

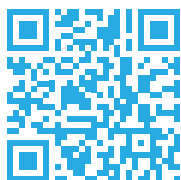
# DENTAL PHOTOGRAPHY – AN IMAGE TO IMPROVE THE FACE OF DENTAL PRACTICE

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## To access & cite this article

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Received :16.5.2019

Accepted : 30.5.2019

Published : 26.6.2019

## ABSTRACT

A picture is worth a thousand words. DSLR cameras give us the ability to store digital negatives of every image that we click called RAW format file while mobile phones are worst for dental photography. The DSLR camera has a huge dynamic range and is capable of detecting and recording true colours at appropriate settings efficient with Hue, Value and Chroma. The three most important camera settings are the aperture, shutter speed and ISO – together called the Exposure triangle. The camera used for professional dental photography should record distortion free images. The mobile phone camera has image processors and sensors which are inferior to DSLR cameras and hence are unable to detect and record true colours of an image. Photography has always been an integral part of dentistry and its application in dental practice is simple, fast, and extremely useful in documenting procedures of work, patient education, and pursuing clinical investigations, clinical case discussions with professional colleagues thus providing many benefits to the dentists and patients. This article highlights the importance of dental digital photography with DSLR camera in today's world of interdisciplinary dentistry and medicolegal cases.

**KEYWORDS:** Legal documentation, clinical investigations, DSLR camera, RAW format file, digital photography, exposure triangle.

## INTRODUCTION:

Dental photography has always been considered as an indispensable valuable part of dentistry<sup>1,2</sup>. With the advent of digital technology, imaging has become easier and more readily accessible. Many practitioners are still yet to embrace this change and start documenting their clinical work<sup>3,4</sup> due to various reasons such as intimidation and lack of knowledge of photographic equipment and technique, interruption in work flow during busy practice hours, cost of additional equipment, tedious post processing work of such photographs, staff and patient compliance, long chair-side working time etc. However as we march into the third decade of millennium dental practice all dentists should value the pros and cons of such value added services offered and upscale their practice. Every practitioner should have a basic knowledge of the DSLR camera and a little know-how of dental photography to implement them into regular daily routine in their clinical setup.

Digital dental photography<sup>5,6,7,8,9,10,11,12</sup> helps in

- Diagnosis and treatment planning - Before and after photographs of clinical cases always reduces the fear of the patient and gives them hope that the dental procedure they are about to undergo is simple and possible. Explanation of the procedure with such photographs builds trust between the patient and doctor too. Intraoral photographs in addition to patient records such as diagnostic radiographs, study models provide a 360° evaluation, helping in analysis and an in-depth look at the patient's dentition that is easily reviewed and compared with the patient's other records.
- Patient education and communication through the procedures – Today's patients are well informed with dental diseases and look into the internet for information. However it is always better for dentists' to counsel the patients about the specific needs and concerns, address their expectations, showcase similar cases of clinical interest and also guide them in taking informed consent decisions towards the treatment. Multimedia videos, power-point presentations, software aided treatment outcomes can be shared prior to decision making and case acceptance.
- Legal documentation – Lawsuits has crept into the medical profession and is slowly spreading its tentacles. Careful systematic documentation by the attending doctor will

surely help them save their skin or defend a colleague in such cases of harassment and nightmare.

- Standard of care – Millennium dentistry is more proactive towards being predictable and reproducible protocol based and hence dental photography would support such care and prevent embarrassment in future insurance claims if any.
- Referral and inter-doctor consultation/communication – Photographs always aim at giving a new dimension to our reports. Complete history taking, charting of radiographs, models, accessing healing post surgeries aid in assessment of the treatment protocol.
- Communication to laboratory - Photographs aid in giving added information to the technician in relation to tooth structure, colour, surface complexities etc
- Professional marketing - Pre and post photographs can motivate and encourage patients to go ahead with treatment plan. Good quality photographs with proper contrasts form a very useful tool in patient acceptance.
- Self-education and critical evaluation – Evaluation of photographs enables an operating dentist to self-assess his work, have a learning curve throughout the career and critically evaluate his clinical acumen.
- Peer review and research – Photographs enable a dentist to showcase his clinical work in dental forums such as seminars, websites and also use it for publication purposes for enhancing the standard of dentistry.
- Forensics<sup>13</sup> – Increase in crime rates along with mass destruction and natural calamities has made it mandatory to have ante and post mortem records. Dental photographs have given a name to many deceased individuals through forensic odontology.

The recommended camera equipment [ Fig 1] for dental photography<sup>14</sup> should record distortion free images. The use of wide angle lens must be minimised as it causes distorted images giving a horse-jaw effect. True colours should be recorded. The images should be free of visual noise [the images can look granular and can make the image look blurred] and be of good quality, as they are needed for documentation. The images should be consistent

in nature and not affected by available light as the image is needed for documentation. The ambient light, dental chair light or room lights such as LED or tube light should not affect the colour temperature and intensity. Always shoot both RAW format as it is called the digital negative along with JPEG format. RAW format is mandatory for International level publications. Hence DSLR [Digital Single-Lens Reflex] cameras are preferred over mobile phone camera as they produce high-resolution output.

is due to these reasons that mobile phone images are affected by ambient lights. However DSLR cameras have flash which are efficient for dental photography. The images taken pre and post-operatively during dental procedures match better when taken with DSLR camera for publication purposes.



Fig1 : Camera body used in dental photography



Fig 2: 100 mm Macro lens used in dental photography

The most recommended lens [ Fig 2] for dental photography is 100 mm macro lens, which has minimum or negligible distortion. 18 mm focal length zoom lens [ Fig 3] has maximum distortion whereas 55 mm focal length zoom lens has minimum distortion but is better than 18 mm. Mobile phone camera has the focal length of 2 to 5 mm. The images are generally shot in wide angle lens and exhibit maximum distortion. The image processors and sensors of a mobile phone camera are far too inferior to detect and record true colours. Hue, Value and Chroma are important components of colours, hence they have to be detected and recorded without any distortion. DSLR cameras have a huge dynamic range and at appropriate settings are able to record the images without any compromise. On the other hand, mobile phones work with compromised exposure triangle settings and hence are unable to record the exact colour components, thereby the resulting images can be compromised. This image will have high noise and are grainy in nature. Mobile phone LED lights are the worst lights possible for dental photography because they aren't colour corrected or flash lights, they are upfront with continuous source LED's which are possibly the worst lights to work with, and aren't powerful enough to give the dentist freedom of desired settings for dental photography. It



Fig 3 : 18- 55 mm zoom lens used for general photography

**Table 1 : Enlists the differences in images when stored in RAW and JPEG format**

RAW format file	JPEG format file
Image size is close to 22 Mb	Image size is 5 Mb usually
More information in an image	Less information in an image
They are privacy protected and need special software to open them	They can be easily stolen, downloaded and photoshopped
They are most secure formats	Least secure format



Ownership of an image can be established only with the possession of RAW format	Can be easily stolen
They have the METADATA in them including copyright signatures and watermarking	No such feature
Very essential for International publication	Not sufficient for publication
They have higher medicolegal values	Lesser medicolegal value
They are best files to work with	They are worst files to work with

In today’s dental digital photography using camera compatible high end flash systems and diffusers are a norm, the DSLR cameras enable us with better flexibility of using many such attachments and accessories to record high quality dental images. Many clinics are now equipped with studio lights [strobes]. The two studio lights [ big black and white soft box] one on either side at 45 degree gives the best possible natural effect to your skin tones and the light looks much more natural. When the light source is upfront the images are always flat and loose dimension as well as a 3D effect. The examples of such light sources are in built flash of a DSLR, ring flash etc.

A good image is a play of light and shadows which give depth to the image. The line angles, point angles and buccal convexities are seen clearly with good light reflection whereas the embrasures [especially gingival embrasures] have shadows giving a three dimensional effect to the images. The twin light system helps us in dental photography. Mobile phones don’t give us space to add accessories. However there are some mobile phone companies which have macro lens attachment which are a poorly designed glass which further deteriorates the image quality. Ring flashes are commonly used in dental photography. Twin or dual flash is used mainly in aesthetic dentistry or for anterior aesthetic shots.

The fundamental camera settings while using dental photography in the manual mode is with exposure triangle. Shutter speed, ISO and aperture are the three components of exposure triangle. The ideal settings for intraoral exposure are shutter speed

– 1/200 of a second, ISO 100 and aperture between f 18 – 25 [ Fig 4 ] . The aperture is the opening in the lens that allows light to pass through. The aperture setting is measured in “F-stops”.

F- stops are fractions and hence moving from one stop to another can increase or decrease the amount of light that gets into the camera, for example if we move from F- stop of f/8 to f/11, the amount of light getting inside the camera becomes half. However, if we move backwards from f/11 to f/8 it doubles the amount of light coming in. F-11 is actually one – eleventh. This clearly explains that when we move from one- eighth to one – eleventh then less light gets in as we are moving to a smaller fraction.

Aperture determines the depth of field of the photograph. A deep depth of field means that you can see a lot of things in focus in the photograph. A shallow depth of field means only one area is in focus, and the surrounding areas are blurred.



Fig 4: Recommended settings for dental photography

**Table 2: Describes the differences between deep and shallow focus**

Deep focus	Shallow focus
The focus is on the entire picture	The image closest to the lens is clear
Clarity of the image is in totality	Rest of the field is blurred
Entire picture has sharp images	Highlights the object which is closest
A generalised detailing is seen in the picture	Minute details of the closest objects are seen
Usually used in dental photography	Very artistic approach to the object

**Table 3: Describes the differences between fast and slow shutter speed**

Fast shutter speed	Slow shutter speed
Less light gets in as it closes quickly	The hole stays open for long allowing more light in
We need crisp pictures	Difficult to keep the image in focus
Hand held photography	We need tripod to steady the camera
Eg; dental photography	Great for action photos like capturing motion Eg: a runner , wildlife photography

As a general rule, the lower the ISO [International Standards Organization] setting, the higher the quality of the image and determines how sensitive your camera is to light.

**Table 4: Describes the differences between higher and lower ISO**

Higher ISO	Lower ISO
Very sensitive to light	Less sensitivity to light
Grainy image or more noise in the image	Better image quality
Eg ; in low light settings for a concert where flash photography is not allowed	Eg; bright light settings for pictures taken on a sunny day

In dental photography, because we use a twin or ring flash, we can use an ISO setting of 100 or 200, keep the quality high and the noise low, a wide depth of field to keep everything in focus, and a shutter speed high enough to shoot sharp images.

Certain rules to remember for ideal settings for dental photography<sup>15,16,17,18</sup> are

- Focal length is inversely proportional to distortion
- Focal length is directly proportional to minimum focussing distance[ MSD]
- More ISO means brighter the image
- When f number [ focal length] is small, the hole[ aperture] is big
- If we increase the f number, the image quality will get compromised
- If image is dark, reduce the f number

Achieving the highest possible image quality

relies not only on using the best available equipment, but also making correct photographic choices. Correct use of exposure, lighting techniques, and post processing techniques all affect the overall quality of an image.

**CONCLUSION:**

Dental photographs are an irreplaceable document and careful documentation is of prime importance. The entire dental clinic set up along with the auxillary staff can be trained to lend a helping hand to the practicing dentist especially during recording of such photographs. This article highlights the best recommended dental photographic equipment along with the ideal settings which would enable dentists to record their cases.

**FINANCIAL SUPPORT AND SPONSORSHIP:**

Nil

**CONFLICT OF INTEREST:**

There is no conflict of interest

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