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Photography and its role in aesthetic dentistry.

Dr Paulo Monteiro, Caparica, Portugal

Digital dental photography can be a valuable instrument in restorative dentistry: one that enhances teamwork, improves treatment planning and facilitates great results in direct and indirect restorative procedures.

Practitioners without experience in photography, though, may find it hard to get started – especially with such a wide range of cameras and equipment on offer. This case study guides you through some of the basics, such as what camera and lens type is needed, how manual camera settings work, what accessories may be useful, how to take high-quality dental photographs, and tips on developing a standardised photo protocol in the dental office.

Photography is a form of art that plays an important role in restorative dentistry: Digital photographs of the patient's face, smile and teeth are used for treatment planning and documentation as well as for communication with the laboratory technician and the patient. Taking a look at the pictures afterwards may help evaluate a clinical case, so the images are useful for anyone striving for self-improvement. Last but not least, beautiful pictures of patients and treatment results serve as a valuable marketing instrument.

For dental practitioners without any experience in dental photography, however, it may be difficult to get started: Lots of different camera types and a wide choice of equipment are available and need to be selected and employed properly.

Equipment

We recommend the use of a digital single lens reflex camera (DSLR) with an APS-C CMOS sensor for the semi-professional user. Examples are Canon EOS 80D and Nikon D7200 or D500. Moreover, for intraoral photography, a macro lens with a fixed focal length is required. The macro lenses preferred for dental use have a focal length of 60 mm to 105 mm. They allow for a convenient working distance that offers enough room for lighting.

Comparison of an image of anterior teeth taken with a ring flash (left) and a twin flash (right).

Subject	Anterior teeth	Posterior teeth
Camera type	DSLR with APS-C sensor **Examples:** Canon EOS 80D, Nikon D7200	DSLR with APS-C sensor **Examples:** Canon EOS 80D, Nikon D7200
Lens	Macro lens with focal length ~ 100 mm **Examples:** Canon EF 100 mm f/2.8L Macro IS USM, Nikon AF-S VR Micro-Nikkor 105 mm 1:2,8G IF-ED	Macro lens with focal length ~ 100 mm **Examples:** Canon EF 100 mm f/2.8L Macro IS USM, Nikon AF-S VR Micro-Nikkor 105 mm 1:2,8G IF-ED
Flash	Twin flash **Examples:** Canon Macro Twin Lite MT-24EX, Nikon R1C1 Wireless Close-Up Speedlight System	Ring flash **Example:** Canon Macro Ring Lite MR-14EX II

Equipment recommendations for intraoral photography.

This leads us to the selection of the external flash system. Generally, ring flash systems emitting light 360 degrees around the lens and twin flash systems with two light sources located on opposite sides of the lens are sed frequently in dental photography. For images of the anterior teeth, a twin flash system is preferable: It ensures a uniform illumination of the teeth without eliminating all shadows and gives the photograph a 3D effect.

In this way, the surface details, color transitions and variations in translucency etc. are revealed more accurately than with a ring flash, which illuminates the entire field from all directions. This leads to a strong white spot in the center of the image and a lack of shadow and plasticity. In the posterior region, a ring flash is often preferred as it illuminates the teeth in this area more properly. With the twin flash, best results are obtained when using a soft diffusor.

Settings

Once the equipment is available, we need to know how to use it. The automatic control mode is not appropriate – it is necessary to adjust the settings manually to obtain the desired results. The three most important values that need to be set are the aperture number (f), the exposure time and the sensor's specific light sensitivity (ISO).

The aperture number defines how much light is permitted to pass through to the diaphragm (that is inside of the lens). The larger the f value, the less light reaches the sensor. Naturally, with a large aperture number, the image will appear darker than with a small one, but at the same time, the depth of field is increased.
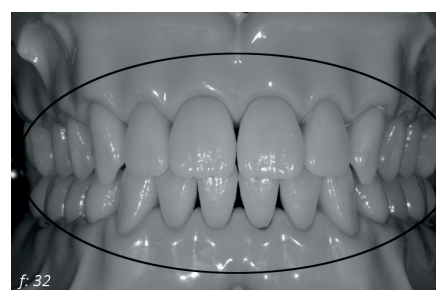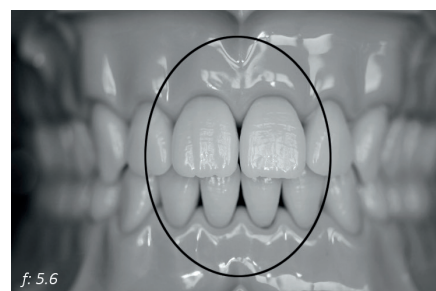
Small depth of field (above) at aperture f = 5.6 and large depth of field (below) at aperture f = 32.

The exposure time defines the time that elapses between the opening and closing of the shutter. The higher the shutter speed, the more light is able to reach the sensor, and the brighter the image will be. With long exposure times, however, the risk of blurring caused by camera shakes increases. Finally, the ISO sensitivity determines how much light is required for an adequately exposed image. The sensitivity influences the exposure time on the one hand and the amount of digital noise on the other. Thus, higher ISO values are usually employed when a fast shutter speed is needed (e.g. at indoor events), but the benefit comes with the cost of a higher amount of digital noise.

For intraoral photography, the following settings are recommended:
● Aperture f: 22
● Exposure time: 1/200s
● ISO: 100-200

Two additional settings important for good results are the white balance, which should be set to "automatic" or to custom values (Kelvin degrees in the day light temperature, around 5500K) by the more experienced photographer, and the image format. Two different formats may be chosen: JPEG or RAW. The latter format stores the images as unprocessed data, much like a picture on a roll of film before processing. They have a high level of integrity and offer a lot of processing options, but need a high storage capacity. JPEG images are easily used on all computer platforms and are compressed automatically to reduce the storage space required. For international publication of clinical papers, the RAW format is highly recommended.

Accessories

In order to take intraoral photos, a number of accessories is needed. It begins with lip and cheek retractors (e.g. OptraGate®, Ivoclar Vivadent) and mirrors necessary for occlusal, lingual and lateral shots. Finally, contrastors (e.g. Flexipalette, Smile Line, powered by StyleItaliano™) are highly beneficial to increase the intraoral contrast and highlight the photo subject.

Getting started

The following images were taken to provide some guidance for high-quality dental photography. Each of the photographs shows a different view. The photos were taken with an APS-C camera and the selected settings are listed for each picture. With the aid of these recommendations, it should be easy to take the first intraoral photographs. If the images appear too dark, it may be helpful to increase the flash power and ISO value and, if possible, decrease the f value. Too bright images are corrected by decreasing the flash power and increasing the f value.

Image of the patient's smile.
● **Point of focus: Midline/central incisors**
● **Camera settings: 1/200s, f/22, ISO 100**
● **Flash 1/2 power, lens set to 1:3 magnification**
● **Camera position: parallel to the tooth surface**

Frontal view.
● **Point of focus: Lateral incisors**
● **Camera settings: 1/200s, f/22, ISO 100**
● **Flash 1/2 power, lens set to 1:3 magnification**
● **Camera position: parallel to the tooth surface**
● **Retractors held in place by the patient**

Frontal view on black background.
● Point of focus: Lateral incisors
● Camera settings: 1/200s, f/29, ISO 100
● Flash 1/2 power, lens set to 1:2 magnification
● Camera position: parallel to the tooth surface
● Retractors held in place by the patient; contrastor used to reveal tooth shape

Lateral view.
● Point of focus: Lateral incisor
● Camera settings: 1/200s, f/22, ISO 100
● Flash 1/2 power, lens set to 1:3 magnification
● Camera position: parallel to the tooth surface
● Retractors are held in place by the patient and released on contra-lateral side; contrastor used to fade out background

Full occlusal view.
● Point of focus: center of the mirror, which is inserted by an assistant
● Camera settings: 1/200s, f/22, ISO 100
● Flash 1/2 power, lens set to 1:3 magnification
● Camera position: Parallel to mirror
● Retractors held in place by the patient, contrastor used
● Mirror photos need to be rotated and flipped horizontally to show the correct view

Partial occlusal view.
● Point of focus: center of the mirror, which is inserted by an assistant
● Camera settings: 1/200s, f/22, ISO 100
● Flash 1/2 power, lens set to 1:1 magnification
● Camera position: At a shallow angle to the mirror
● Retractors held in place by the patient
● Mirror photos need to be rotated and flipped horizontally to show the correct view

With the aid of these recommendations, it should be easy to take the first intraoral photographs. If the images appear too dark, it may be helpful to increase the flash power and ISO value and, if possible, decrease the f value. Too bright images are corrected by decreasing the flash power and increasing the f value.

Communication

For communication with the laboratory, however, some additional facts should be taken into consideration. First of all, it is useful to take a portrait photo of the patient so that information about the face and facial harmony can be transferred to the laboratory as well. Here, the basic settings are somewhat different (aperture f = 8 to 11, exposure time = 1/200, ISO = 100, white balance = AWB and file format = RAW) and many additional factors such as the light conditions, the right makeup etc. have an impact on the result.

Apart from taking photos, the practitioner should also consider recording a short video sequence of the patient talking and smiling. The dynamic movements usually appear more natural and allow for a better assessment of the real situation. This is particularly useful e.g. for evaluation of the mock-up and lips and tooth dynamics.

Another tip is the development of a standardised photo protocol together with the dental technician. For proper analysis of the character of the teeth, black and white images as well as those taken with a cross-polarised filter (e.g. polar_eyes Cross Polarisation Filter or Dentalise Polariser) may be very useful. The filter removes all surface reflections from the image and thus gives a deep insight into the colour characteristics of the teeth.

By increasing the contrast and decreasing the brightness of the image, an even clearer view on the colour characteristics is obtained.

Conclusion

With the right equipment, an idea of how to use it and a standardised protocol, digital photography is easily implemented in everyday procedures in the dental office. The images taken are very effective instruments that enhance teamwork and facilitate great results in direct and indirect restorative procedures.

Photo taken under natural light conditions.

Black & white image of the same situation.

Image taken with a cross-polarized filter that removes all kinds of reflections and dazzling from the tooth surface. In this way, it is possible to analyse the colour characteristics of the teeth more exactly.

Paulo Monteiro DMD, MSc

"My passion for aesthetic dentistry began when I attended the last year of the Dental Medicine course in 1998 at the Institute of Health Sciences Egas Monizin Portugal. In 2005, I completed my specialisation in Aesthetic and Restorative Dentistry at the ISCSEM, Lisbon, Portugal. In 2010, I finished a Master's degree in Dental Medicine and I'm currently taking a PhD in Dentistry at Universidade de Santiago de Compostela, Spain."

Paulo is author and co-author of many clinical publications and has lectured in more than 200 international courses and congresses in aesthetic dentistry and is a member of the StyleItaliano™ group.

Contact: 👤 Dr Paulo Monteiro DMD, MSc
Coordinator and Professor in Aestheyic and Restorative Dentistry
Post-graduation program at ISCSEM
✉ paulojorgemonteiro@yahoo.ca

Contact 3M

Australia
3M.com.au/dental

New Zealand
3M.co.nz/dental

3M Health Care Academy

Scientific Affairs

Stephen Langdon
Email: sdlangdon@mmm.com

Janice Pitt
Email: jpitt3@mmm.com

3M Oral Care

3M Australia Pty Limited
Building A, 1 Rivett Rd
North Ryde NSW 2113
Ph: 1300 363 454
3M.com.au

3M New Zealand Limited
94 Apollo Drive
Rosedale Auckland 0632
Ph: 0800 80 81 82
3M.co.nz

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