Dental photography: equipment and technique – part 1

Philip Wander BDS MGDS RCS continues his series with a look at choosing and using equipment for intra-oral clinical photographs: cameras and accessories

EVERYONE is familiar with taking regular photographs, and more often than not has a camera to hand, either on a mobile phone or of the "point and shoot" variety, but "Compact" cameras – even at the high end of the range – have limitations when it comes to taking close-up images such as those required for dental photography.

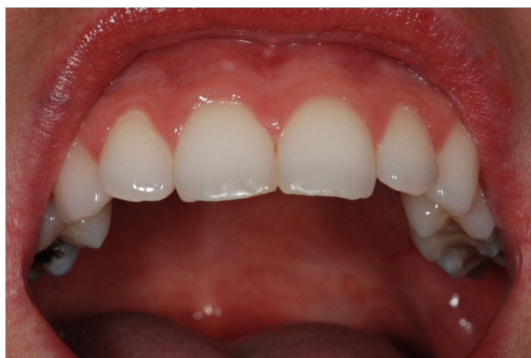
- The lenses are of fixed focal length, usually wide-angle or limited zoom, and do not give a particularly flattering portrait when capturing the average view. On the "macro" close-up setting they usually give a distorted image, as the photographer is very close to the subject.
- The flash is often harsh, resulting in extreme shadows, and is placed above and to one side of the lens, resulting in it not being capable of illuminating the mouth adequately.
- These cameras are "compact" by definition and therefore have quite a small sensor. The resolution cannot match the more specific equipment that is available to take high-quality images.
- It is not possible to reproduce consistent results because of difficulty in reproducing magnification ratios and lighting.

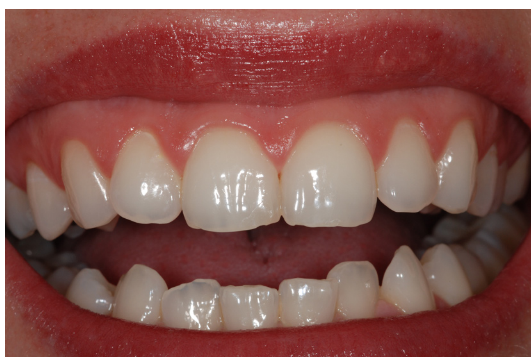
Compact cameras are fine for general photography, and may be adequate to produce a reasonable full-face shot. Some of them even have "face and smile detection" modes.

The specific intra-oral type cameras (fibre optic and cordless light-emitting diode [LED] devices) are of limited use. They are not capable of capturing full arch or portrait views, but easily show close-ups of inaccessible areas, such as around the last molar teeth, and are very useful for showing calculus and staining, as well as fractures in individual teeth.

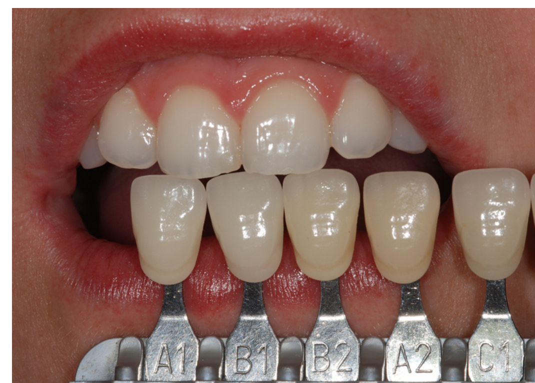
Continuous LED ring lights are available to fit a number of cameras (an example of this is "Doctors Eyes" – details at www.mgdental.co.uk). Caveats of these devices include the need to alter the white balance and to select wider apertures, which limits the depth of field.

For superb, reproducible dental photographs – such as those required when submitting images for accreditation examinations – a single-lens reflex (SLR) camera system is the equipment of choice.


Camera angle from beneath the incisors


Camera lens perpendicular to labial surface of incisors

- The lenses can be removed and changed (for instance, zoom lenses, macro and wide-angle type lenses can be utilised).
- "You get what you see" through the viewfinder.
- The more expensive camera bodies add features that are often not used for clinical photos (technology looking for an application). The Sigma lens and flash combination is cheaper and lighter. It is excellent, and in no way a compromise on image quality.
- The eyepiece of the SLR's viewfinder can be adjusted to suit the individual's visual requirements (Dioptre Adjustment). Photographs are framed in the viewfinder as opposed to compact cameras and mobile phones, where the LED screen at the back of the camera is usually utilised. Some of the latest and more expensive SLRs, such as the Nikon D90, have the "Live View" facility, which incorporates the screens at the back of the camera. These are also used when the camera is set to "video mode".
- TTL Flash is available (electronic through-the-lens flash metering).
- Macro lenses and macro lights (ring flash and/or point source units) are available. Macro lenses are the most optically competent for close-up work.
- Large sensors are incorporated to allow better resolution.
- Pixels of 12 million plus (a pixel is a point on the imaging sensor, measured in millions, eg 6 mega pixels).
- Aperture can be controlled and changed to maximise depth of field (depth of focus or the range of sharp focus), increasing the number of teeth that appear sharply in focus in the final picture.
- White balance can be altered to suit the lighting situation (the white balance should be set to flash for clinical photography, although some cameras give good results on "auto mode").
- Capable of producing 1:1 (or equivalent "life size" magnification) and close-up magnifications of three, two or even a single tooth!
- Simple to use for mirror shots.
- Capable of manual focusing.
- Versatile – can also be used for general photography.
- Ability to shoot in different formats, such as JPEG and RAW. The RAW file is essentially a digital negative, and can be altered, but leaves the original file in place.



Correct use of a shade tab

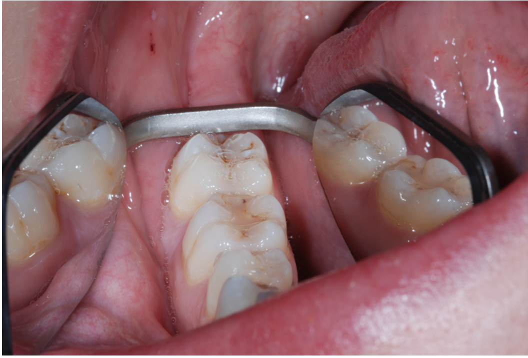
This is vital if the photo is being submitted for any form of accreditation exam or being used for medico-legal purposes. JPEG is fine for average dental use.

Lighting

The universal system for intra-oral photographs is the ring flash, which is

Table 1. Basic settings for dental photography with SLR cameras

Shutter Speed	Flash synchronisation 1/60 or 1/125 second
Aperture	• Portrait f5.6 – f8 depending on ambient lighting • Retracted full arch f16 – f22 • Closer views f22 – f32
ISO	200
Exposure Mode	Aperture priority or manual depending on camera
Image Size	Fine
File Type	JPEG
Flash Unit	TTL (through the lens)



Dual viewing mirror in use

used on the Nikon and Canon set-ups, and the more recently introduced PracticeWorks Dental Photography Kit.

A ring flash gives an even, shadowless illumination and is less harsh, and weaker in power than a conventional flash gun.

A twin-flash unit is a more specialised piece of equipment, not as convenient to use and not as essential for the average user.

However, it is capable of superb results after mastering the learning curve and experimenting sufficiently.

The Nikon R1 Speedlight System enables up to four flashguns to be attached to the camera, and up to eight off-camera, to give a more powerful and creative lighting system.

For a comprehensive range of photography equipment available, consult www.photomed.net (USA), www.photodent.co.uk (UK) or www.bobrigby.com (UK).

It is always useful to consult a dealer who specialises in dental photography to avoid purchasing inappropriate systems (and can therefore save a lot of money in the long run!).

Accessories: mirrors and retractors, etc.

No matter how advanced the camera, it will not produce its best results if the area to be photographed is not sufficiently revealed. Therefore it is essential to have available the following equipment:

Retractors

There are a number of types available...

- Self span – useful for anterior and direct lateral shots. They are available with “handles” or “tabs” to assist pulling the soft tissues away from the teeth and to avoid the appearance of “lip droop”
- Separate retractors to be held by the patient or assistant – these are available in various sizes and combinations depending on the access, size of the mouth and patient tolerance.
- “Retract EEZ” photo lip retractor and “Kombee” for occlusal shots and use with mirrors.
- “Cut down”, “customised” or “trimmed” plastic retractors are shortened on one side to make room for mirrors, then smoothed and polished.

One method of retraction and mirror use for upper occlusion

Mirrors

To photograph parts of the mouth that are difficult to reach...

- Most have front-surface reflecting glass – metal-plated, either rhodium or titanium. Paper towel may be used to clean and wipe the mirrors and to wrap them up prior to autoclaving to avoid scratching them.
- Metal ones are available but do not give as good colour reproduction, and scratch easily.
- For occlusal views the posterior border of the mirror should be placed on the tuberosities, and not in contact with the last molar teeth. Try not to get the lip and nose in view. For lower arch views ask the patient to rest their tongue or retract it behind the mirror if possible.
- Buccal views right and left are useful to record the occlusion. Special shaped lateral mirrors are available but with

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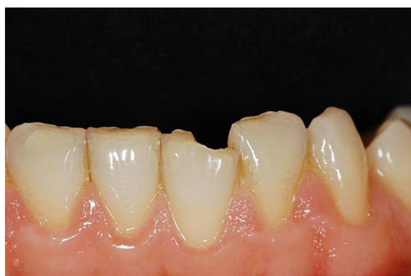
good retraction direct views are often possible especially using the retractors with "tabs".

- "Dual Viewing" mirrors allow a photograph to be taken to show the buccal and lingual surfaces at the same time.

Contrastors

They give a black background, useful for close-up to highlight incisal edges, and to "black out" areas of potential distraction.

Contrasters...



... and in use

Batteries

We can't work without power! Rechargeable are best.

A good range of accessories, mirrors, contrasters and retractors are available in the UK from Dental Directory (www.dental-directory.co.uk).

Taking the photographs – top tips for intra-oral views

1 Look through the viewfinder and visualise the end result. Think: why am I taking this photograph?

2 Look round the edges of the viewfinder frame for distractions, such as the edges of mirrors, retractors, hairs, impression material. Also look out for fragments of cement, bubbles of saliva, blood, food debris and lipstick on teeth.

3 Dry the tissues, use suction and gentle streams of air from the three-in-one syringe.

4 Learn how to focus accurately, and always be prepared so that the patient is not kept posed for too long, especially when taking mirror shots – pre-focus on the area to be photographed before placing the mirror.

5 Use small apertures (f22 and above) for close-ups – set the camera to manual focus, then set the magnification ratio, take aim and focus by moving backwards and forwards, towards or away – once set, do not touch the focusing ring on the lens. 1:3 gives a good overall view.

Remember the range of sharp focus is narrow especially at high magnifications. It is best to focus on a point lying 1/3 behind and 2/3 in front of the area to be photographed; for instance, if photographing an anterior view with lips retracted, focus on the distal aspect of the lateral incisor.

6 Hold the camera firmly and securely, cradling the lens in the palm of one hand.

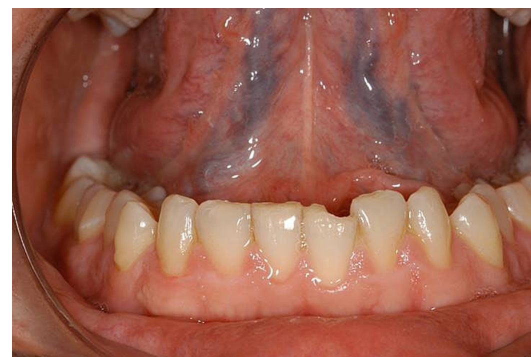
7 Have the patient sit comfortably, semi-upright or supine (some prefer to take upper occlusal shots from behind the patient), with the head turned towards the photographer – keep camera perpendicular to the occlusal plane, as tilting will cause the teeth to appear distorted, elongated or foreshortened.

8 Have the operating light on to assist focusing; some flash units have a built-in modelling light – so make sure to switch it on!

9 When using retractors, Vaseline the patient's lips first. Place the retractor at an angle in the corner of the mouth and rotate it into position. Retract the lips/cheek gently **outwards** and **forwards** on anterior views to see the "buccal corridor". Decide if you want the teeth in occlusion or apart.

10 Dry the tissues, and ask the patient to moisten their lips and to curl their tongue back.

11 Hold your breath and ask your patient to do the same. Wear a mask or make sure your breath is fresh, as in many cases you will only be a few inches away from the patient.



The tongue distracts

12 Prevent mirrors from fogging by pre-warming the mirrors in warm water, or by blowing a stream of air with a three-in-one syringe, over the mirror once in use. For occlusal views, focus on the image you see in the mirror in the premolar region. Keep the camera perpendicular to the mirror.

13 Frame .... Focus .... Fire.

14 Check the result in the monitor viewing screen at the back of the camera and learn how to read histograms.

Table 2. Approximate focusing/ working distance guide

Ratios as marked on lens	View	Working distance
1:15	Portrait	~ 6 feet (1.5m)
1:3	Full arch	~ 14 inches (35cm)
1:1.5	Canine to canine	~ 7 inches (18cm)

Helpful hint: practice focusing on this printed text/table until it appears sharp in the camera's viewfinder

Histograms

In "playback", the photograph may be viewed with information superimposed on the image. One of the most useful features is to view the image with the histogram to check the exposure is perfect and repeatable every time.

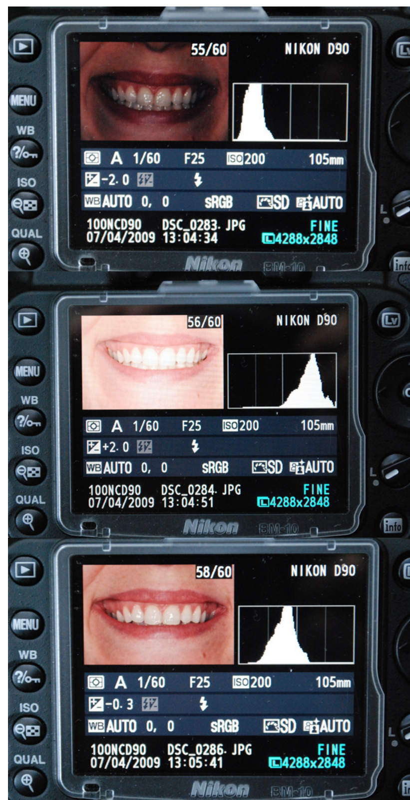
One of the best things about digital SLRs is the ability to review your captured images on the back of the camera, in order to instantly assess whether you have a perfect shot. A histogram feature should be used to determine whether your shots are too light or too dark. A histogram is a simple bar chart: the peaks show the number of pixels. In a dark image, the peak will appear on the left; a peak shifted to the right would denote a high key image, ie over-exposed, giving a very light image content.

NB. Extreme close-ups of teeth cause "white out", due to too much tooth in the image. The TTL metering system is fooled – this can clearly be seen with a histogram – and the picture appears far too bright. The solution is to alter the exposure compensation within the camera, use a smaller aperture (f-stop) or reduce the flash power. If a picture is too dark, it may mean you have used too small an aperture or the batteries in your flash are failing.

Another situation when your TTL flash metering system may not function as you wish is when taking "before and after" bleaching photographs. This is due to the camera detecting that the "before" photo needs more light (because the teeth are dark) and the "after" photo reflects substantially more light (once the teeth have been bleached).

The only way to show the true degree of bleaching is to set the camera to manual mode and manual flash, then keep the same settings for the before and after pictures. However, a simpler method is to always have the "shade tab" in view, when taking before and after bleaching photographs. The shade tab should be placed level with the incisal edges of the teeth (ie in the same plane).

There are a number of excellent DVDs available to help explain the above techniques in more detail, from www.photomed.net; the Dental Photography Interactive Training Program by Dr Christopher Orr (info@smile-on.com), and Glen Krieger (www.betterdentalimages.com/). Other useful information is available from the BACD website (www.bacd.com) and the AACD website (www.aacd.com), where you can also acquire very useful accreditation photography guides.



From top: too dark; too light; perfect!

Essentials to remember

- Consistency of framing, magnification ratios, exposure/lighting and focus – this can only be learned through practice and experience.
- Get to know your equipment. Always have it ready for use.
- If the camera is to be used in a surgical situation, for instance photography of dental implants, to prevent blood and other contaminants affecting the camera, wrap the camera system in "cling film". This should prevent cross-infection.
- Focal length – this describes the magnifying power of a lens: the longer the focal length, the greater the magnification.
- F-stop – the f-number is the ratio of the aperture (opening) of the lens to its focal length. A high f-number (eg f22) would be a smaller opening in the lens.
- JPG – Joint Photographic Expert Group. This is the commonest used system of image compression.
- CCD – Charged Coupled Device. This is the light "sensor" inside the camera that the image is recorded on (and replaces film).
- Depth of field – when you focus on a subject, some detail behind and in front will also be in focus. This is known as the depth of field. The smaller the aperture of the lens, the greater the depth of field. This is why it is important in close-up photography to use smaller apertures (eg f22 and above) so that more teeth will be in focus in the final result.
- ISO (International Organisation for Standardisation) rating. This is a measure of light sensitivity. Select the lowest ISO possible to reduce "noise" (unwanted graininess in the final image).

Dr Philip Wander has over 40 years' experience in both NHS and private practices in Manchester. He co-authored with Dr Peter Gordon the *BDJ* textbook *Dental Photography*, and has written numerous articles and lectured extensively on the topic. He is currently giving a series of hands-on courses on "Shoot your patients to build your practice". For further information, contact Philip at info@dentalphotos.co.uk.

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