Clinical digital photography. Part 1: Equipment and basic documentation

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A BSTRACT: The use of photography is becoming a standard in modern dental practice. The sharing of pictures is not only essential for communication between dentist, laboratory technician and patients, but also for communication between professionals, undergraduate and postgraduate students with their teachers and for documenting of clinical procedures in cases you want to show to both patients and work colleagues at scientific meetings. This article will describe the necessary equipment for clinical photography, explain its uses and deliver the foundation for basic documentation and structure for clinical cases. The second part will discuss the step by step documentation and show practical examples to improve your results.

Introduction

The first process of photography was presented to the world by Louis J. M. Daguerre at the Paris Academy of Sciences on January 7, 1839. In that same year, Alexander S. Wolcott, a manufacturer of dental instruments, designed and patented the first camera producing images on a silver-coated copper plate. 1 Thanks to the graphic documentation that this allowed, it created the first dental journal, the American Journal of Dental Science. 2

Due to the advancement in technology, we now have the privilege of having digital photography that allows an immediate view of the results and not having to wait for the processing of films as was the case of old movies, utilising silver halide ions in a gelatin emulsion on a strip of celluloid film to capture latent images. The advantage of digital images is that in addition to instantly seeing them through a viewfinder, there is less cost of developing film negatives and their storage is easy and fast. The power of viewing and saving images in computers also saves space and access to a database is almost immediate. By developing different virtual media files and almost universal use of email, information sharing is almost instantaneous anywhere in the world.

Because many of the procedures performed in dentistry represent established protocols that should be read, learned and then practiced, it becomes clear that photography aids us in teaching or explaining to our patients what we think are common, but to them are complex and mysterious procedures.

Digital Cameras

There are currently hundreds of cameras on the market. If we compare their features and capabilities, we can divide them into 5 groups:

Compact cameras (point and shoot), interchangeable lens cameras (mirrorless system cameras) and reflex cameras, SLRs DSLR (Digital Single Lens Reflex).

Initially, compact cameras (Figure 2) may seem appealing, but they have many limitations. They do not have a consistent image control, the position of the flash is not suitable for intraoral photography, distorted images from utilization of an insufficient macro lens in the wide-angle position, lack of manual exposure and focus problems. One of the biggest problems is the inability to change the lens, which gives its design for a wide angle or mid-distance, causes distortion of perspective, as the clinician would have to stand close to the patient. This has another negative effect of poor lighting. 3, 4

The second group seems promising, but is still in development, and the third group, DSLR cameras (Figure 5), are those with greater advantages for clinical use, thanks to the sensor size and the many options in manual mode, lenses and flashes.

These cameras use a lens for both image composition and image capture. 5 This design, which allows direct viewing and focusing without parallax error, is ideal for dental photography. 6, 7, 8 One of the biggest advantages is the ability to exchange lenses. For example, you can take pictures of landscapes, portraits, and all dental treatments with the same camera, by just changing the lens. The same applies when changing the flash. All professional cameras have more than meet the requirements. Semiprofessional cameras (with a more affordable price) that meet these requirements are for example Nikon D7000, D90, D5100, D3200, Canon EOS 550D, 50D or other similar brands.

Flash

The discussion with which flash, macro lateral or twin flash light (Figure 4) or ring flash (Figure 5), is most suitable for intraoral photography, and has been a quite discussed topic for many years. 9, 10

The ring flash light is the favourite amongst inexperienced dental photographers and it is considered the universal flash system for general macro photography. 10 On the one hand, it is true that the greater the distance between the ring flash and the subject, the flatter, less texturised and refined the photos are, while a twin flash generates pictures with more texture, contrast and that look more alive. 11

The macro lateral flash shows more variability in light direction, allowing certain details to be highlighted. The overall hue of colour, cracks and also transitions are best captured with the macro lateral flash. 9, 10 Probably the only drawback, besides its higher cost, is when photographing posterior regions, where access and space is limited. In these cases, the homogenous light and easy handling of the ring flash has an advantage. In the author’s experience, when a clinician decides to begin clinical photography, a ring flash is more...
than adequate; the extra cost of the macro lateral flash is not justifiable, since differences in the early stages of the learning curve will not be substantial. Then once they handle certain techniques, the macro lateral flash is a great contribution.

Lenses
Basically, macro lenses from 50 to 200mm in focal length are used for clinical photography. In the author's experience, macro lenses of about 100 mm in focal length provide the ideal combination of magnification ability and convenience working distance for dental purposes. Teleconverters or zoom lenses can be used, but not recommended. The same goes for lenses with autofocus mode. If this is the case, the automatic mode must be switched off and put on manual. Focusing is done manually and moving the ring lens near a sharp image, and with small movements to and fro, achieves perfect focus. A high quality lens is paramount to capturing crisp and bright photos. This aspect should not be compromised. It is ideal to have a magnification ratio of 1:1. In the author's experience a good lens to start off with at a reasonable cost is the Sigma 105mm f/2.8 EX DG macro (Figure 6), which is compatible with different brands of cameras. On the other hand, for the seasoned and professional photographer, who does not want to compromise quality, a Nikkor macro lens and the AF-S 105mm f/2.8 ED, could be recommended, though costing more than doubled compared with the aforementioned Sigma.

 وبعد ذلك، يمكن للإضاءة المختلفة أن تؤثر على النتائج النهائية، حيث يمكن أن تؤدي الإضاءة الخامسة إلى الارتداد وتشوهات في الصور. لذلك، من الضروري أن تكون الإضاءة صحيحة ودون أي عوامل تشتت تؤثر على النتيجة النهائية.

Accessories
Retractors
To gain better access to the buccal cavity, better visualization of the structures of interest and that they are sufficiently illuminated, it is essential to have good lip retractors. They should neither be very uncomfortable for patients, should avoid reflections and ideally possess a certain capacity to stay in place and avoid having the dental assistant hold them, as is the case with Mirahold type retractors (Figure 8). In the case of a Span dex type (Figure 9) or soft latex retractors from bouclier Vivident OptraFizate (Figure 10), this does not happen and the picture can be taken without external help. Ideally, always choose the largest possible retractor for improved exposure of the structures of interest. The clinician can make the process less cumbersome by using petroleum jelly or cream on the patient's lips before starting.

MIRRORS
When taking pictures in posterior regions, mirrors are invaluable, since the angle of the buccal area doesn't allow taking of direct photos. To avoid double images and to enhance the sharpness, quality mirrors are needed, ideally hodium. It is useful to have mirrors with long firm handles (Figures 11-15), in order to position your hands away from the objects of interest and avoid unwanted shadows. This is of particular importance when showing the use of materials or objects near to the teeth. To prevent the mirror missing up, they must be at a temperature similar to that of the oral cavity. For this effect you can use hot water or any type of air heater. You should also ask the patient to breathe through their nose. Another option is that the dental assistant gives a patient a gentle stream of air with the triple syringe. It is noteworthy that these mirrors are very sensitive with Mirachrome, hodium or Mirahold, so they must be treated with great care by the staff.

Black background or contrastors
On the previous section, where the aim is to show the upper and lower teeth separately, the rest of the structures in the background can distract from what you want to highlight. To avoid this, we recommend the use of opaque black plates called contrastors, recommended behind the teeth you want to photograph. When used correctly, the quality of the picture is improved and the viewer can focus on the subject (Figures 14 and 15). Besides commercial products from brands like Anaxdent, Doctors' eyes and Photonmed, different types of black plastic can also be used as long as they do not generate unwanted reflections. If you do use material other than contrastors, it is important to use your preference consistently when photographing a series of photos. If you decide to cut the edges of the picture by using software such as Photoshop, it not only will not produce the same results, because cropping will increase the relative size of the pixels due to the magnification of the desired area, but will increase the time invested by the clinician producing good quality clinical photos.

Examples
In order to compliment intraoral photography, it is recommended to show pictures of patients before and after treatment. These types of photos, although may seem simple and easy to execute, can present difficulties. In Figures 16 and 17, you can see a badly taken photo, distracted by multiple flaws such as inadequate background, shading on the right side, and an unfavourable facial expression, etc. In contrast, Figure 16 shows a clearer picture, a neutral background, no unwanted shadows, good lighting and a positive facial expression. In Figure 17, you can see two examples of a photo, the first badly taken and second well taken. In this case, interest should focus on the anterior teeth that need treatment. Therefore, there is no point taking a picture showing lips, facial hair such as moustache, lip retractors and excessively showing gingiva. These structures only distract from what is really important.

It is also easy to make errors in lateral view photos; an example of this is Figure 20, which shows that, in addition to an underexposed stream of saliva, the picture is dark, the angle is not right, you see the lips and the lip of the mirror. On the contrary Figure 21 is a better photo, having the proper exposure, no distracting elements and the correct angle was taken.

In the occlusal view, both mandibular and maxillary, one must keep other distracting factors in mind. A good mandibular occlusal photo is far more difficult than the maxilla by several factors: Firstly, the tongue needs to be retracted, secondly, the range of movement in the patient makes the clinician act quickly and without hesitation. Thirdly, the angle of the photo.

In Figure 22 you notice, in addition to being inadequately illuminated, the axis of the arch is not centered with the photo, we can see the jaws and teeth as well as the edges of the mirror. In contrast, Figure 23 shows an image best achieved where the picture is centered, well lit, and in the absence of other distracting structures.

Case report
One of the main objectives of the documentation process, is to facilitate the treatment and for students what steps were performed to reach certain results. It is also beneficial to graphically present and compare new and already established techniques. The following is simple a case of two composite restorations with sectional matrices and a centrepiece layering technique for an esthetic crown, followed by the detailed documentation and standardization that images should demonstrate.

Another objective of a systematic and thorough documentation is to have graphic material, either for patients to understand or for treatment results objectively, so they have no obscure treatment expectations. These types of aesthetically documented treatments will be discussed and presented with documented cases in a step by step manner in the next chapter of this series, in addition to discussing common mistakes and how to solve them.

Editorial note: References are available from the author.