

Guideline

Subject: Photography for Clinical Forensic Medicine
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This document refers specifically to photographs and not to video, although many of the same cautions apply.

Disclaimer: This is a guideline only for Australasian forensic examiners. Local jurisdictional policies / procedures (if available) should always be checked.

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Introduction

There are currently three ways to document an injury:

- Verbally – this requires correct use of injury terminology and generally includes some description of the injury seen
- Diagrammatically – this records the relative site, size and shape but rarely provides specific details of the injury itself
- Photo-documentation – this complements the previous two. It is the only method of injury documentation that enables a secondary independent opinion to be made, albeit with some limitations.

Forensic photography has one primary purpose and that is for documentation of a clinical finding. Secondary purposes for photo-documentation may include, amongst others:

- An aide-memoir for the examiner
- Review by peer, mentor or colleague
- Evidence for court
- Evidence to assist in the investigation of a crime
- Teaching and education
- Research
- Assessment of injury healing / change over time

Photo-documentation is an important tool in the development of factual clinical conclusions.

When a forensic examiner is required to document an injury, it should be completed in the most comprehensive manner possible, within limits imposed by patient consent and legislation. Photo-documentation is an adjunct to, not a replacement for, other forms of documentation.

Consent must be provided before photographs are taken.

The health and psychosocial needs of a patient must take priority over the requirement to photograph an injury. The patient must be fully informed of the intended and potential uses for any images collected, and give their consent to taking and the use of images

The Camera and Photography Training

A digital SLR (DSLR) camera is the best device for taking high quality images. Consideration should be given to purchasing a camera that can be readily serviced and has compatibility with available equipment (lenses, electronic flash etc.). This is not to deny the value of modern “point and shoot” digital cameras with built-in electronic flash and zoom lens plus other features of DSLRs other than the reflex viewfinder and interchangeable lenses. However digital SLRs are more flexible and have a wide range of lenses and attachments available for special purposes.

Lenses

Lenses are characterised by their focal length, focussing range, maximum aperture and for zoom lenses, the zooming range.

In general, the wider the aperture (the lower the f number), the more expensive the lens and the better suited it is to photography under low light conditions. A good quality 55 mm fixed focus lens would have a minimum f number less than about 2.8.

The focal length of the lens refers to its magnifying power and has an effect on the extent of the subject that is captured in an image and may also affect distortion of the image. Zoom lenses have a manual adjustment to vary the focal length within a certain range. A focal length of about 50-55 mm is considered to produce images that are of a similar size to what is seen by eye. Focal lengths below 50 mm are “wide angle” and produce images that cover a wider field than the naked eye but may also be distorted. The most extreme example of this are so-called “fisheye” lenses that produce highly distorted images that are generally not suitable for forensic purposes. Focal lengths greater than about 55 mm are “telephoto” and produce magnified images of a smaller field. The longer the focal length the less distortion. For general forensic medical work, a zoom lens with a range of about 35-100 mm or more would be suitable for most subjects.

If you are buying lenses, you need to know that lenses used with smaller format digital SLR cameras will have an effective focal length greater than if they were used in a 35mm film camera or full format digital SLR. The multiplication factor varies between cameras and should be checked in the camera documentation. e.g. a 50 mm lens in a small format camera with a multiplier of 1.5 will perform like a 75 mm lens in a full format camera.

The minimum focussing range of a lens defines how close to the subject the lens can be for the image to be properly focussed. This varies with quality and focal length. A lens capable of very close work is called a macro lens.

Lighting and exposure

Photography is all about light and how that light is reflected and absorbed from the subject to record an image. Modern cameras set on ‘automatic’ aim to provide the photographer with an image that is correctly exposed every time a photograph is taken, but only if the subject is ‘normal’. ‘Normal’ in terms of the photographic world, is an average scene with an overall subject reflectance of 18%.

For example, white/light skin reflects more than 18% of incident light (brighter) and dark skin (including dark bruising and/or blood) has a reflectance of less than 18% (darker). This means that reliance on an automatic exposure setting on the camera, without using exposure compensation functions, could underexpose light skin (making it appear too dark) and overexpose dark skin (making it appear too light). Most DSLR cameras have a +/- override button that will compensate for exposure when the subject is outside the average scene or subject (18% reflectance).

Exposure is controlled by three components that relate to each other with respect to the amount of light entering the camera and exposing the sensor (or film). Other visual changes to the image also occur with these different components:

- Aperture or f-stop (opening of the lens). The wider the aperture (smaller number), the more light reaches the sensor while the shutter is open. Aperture or f-stop also affects the depth-of-field, or the amount of the subject that appears in focus. Depth of field is reduced with wide apertures (low f-stop numbers).
- Shutter speed. This is the time the shutter is open allowing light to reach the sensor. Slow shutter speeds (below 1/30th second) may cause subject blur due to camera shake or subject movement. Many modern cameras include automatic systems to reduce this.

- ISO. This is the “sensitivity” of the film or digital sensors to light. The higher the ISO number the greater the sensitivity to light requiring less exposure. Digital cameras allow the ISO number to be changed while in film cameras the ISO is a fixed characteristic of the film being used. A safe choice of ISO is between 200 and 800. Higher ISO settings (i.e. 1600 ISO) may introduce noise which has the appearance of graininess of the image. Noise affects the level of fine detail and sharpness of the image.

Lighting considerations

Ambient light (also referred to as available light) comes from a constant source of illumination. It may be sunlight, room light (incandescent/fluorescent/LED) or window light. It may be a combination of all three.

Electronic flash provides an instantaneous ‘burst’ of light coming from a device in-built or externally connected to the camera.

Important technical note: Each light source produces a different colour (colour temperature) that will affect the colour of the image. The camera ‘white balance’ must be set for the colour characteristics of the light source. Electronic flash provides the most reliable and consistent colour quality of light for the reproduction of accurate image colour.

A DSLR camera, that has had settings selected manually, can be set up very specifically to produce consistent quality even under varying conditions. Adjusting the aperture, shutter speed and ISO can result in different effects while at the same time ensuring the exposure is correct for the specific area of forensic importance. For example, a small aperture will result in greater depth of field, a large aperture will result in a narrow depth of field. A fast shutter speed captures a moment in time but a slow shutter speed may exhibit movement. A high ISO will allow images to be taken in dark surroundings but will result in a noisy (grainier) image than if a low ISO was used.

Suggested SLR camera settings with additional flash and macro lens:

White Balance	Flash (when using electronic flash)
Aperture (f-stop)	F8 to 11 (adequate for reasonable depth-of-field)
Shutter speed	1/200 (or the speed recommended for flash)
Mode	Manual
ISO	800 (within the range of 200-1000)
Image Type	JPEG
JPEG compression	Optimal or High Quality
Image Size	Large
Image Quality	Fine

It is strongly advised that you consult with a person experienced in photography in order to assist with the set-up for your particular camera, keeping in mind the range of settings under which the photographs are likely to be captured.

While images may be captured in a RAW format (image file format) this format also requires some image processing and post-production in much the same way as a film negative requires processing in a dark room in order to produce a photograph. Capturing images in a Large

(Image Size), Fine (Image Quality), JPEG format is the most useful format for clinical forensic photography as this can be viewed by most computers etc. and does not require post production processing.

A dedicated camera for the purpose of photo-documentation of injuries and other case features, is recommended. Capture of images using a phone or tablet is not recommended. Although the images from these devices may 'look good', they produce many technical issues that make reliable interpretation of the image technically difficult. Furthermore, images captured on mobile devices have significant security consequences that could damage patient confidentiality and may breach organisation policy.

It is vital that training on how to use your particular camera has been undertaken. Each camera has its own peculiarities and examiners need to be familiar with how to turn it on, where batteries are stored / charged and how they are inserted, how to go back to original settings or default (in case someone has inadvertently made changes), how to operate the flash, how to review the images, how to interpret exposure histograms, how to delete photos and how to download them etc. It is also critical that the settings in the menu are appropriate for the shooting conditions, including the colour temperature of the light source (white balance setting).

Guidelines / Procedures and Policies

Photo-documentation should not be attempted until guidelines, procedures and/or policies are in place.

These should address the following issues:

- The camera that is being used for this purpose and appropriate settings
- Storage of the camera, battery, flash and lenses
- The correct date and time is set on the camera (for obvious reasons relating to court evidence)
- Digital storage of resultant images and for how long they will be kept
- Review of images by examiners and how this is going to occur
- Transmission of images e.g. to the Court, Police, Prosecution, Defence, Examiner, Reviewer
- Guidelines re: destruction of images
- Consent of the patient
- The need to record, within a person's medical record (if appropriate) or within an Expert Certificate or Statement, that photographs have been taken.
- Ownership of images (do they belong to a Health, Justice, Police organisation, the patient or to the examiner)
- Who can have access to the images and who is likely to see them
- All intended uses for the images e.g. research or teaching
- Images may need to be surrendered upon receipt of a valid subpoena or under other legislative requirement

Correct Sequence for Photo-documentation

Prior to taking photographs, the examiner should think carefully about when images should be taken. If they are going to be taken in conjunction with the collection of forensic evidence, consideration should be given to taking them at the conclusion of the evidence collection to reduce the potential for DNA contamination. This is because it is not practical to decontaminate photographic equipment to the same standards that apply to the rest of the forensic

environment. Another option is for the frequent changing of gloves when moving from evidence collection to photographing injury and back again.

Photo Identifiers

It is important to ensure that photographs on a camera can be accurately matched to the person being photographed. This is particularly important when a single camera is used to take photos of multiple patients or when the photographs are to be downloaded by a person, other than the examiner who took them.

An identifier of some sort should be used, generally as the first of a series of photographs, as well as a method of indicating the end of a series of images. This should be dictated by current guidelines, procedures or policies. It can include a photograph of a hospital label (ensure no address is included as this might impact later on patient safety), a signed consent form, a head shot etc. The examiner should record the first and last number of the photos (as generated by the camera in use) in the patient record, as a secondary measure. Make sure the camera's clock is set to the correct date and time so the metadata also reflects accurate information (especially important if the photographs are used in court the metadata should match with the examiners contemporaneous notes).

Preparation

It is a good idea to test the camera by turning it on and ensuring the flash is working. Take a photograph under similar conditions as your subject and carefully check for a correct exposure. Make camera setting adjustments, if necessary.

Ensure the diopetre setting (for the view finder) has been adjusted for your eyesight. Refer to your camera instructions on how to do this if you are unsure. This is critical if you are using manual focussing otherwise the resulting image will not be sharp despite looking sharp through the viewfinder.

Turn off spotlights that may affect the colour of the subject. Remove any unnecessary shiny objects.

Consider draping and framing the body/patient's injury in such a way so as to preserve the patient's modesty where possible e.g. avoid including the nipple/areola in photographs of breast injuries unless this is the site of the injury.

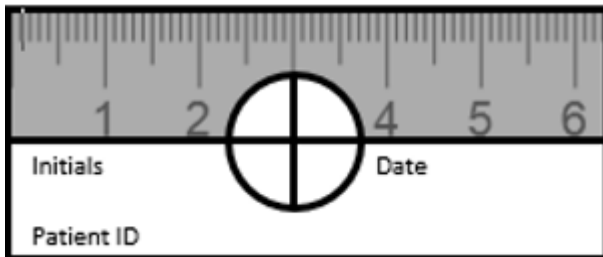
An anatomical identifier to clearly demonstrate the part of the body being photographed is recommended prior to capturing close-up images of injuries. Good photographs can be rendered virtually useless if there is no way for the examiner to later identify the location of image on the body.

Size of an Injury

There is rarely any forensic imperative to provide an accurate injury measurement unless the injury is thought to be a bite or might be a patterned injury. Relative or approximate size is often sufficient in the majority of cases.

If a scale is to be used it should be fit for purpose. If an injury is thought to have been a bite, an ABFO#2 scale should be used (American Board of Forensic Odontology). It should not only have measured increments but also a circle with cross hairs.

It is important that the scale is placed in the same plane as the injury and as close to it as possible, without obscuring any of the injury. It is good practice to take one image with the scale and one with the scale removed to disclose any detail that may be under the scale.



If the horizontal bar and the vertical bar of the cross hairs are of the same length, when measured in the photograph, the camera was perpendicular to the scale when the image was taken. If the image has been taken perpendicular to the scale, and the scale is on the same plane as the injury, accurate measurements can be made using the scale

from the photograph. If not, any measurements are likely to be approximations.

Give consideration to the type of scale used e.g. DNA free, sterile, single use or reusable and take steps to reduce any risk of DNA contamination, as required.

Before and After Photos

There is value in obtaining injury photographs immediately after the assault i.e. without washing of the injury and without medical treatment, if possible. A second set of images should be taken following cleaning so that skin edges and finer injury definition can be recorded.

Image Storage

This needs to be determined prior to the capture of any images. Secure drives, where backups occur regularly and where access can be limited, is one option for larger forensic units. If downloaded onto USB sticks, external drives or DVDs, consideration needs to be given to both secure storage and to the possible need for transferring the images to new devices after four or five years given the potential for device failure.

Images should be downloaded from the camera to a secure storage location where they are “read only” and cannot be modified. Working copies for court or inclusion in reports can then be made from the originals and distributed or labelled as necessary.

Sensitive Images

Sensitive images are generally considered to relate to images that show a person’s genitalia or a person in a state of undress. Specifically, this refers to images of breast, buttock, anus or genitalia. Some jurisdictions within Australia and New Zealand (NSW and Queensland for example) have special precautions that are legislatively mandated when handling or accessing “sensitive images” e.g. they can be viewed by a defendant but cannot be retained etc.

Images of sensitive areas sometimes can be cropped to preserve the dignity of the patient or digitally obscured using post-production methods (pixilation, boxed out etc.). Generally, there is nothing that prevents an examiner from doing this providing they clearly document for the Court that:

- The image has been cropped/alterd for this purpose
- That the original uncropped image can be made available to the Court, should it be required

Reviewing and Deleting Images

One could question the need to keep images that are poorly taken or are not beneficial. This can usually be done without problem if a second, better quality image has been taken. Refer to local guidelines regarding the deletion of images.

It is a good idea for examiners to review images as they are being taken. The best way to do this is to see the image live on a computer screen (e.g. with software such as Adobe Lightroom) as the examiner captures the image. As this is unlikely to be available for the majority of examiners, they should be encouraged to review the image on the back of the camera and to magnify the image (many times) to ensure focus is sharp. An image shown in playback mode on the back of a camera, unmagnified, is insufficient to determine whether an injury is in focus. While many image issues can be addressed post-production, blurred images cannot.

Images can be modified prior to sending to Court as long as it is clearly documented for the Court that:

- The image has been altered in some way
- The reason for altering the image
- Each of the steps (or processes) involved in the alteration are documented
- That the original unaltered image can be made available to the Court, should it be required

How you want your Images viewed by the Court

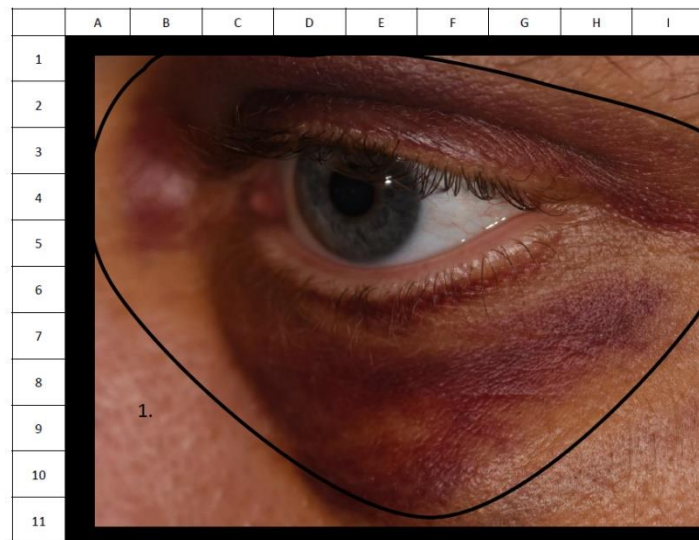
How images are handled may vary significantly, dependent upon the Jurisdiction within which you are working. It can be incredibly frustrating to print out your images on high quality, fade resistant, archival paper only to find these photographs never leave the police station and that Court is handed, instead, a scanned copy on plain A4 paper!

It can also be difficult if many images have been taken and they are presented to the Witness, out of order. Consider presenting them to the Court in a numbered format (so that the Witness and the Court can be assured they are both referring to the same image).

Printing photographs inside an index grid as shown can be useful when specific features need to be referenced

It is also useful to keep a second set of images that have had the injuries circled in the photos and numbered according to their numbering in any Expert Certificate or Statement that

has been prepared. It can be embarrassing turning up to Court years later only to find that you can't see where the injury was, on the photo, or what part of the body is shown in the photo.



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Opinions from Photographs

Occasionally an examiner might be asked to provide an opinion on an injury from photographs alone, not having the opportunity to examine the patient personally. In these cases, it might be wise to consider the following:

- Providing a disclaimer as to the limitation of injury interpretation from photographs alone
- Refraining from any comment about colour, especially if there is no inclusion of a colour reference card
- Refraining from any comment with regards to specific size unless the scale has cross hairs included, these are equal in size and the scale is adjacent to and on the same plane as the injury. Comment about approximate sizes might still be reasonable.
- Be extremely careful when making comment on photographs that have been provided in any format other than their original digital format. This includes photographs that have been PDF'd, scanned, printed, photographed from a computer screen or sent in a reduced format. Comment might still be possible but it is often worthwhile noting the less than ideal image format that has been provided.

It is highly recommended consulting with an expert in forensic photography before submitting any written or oral opinions when made directly from photographic sources.

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Glossary

See also: https://en.wikipedia.org/wiki/List_of_abbreviations_in_photography

ISO – acronym for “International Standards Organization”, that defines photographic media sensitivity. Formerly ASA.

JPEG – acronym for “Joint Photographic Experts Group” – an image format that reduces the file size of by “compressing” the image by a variable amount hence losing a certain amount of detail. Heavily compressed JPEG images have small file sizes but may not reveal sufficient detail for forensic purposes.

Metadata – digital information encoded in an image file that contains details such as date, time, location (for certain cameras) , camera identification, camera settings, shutter speed, f-stop, ISO etc.

PDF – acronym for “Portable Document Format” – a non-editable format that is used to distribute final versions of documents

RAW – the internal format used by the camera to acquire and save images. These files can be very large and may not be able to be read by devices other than the original camera. They are usually processed internally by the camera into JPEGs.

References

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