

Clinical digital photography.

Part 1: Equipment and basic documentation

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Abstract

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, 1839.¹ 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.² Thanks to the graphic documentation that this allowed, it created the first dental journal, the American Journal of Dental Science.³

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 gelatine 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.



Figure 1: Clinical photography can be helpful, provided that we understand the basic principles and have the right equipment.

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Figure 2 and 3: Compact and SLR camera (DSLR).

Digital Cameras

There are currently hundreds of cameras on the market. If we compare their features and capabilities, we can divide them into 3 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 given its design for a wide angle or middle distance, causes distortion of perspective, as the clinician would have to stand close to the patient. This has another negative effect of poor lighting.^{4, 5}

The second group seems promising, but is still in development, and the third group, DSLR cameras (Figure 3), 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 capture⁶. 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 with changing the flash. All professional cameras 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 7d, 60d, 550d 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 years⁹.

The ring flash light is the favourite amongst inexperienced dental photographers and it is considered the universal flash system for general macro photography.^{10, 11} On the one hand, it is true that the greater the distance between the ring flash and the subject, the flatter, less textured and



Figure 4 and 5: Macro lateral flash and ring flash.



Figure 6 and 7: Different types of lenses, Sigma 105mm f/2.8 EX DG macro and micro Nikkor AF-S 105mm f: 2.8 ED, NC, VR.

refined the photos are, while a twin flash generates pictures with more texture, contrast and that look more alive¹²

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.¹³ Probably the only drawback, besides its higher cost, is when photographing posterior regions, where access and space is limited. In these cases, the homogeneous 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.¹⁴ 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 micro lens and the AF-S

105mm f: 2.8 ED, NC, VR (Fig. 7), would be recommended, though costing more than doubled compared with the aforementioned Sigma.

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 Spandex type (Figure 9) or soft latex retractors from Ivoclar Vivadent OptraGate (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.

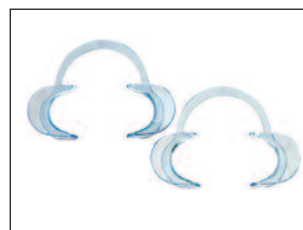
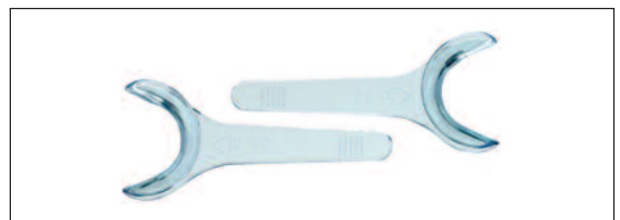


Figure 8, 9 and 10: Mirahold, Spandex and OptraGate retractors.

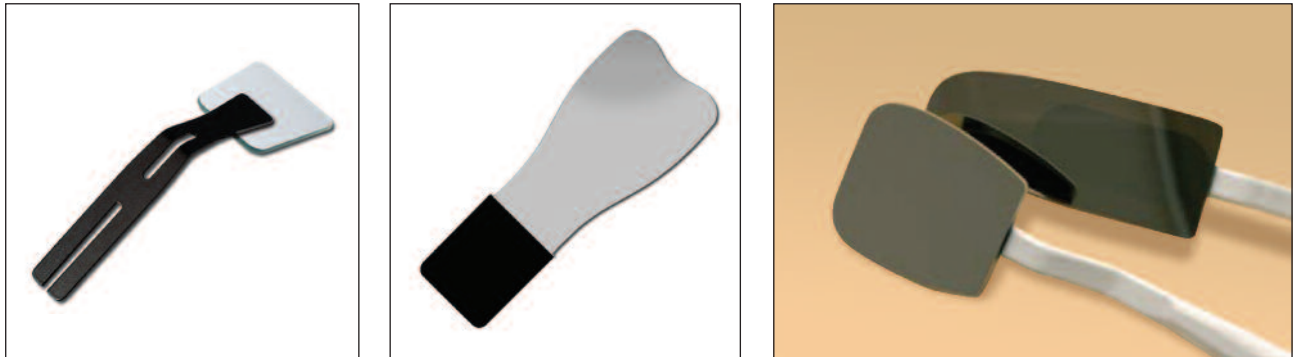


Figure 11, 12 and 13: Different types of intraoral mirrors.

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 Rhodium. It is useful to have mirrors with long firm handles (Figures 11-13), in order to position your hands away from the objects of interest and avoid unwanted shadows. This is of particular importance in documenting steps when showing the use of materials or objects near to the teeth. To prevent the mirror misting 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 gentle stream of air with the triple syringe. It is noteworthy that these mirrors are very sensitive to fractures, bites, abrasions or scratches, so they must be treated with great care by the staff.

Black background or contrastors

In 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, positioned 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, Doctorseyes and Photomed, 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.



Figure 14 and 15: Photo without and with a contrastor. Notice how other structures distract the viewer from what is to be displayed effectively. When using a black background, all the attention goes to what the desired clinician wishes display.



Figure 16 and 17: Examples of a portrait with distracting factors and a clearer one.

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 Figure 16 and 17, you can see a badly taken picture, distracted by multiple flaws such as inadequate background, shadowing on the right side, and an unfavourable facial expression, etc. In contrast, Figure 16 shows clearer picture, a neutral background, no unwanted shadows, good lighting and a positive facial expression.

The second aspect to show in most of the treatments is a buccal overview of the oral cavity, starting from the anterior teeth. In the Figure 18 and 19, 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's, lip retractors and excessively showing gingiva. These structures only distract from what is really important.



Figure 18 and 19: Examples of a general anterior photo. Ideally, lips, corners, mustaches and retractors should not appear in the photo.



Figure 20 and 21: Example of a lateral view. Note the difference between the two pictures both in lighting and in the presence or absence of distracting factors.

It is also easy to make errors in lateral photos, an example of this is Figure 20, which shows that, in addition to an underexposed sensor (insufficient light, the picture is dark, the angle is not right, you see the lips and the tip 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 several aspects 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 rapid accumulation of saliva of the patient makes the clinician act quickly and without hesitation, and 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 no presence of other distracting structures.



Figure 22 and 23: Mandibular occlusal view. This kind of picture may be difficult to achieve with the presence of the tongue. Examples of a poor and well taken picture.



Figure 24



Figure 25



Figure 26

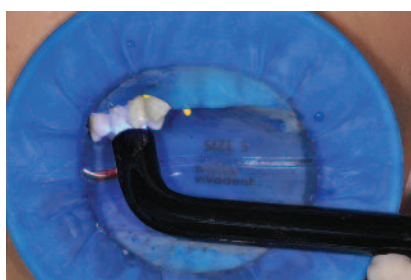


Figure 27



Figure 28



Figure 29

Case report

One of the main objectives of the documentation process, is to explain to our colleagues or 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 centripetal layering technique as an example of the detailed documentation and standardization that images should demonstrate.

Another objective of a systematic and structured documentation is to have graphic material, either for patients to understand or to show treatment results objectively, so they have no obscured 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.



Figure 30



Figure 31



Figure 32



Figure 33



Figure 34

Figure 24-34. Example of standardized documented photographs to show a step by step procedure.