

FUNDAMENTALS OF DIGITAL PHOTOGRAPHY IN DENTISTRY

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ABSTRACT

Photography has become an invaluable asset in daily dental practice. Technological developments in photography have continued to facilitate and enhance the practice of dentistry. This evolution to a contemporary photographic process is revolutionizing the way clinicians diagnose, treat, and communicate with patients and colleagues. In this technologically progressing profession, clinicians should consider using an objective strategy for the selection and application of a reliable camera system that best suits the needs of their practice. This article provides clinicians with an overview of the various camera systems, exposure variables and basic functional components of a professional digital single lens reflex (DSLR) camera system, and the typical settings recommended for obtaining a quality dental image.

KEYWORDS: Photography-dentistry; Digital photography-dental; Single lens reflex camera

INTRODUCTION

“A picture can tell a thousand words”. Photography in dentistry plays a wide role of significance in teaching, research and clinical recording.^[1] We have seen an explosion in the use of photography due to the advent of digital cameras and their ease of use and economic advantages. Clinical photography has become an important part of standard dental practice. Clinicians in both general practice and specialty areas have found the pictorial representation of a patient’s condition to be of a valuable part of the patient’s record.^[2] When evidence-based dentistry is gaining roots worldwide, dental photography finds an important place in providing the evidence. In addition to conventional patient records and radiographs, dental photography offers the dental professional another possibility of visual reconstruction of the various stages of treatment. Proper records will help avoid any post-treatment disputes.^[3]

TYPES OF CAMERAS

Cameras are broadly divided into three main types: a) Those based on the single lens reflex (SLR camera) design with interchangeable lenses. b) Those based on a compact design where the lenses are not interchangeable - Digital camera and intraoral camera. c) Digital SLR camera (combination of Digital and SLR camera).

SINGLE LENS REFLEX (SLR) CAMERA SYSTEM

SLR camera used in dental photography has two main parts, its body and lens. The camera body can influence the ease in which good results of photography can be obtained; by offering the photographer additional features such as auto-exposure and auto advance. Cameras that are manual will function perfectly adequate, however cameras with auto exposure allow for more concentration on the patient and not photography. The use of a SLR is valuable for several reasons i.e. there are a variety of films to choose, it is compact and easy to use, but probably the most important is that they can utilize interchangeable lenses. Good quality lenses come inscribed with these numbers allowing for standardization of views, magnifications and exposure information.^[4]

DIGITAL CAMERA SYSTEM

Digital photography has become very popular and its application to dentistry offers many advantages. This allows photographic freedom, immediate review of pictures and most cost effective. They have a LCD screen so that the pictures can be reviewed and poor quality pictures can be deleted. In the near future, dentists will likely to be involved in teleconsulting and teleconferencing. The consultants can e-mail the pictures and/or radiographs for review, without the referring dentist having to travel to the consultant’s office.^[5] Digital cameras use charge-coupled device (CCD) or complementary metal oxide semiconductor (CMOS), instead of the conventional film. It is this chip that converts the light entering the camera into an electrical signal, which eventually ends up as the digital

image. The recorded image can be viewed on a LCD screen on the rear of the camera. However, the quality of images shot with digital cameras is lower than of images recorded on chemical films.

Concept Of Charge-Coupled Device

The heart of any digital camera is the CCD. The individual areas on the CCD, which register the light falling onto them, are photodiodes, otherwise known as pixels. Megapixels are therefore millions of such pixels. So the resolution of the camera, is a measure of how many pixels or tiny bits of information the camera's image sensor uses to split up and then reassemble the picture. The higher the MP (Mega Pixel) number, the smaller the pixels, the better the resolution. A chip with 1600 pixels x 1200 pixels will be a 2 megapixel camera, whilst a camera with 3200 x 2400 pixels on the chip will be 4 megapixels and so on.

DIGITAL SLR CAMERA

These cameras combine the features of the SLR system with the digital camera. These include: i) an interchangeable lens which gives the option of taking extreme telephoto images that would be difficult or impossible with a compact digital camera. Add-on lenses are available for extending to reach of such cameras, but the quality of add-on lenses cannot be compared with that of an interchangeable lens. ii) Digital SLRs with large sensors will have much less noise than compact cameras. This will give better fine detail, better shadow detail, and more flexibility to recover from exposure errors. When you examine a shot from a digital SLR at full size, it will look smooth and have pure colors. At the same megapixel rating, you will get more flexibility to crop and enlarge with images from a digital SLR. iii) Digital SLRs use the faster and more accurate phase detection autofocus method and generally have shorter shutter lag times, making it easier to capture the action.^[6]

DIGITAL VERSUS OPTICAL ZOOM

A digital zoom is not a true zoom lens, it merely crops the image throwing away the information at the edges and increasing the apparent magnification of the lens. Optical zoom implies the actual change in focal length. It functions by using a system of lenses to refract light and magnify the image on the CCD. Optical zoom magnifies the image quality along with the resulting details and clarity unlike digital zoom.

EXPOSURE VARIABLES

These cameras do have certain variables which define the outcome of the image. These factors are called exposure variables. They are

1. Aperture
2. Shutter Speed
3. Iso setting
4. Light source
5. Lens
6. White Balance

APERTURE

Referred to by "f-stop". Corresponds to a specific opening in the lens. Controls the amount of light exposing the sensor and determines "depth of field". Smaller the opening, larger is the f-stop value and greater is the depth of field and vice versa.

SHUTTER SPEED

It is length of time the camera sensor is exposed to light. In dental photography we use the cameras "flash sync speed". The flash synch speed is the fastest shutter speed that can ordinarily be used to take a picture with an electronic flash. Typical value would be 1/200 of a second. Faster shutter speeds "freeze" the motion whereas slower shutter speeds "blur" the motion.

INTERNATIONAL ORGANISATION FOR STANDARDIZATION (ISO)

ISO is the yardstick for sensitivity to light. The higher the ISO, the "faster" the speed of the camera with respect to image recording. Digital SLR's now feature ISO's up to 3200. But the best quality image will come from a low ISO number. The higher the ISO number the more "digital noise" present.

LIGHT SOURCE

There are different types of flash available and these are point, ring and dual point flashes. The **point flash** is a directional flash and offers more natural lighting with increased shadows and more depth and contrast. These shadows help your eye see 3-dimensional depth and surface texture. The **ring flash** is a circular flash that encircles the lens barrel and fires in all directions. This gives an even distribution of light with fewer shadows but less contrast and depth. The images from ring flashes have more of a flat even look to them. The ring flash is extremely useful for photographing areas where access is difficult and where uniform illumination is required, e.g. occlusal and

proximal photos. **Dual point flash** is the best for anterior shots as it has the ability to change the angle of the flash, it reduces reflection, and can give you better depth and capture more texture and form. It is a little more difficult to get as good a posterior shot. It is also not as easy to stay consistent, because of the many ways to manipulate the twin flash -you need to set up a system for yourself to take particular shots in certain positions while the ring flash stays put in the same position all the time.

LENS

Many 35mm zoom lenses have “macro” settings which allow you to focus closeup, but not nearly as close as we need for clinical photography. In order to focus very closely, we need a true macro lens. A true macro lens allows you to focus down to a 1:1 magnification. Intra-oral photography needs a fair amount of working distance and distortion free headshots. A macro lens in the range of 90-105mm is ideal. This focal range is also perfect for taking photos up to head size.

WHITE BALANCE

The human brain is very good at judging what is white under various light sources. Digital cameras cannot emulate the human brain and must be set to adjust color according to the lighting present. White balance (WB) is the process of removing unrealistic color casts, so that objects which appear white in person are rendered white in your photo.

EXPOSURE MODES

The exposure variables mentioned can be set accordingly using various exposure modes. They are:

Program Mode: camera adjusts both shutter speed and aperture, according to a built in program

Shutter Priority: photographer controls the shutter speed and the camera chooses the aperture for a good exposure

Aperture Priority: photographer chooses an f/stop and the camera chooses the shutter speed to achieve a good exposure

Manual Mode: photographer chooses both an f/stop and the shutter speed to achieve a good exposure

TYPICAL SLR SETTINGS FOR DENTAL PHOTOGRAPHY

- The Aperture priority mode should be selected “Av”.
- Aperture: F Stops - 22-32 for close ups, 5.6-6.7 for portraits.
- ISO value can be set at 100.
- 95-115 mm macrolens with a ring or dual point source flash.
- White balance: 5000 to 5700 Kelvin or “daylight”.

CONCLUSION

The high rate of innovations in the market often confounds dental professionals in the world of digital photography, which has been adopted by all dental specialties and became an important resource. Photographs can be easily obtained using the correct equipment, proper settings and the most effective techniques, thereby increasing the chances of obtaining high-quality images.

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