucosal lesions, without costly mirrors.

## Videos

Most present day compact digital cameras have video recording capabilities with sound. Most allow 640X 480 video which gives sufficiently good clarity for PowerPoint presentations etc. The same can be put to various uses effectively, eg. for demonstrating basic signs in dermatology like Auspitz's sign or the Nikolsy sign etc.

## Storage

Most electronic submissions accept the JPEG (Joint Photographic Expert Group) format as the standard. The major advantage of the JPEG format is that the image size can be compressed considerably without significant visible loss of resolution. This ensures ease in online submission as well as powerpoint presentations etc. Some journals insist on the TIFF (Tagged Image File Format) images to be sent on CDs as a follow up to online submission (where digital images are the only source). TIFF is considered to be the default industry standard for a cross platform image format that can be opened by virtually all graphics applications. The disadvantage of TIFF files vis-à-vis JPEG is a bigger file size.

Other standard formats used for storage include the -PSD (Photoshop document), PNG (Portable Network Graphics), BMP (windows bitmap) and GIF (Graphics Interchange Format). [6]

Most digital cameras save the images by default at a resolution of 72 dpi. This can be converted to 300 dpi with the use of basic photoediting software. The resolution of 300 dpi is the general standard for most journal submissions. [6]

Another file format used, especially in the context of SLRs is that of the RAW files. This refers to the minimally processed data file from the image sensor of a digital camera. Raw image files are sometimes called digital negatives, as they fulfill the same role as film negatives in traditional chemical photography: that is, the negative is not directly usable as an image, but has all of the information needed to create an image. The advantage obviously is the markedly higher quality of image as virtually no pixels are lost, as a corollary, the disadvantage is that the files are two to six times larger than JPEG files. Another problem is that currently there is no standardised RAW format, with different camera manufacturers using different versions eg. .crw (Canon), .ptx (Pentax) and .nef (Nikon).

With the cost of hard disks dramatically going down over the last few years, it has become very easy to store entire image inventories in single spaces. Other than the primary hard disk it is always advisable to keep a back up copy of your images on an alternate site like a portable hard disk (a range of which are available at very reasonable prices), The back up copies can also be saved in the compressed JPEG format so that the space taken up can be minimized. It always makes sense to delete images that are blurred as they are unlikely to be used by you and will unnecessarily clutter up the hard disk space.

Make it a point to catalog all saved images (or containing folders) tagging it with the patient's name, hospital number, date and even the provisional diagnosis if possible. Meticulous cataloging may seem cumbersome at the beginning but makes future retrieval of imaging very convenient.

## Imaging software and tampering issues

A variety of software packages are available on proprietary, shareware and freeware basis. The most commonly used ones include Adobe Photoshop, Paint shop pro, Corel draw, GIMP and Irfan view. The software can be used for optimal cropping, adjusting the resolution and to a certain extent in adjusting variables like brightness, contrast and saturation. The question to what extent of image adjustment will fall within the purview of ethical image editing is still not answered. There already have been umpteen instances of editing software used unethically to completely alter medical images

-both clinical and histopathological. [7],[8]

## Teledermatology

The digital image forms the basis of 'store-and-forward' teledermatology. A proper digital photograph highlighting the representative lesions and a proper history is often sufficient for a dermatologist to make a reliable diagnosis. Many studies have demonstrated that good quality images can actually substitute for a dermatological physical examination in a good percentage of cases. [9]

Photography resources and help sites on the net

<http://en.wikipedia.org/wiki/Portal:Photography>

[www.steves-digicams.com/hardware\\_reviews.html](http://www.steves-digicams.com/hardware_reviews.html)

[www.dpreview.com/reviews/](http://www.dpreview.com/reviews/)

<http://www.shortcourses.com/>

The above resources are all regularly updated and give a fair idea of which camera to go for depending on whether you are a beginner, or an advanced user. In fact <http://www.dpreview.com/reviews/compare.asp> gives you the choice to select exact attributes of the camera you want and get a list of the available cameras in that range. For beginners we would suggest an entry level camera with at least 6 MP resolution, and 3X optical zoom as a minimum -eg. Canon PowerShot A590 IS, Fujifilm FinePix J10, Nikon Coolpix P60 or Kodak EasyShare M1033 (other relevant features like macro mode, and video are available in virtually all present day entry level cameras). For users looking for more advanced options - 'prosumer' cameras like the Sony H series / Canon SD 950IS or entry level digital SLRs like the Canon 350/400D would be a good option. For professionals of course a good SLR like Canon EOS 40D, Nikon D300 and Sony alpha A700 would be good, provided the cost is not a consideration.

## Conclusion

Digital photography has revolutionised the way images can be taken and stored in the context of clinical dermatology practice, research and teaching. However as the options of available equipment increase day by day, we should be aware of what is the optimal equipment that we need as well as understand the potential possibilities and limitations of the available equipment in our hands. For our routine practice, the entry -level digital cameras not only suffice, but are also handy. Moreover even with these cameras additions like movie mode and basic microphotographs can be done. With a few basic points regarding framing, lighting, exposure and resolution virtually anyone can produce good quality clinical photographs of standards meeting the specifications for publication.

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