

Digital Single Lens Reflex Photography in Clinical Orthodontics: Revolution or Evolution

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ABSTRACT

The field of dentistry has witnessed a ‘Digital Revolution’ in the recent past which has made the maintenance of patient’s pre-treatment and post-treatment records a necessary protocol. The speciality of orthodontics depends heavily on patient’s records for various purposes including diagnosis and treatment planning and patient motivation. The recent upsurge in digital technology has been both inviting and confusing as an orthodontist finds himself in a dilemma regarding which camera to choose for orthodontic photography. This research article tries to develop an understanding about the cameras to choose for the above mentioned purpose and that whether digital SLR technology is really a revolution or just an evolution.

Keywords: Orthodontics, Camera, Photography, Digital SLR, Point and shoot, Resolution, Dental, Dentistry, Orthodontic photography.

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INTRODUCTION

Intraoral and extraoral photography are widely used to document orthodontic patients at the start of treatment and to monitor treatment progress.¹ Photographs are an essential part of clinical documentation.² If correctly taken, they offer more useful information about the malocclusion and treatment than any other clinical record.³ There are two types of digital cameras available in the market, digital point and shoot (DPS) and digital single lens reflex (DSLR). The DPS cameras are named after the two steps required to shoot a photograph with them, i.e. point at the object and shoot the image, without cumbersome adjustments of various kinds. Mostly they rely on ‘auto focus’ functions, primarily

factory presets, but the newer range of these cameras do have a variety of customizable options available to shoot and modify as per need.

On the other hand is, what is called as, a rich boy’s tool- i.e. DSLR cameras (Although the DSLR cameras also come in midrange price segment as well, but still they are undoubtedly costlier). The strength and robust body design, rapid auto-focusing systems, multiple fast exposure options, and choice of different lenses are the features boasted by this class of digital cameras, that increases the price of the camera. Most of these features are appropriate for individuals planning to do action photography or imaging in variable lighting conditions. Very few of these features, however, are of actual need for the type of imaging performed in orthodontics.

BASIC DIFFERENCE BETWEEN A POINT AND SHOOT CAMERA AND A DIGITAL SLR

The main difference is how the photographer sees the scene. In a point-and-shoot camera, the view finder is a simple window through the body of the camera. Photographer does not see the real image formed by the camera lens, but he gets a rough idea of what is in view.

In an SLR camera, he can see the actual real image that the film will see. The advantage of its design is that photographer can adjust the focus and compose the scene so he gets exactly the picture he wants. For this reason, professional photographers typically use SLR cameras (Figs 1 and 2).

ORTHODONTIC PHOTOGRAPHY: NEED BASED OR PASSION BASED!

The primary purpose of taking photographs of an orthodontic patient is to maintain a record as the treatment progresses. Orthodontic photographs are not taken out of passion for photography but they are really need based. So, running after complex camera features and burning time and money for that extra microscopic detail really needs a value judgement proposal.

MATERIALS AND METHODS

Seven point and shoot digital cameras available in the market were reviewed for their features. These cameras were falling in the price range between US\$ 350 and US\$ 450 and were

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Fig. 1: Points and shoot camera



Fig. 2: Digital SLR camera

considered to be an easy buy for most of the practising orthodontists. They were far cheaper than many of the 'mid range' digital SLR cameras floating in the market.

Basic to advanced features, that these cameras had, were highlighted and reviewed. A comparison was made with the most common features available in the digital SLR cameras (taking Nikon D70s as prototype) that generally make them 'the better choice' for orthodontic photography.

The features reviewed were:

1. Megapixels
2. Metering technology
3. Magnification and magnification ratio
4. Sensor size
5. Viewfinder
6. Exposure compensation
7. Histogram
8. Macro photography capability
9. Grids
10. Interchangeable lenses
11. Customizable aperture and shutter speed settings
12. External flash options
13. Price (in US\$).

RESULTS

The results obtained and tabulated after a thorough review of the cameras under consideration are presented in the Tables 1A and B.

DISCUSSION

The digital point and shoot cameras have a lot of features that are comparable to DSLR cameras (at least in the sense of their presence if not to the extent).

Megapixels

Megapixels refer to the extent of close packing of the pixels in an image. It is also suggestive of the possible size of the

print that can be suitably achieved without distortion. All point and shoot cameras had approximately the same megapixel values which was almost the same as that of the SLR camera.

Metering Technology

The camera should have both the matrix and spot metering options. Intraoral orthodontic images have high contrast and if they are matrix metered then overexposure of teeth (lighter structures) can occur as exposure value is set to the averaged contrast of the whole seen, including the dark posterior areas as well. Spot metering allows only a small area on the tooth (preferably) to be metered and exposure is automatically set according to it. So accurate exposure of the intraoral image occurs.

All the cameras that were included in the study showed options for both type of 'Metering', i.e spot metering as well as matrix metering. This feature makes them comparable to the digital SLR cameras (many of us do not even know that point and shoot cameras have this function!).

For extraoral photo shots matrix metering option can be chosen, which was also available in the cameras.

Magnification and Magnification Ratio

A magnification ratio of 1:1 means that the image produced on the sensor/film is of the same size as that of the actual object. This is highly desired for intraoral shots. When we press the 'zoom' button then lens changes its focal length by increasing the distance from the sensor/film and we achieve consistent magnification that is required for intraoral photographs.

All the point and shoot cameras had optical zoom in the range from $\times 3$ to $\times 10$ (one even showing $\times 15$), meaning that they can actually double or triple the size of the teeth in the intraoral shot.

Whereas in DSLR cameras since the focal length of the macro lens is same, the magnification can not be increased or decreased readily.

Tables 1A and B: Tabulated results after review of the cameras

A.

Parameters	Sony DSC-TX1/H	Sony DSC-T900/s	Sony DSC-T90/P	Sony DSC-H50/B	Sony DSC-H20	Nikon coolpix S70	Nikon coolpix S640	Nikon D70s
Megapixels	10.2 megapixels	12.1 megapixels	12.1 megapixels	9.1 megapixels	10.1 megapixels	12.1 million	12.2 million	12.2 million
Metering technology	Multipattern/center weighted/spot	Center weighted/spot						
Magnification and magnification ratio	4:1	4:1	4:1	15:1	10:1	4:1	4:1	1:1 to 1:10
Sensor size	1/2.4 exmor CMOS sensor	1/2.3 super CCD	1/2.3 super CCD	1/2.3 super CCD	1/2.3 super CCD	1/2.3 in CCD	1/2.33 in CCD	23.7 × 15.6 mm CCD
Viewfinder/LCD display	Viewfinder + LCD display	Viewfinder + LCD display	Viewfinder + LCD display	Viewfinder + LCD display	Viewfinder + LCD display	Viewfinder + LCD display	Viewfinder + LCD display	Viewfinder + LCD display
Exposure compensation	Plus/minus 2 EV, 1/3 EV step	Absent	Absent	Present				
Histogram	Present	Present (but can't be used in real time)						

B.

Macro photography capability	Close focus enabled range	Approx. 1 to 20 cm	Magnifying glass mode approx. 1 to 20 cm	Magnifying glass mode approx. 1 to 20 cm	Magnifying glass mode approx. 1 to 20 cm	Macro auto focus range approx. 1 cm to infinity	Macro auto focus range approx. 2 cm to infinity	Macro auto focus range approx. (3 cm)	Macro function (2 cm)	Macro lens has to be attached	Grids	Interchangeable lenses	Customizable aperture and shutter speed settings	External flash options	Price (US\$)
Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
No	No	No	No	No	No	No	No	No	Yes	Interchangeable lenses	No	Customizable aperture and shutter speed settings	External flash options	Price (US\$)	
No	No	No	No	No	No	No	No	No	Yes	Customizable aperture and shutter speed settings	No	Customizable aperture and shutter speed settings	External flash options	Price (US\$)	
Can be added	Can be added	Can be added	Can be added	Can be added	Can be added	Can be added	Can be added	Can be added	Can be added	Can be added	Can be added	Can be added	Can be added	Can be added	Can be added
428	428	367	367	449	387	408	1018	428	428	428	367	449	387	408	1018



Sensor Size

Sensor size affects the magnification of the image. The smaller the sensor size the greater the cropping of the image (in frame) occurs by the sensor and greater is the magnification achieved.

The DPS cameras had similar sensor sizes to that of DSLR cameras so this feature does not amount to much of a difference between them.

Viewfinder/LCD

It is claimed that in a point and shoot camera, what we see in the view finder is a parallax error biased image of the object or photographic frame and that the DSLR cameras show the real image (by their Single Lens Reflex technology). All the cameras had a colored LCD display which shows the frame in real time and hence there is no parallax error as the light comes through the lens itself. On the contrary the usage of this real time display is not possible in DSLR cameras for shooting photos as the mirror lies ahead of the lens during focussing. So perhaps digital point and shoot cameras are equally efficient in showing and shooting the real picture by the help of their LCD display.

Exposure Compensation

Exposure compensation is required to manually do adjustments for the exposure. In DSLR cameras there is adjustable shutter priority or aperture priority which controls the exposure together with manual exposure value settings.

All the cameras had exposure value (EV) settings to at least +2.0 and -2.0. (except the cameras from Nikon, which were lacking the EV settings).

So these cameras are capable of doing exposure compensation as well.

Histogram

Digital SLR cameras, as well as many point-and-shoot models include histogram displays, which are charts on the LCD that show the number of tones being captured at each brightness level. Here, the non-SLR cameras have an advantage: point-and-shoot models can display a real-time 'live histogram' on the LCD as we compose an image. We can then make immediate adjustments to optimize exposure. A DSLR, on the other hand, cannot show a preview image because the flip-up mirror gets in the way of the sensor prior to exposure, so histograms can be viewed after we have taken the image (Fig. 3).

So it appears that although histogram function is present in both the digital point and shoot and the DSLR cameras, the former offer an easier usage of the same.

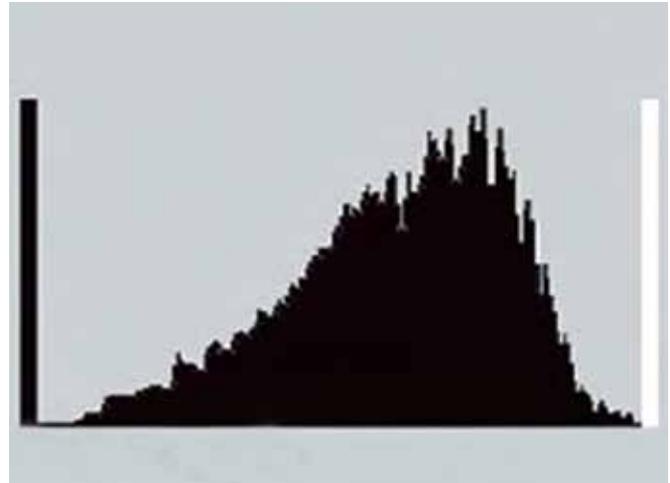


Fig. 3: Histogram display

Macro Photography Capability

Macro means 'close up'. For shooting intraoral photographs we require this feature present in the cameras. While DSLR cameras have macro lenses in their stable the digital point and shoot cameras showed 'macro function' – both offering close-up intraoral photo shots.

The macro function was present in all the cameras, so although we can not get the kind of focus achievable with DSLR cameras but a respectable intraoral shot is definitely up in the store by the help of this function (Macro function) in digital point and shoot cameras.

For extraoral shots this 'macro function' option can be switched off.

Grids

Grid function allows precisely spaced lines to appear in the viewfinder of the camera and they help in the orientation of the structures within the photographic frame, for example to bring the midline of the central incisors at the center of the frame.

All cameras had this grid function which further enhanced their strength.

Interchangeable Lenses

DSLR cameras offer variety of interchangeable lenses for close-up photography. In this aspect they are a clear winner, as digital point and shoot cameras have just a fixed lens. Although practically we do not require to change the lenses very often as a 100 to 105 mm macro lens is ideal (Figs 4A to C).

Customizable F-Stops and Shutter Speed Settings

As the F-stop value is increased the aperture size is reduced and due to more light bending through the small aperture



Figs 4A to C: Interchangeable lenses

the ‘depth of field’ is greatly enhanced. So we can clearly see up to the last molar posteriorly to the central incisor anteriorly in the image.

The point and shoot cameras did not have this setting, although these cameras with the ‘macro function’ switched on show pretty crisp intraoral shots with reasonable depth of field (Fig. 5).

External Flash Options

External flash allows for exposure adjustments when shooting with a macro lens and high F-stop settings (in a DSLR camera).

The point and shoot cameras had option for an external flash but whether it actually is helpful or not could not be discerned.

Price

All the point and shoot cameras fell in the price range between US\$ 350 and US\$ 450. This is a reasonable price tag that these cameras, with good features for dental photography, offer. While on the other hand the digital SLR camera (Nikon D70s) costs around US\$ 1020 and a dedicated macro lens would have to be taken in addition to it (cost of macro lens not included).

Perhaps buying a digital SLR is still out of reach of many orthodontists but a point and shoot camera can be placed to meet the most general needs of an orthodontist, with its attractive price and loads of features.

CONCLUSION

The digital point and shoot cameras were reviewed for the features they present and a comparison was made with the

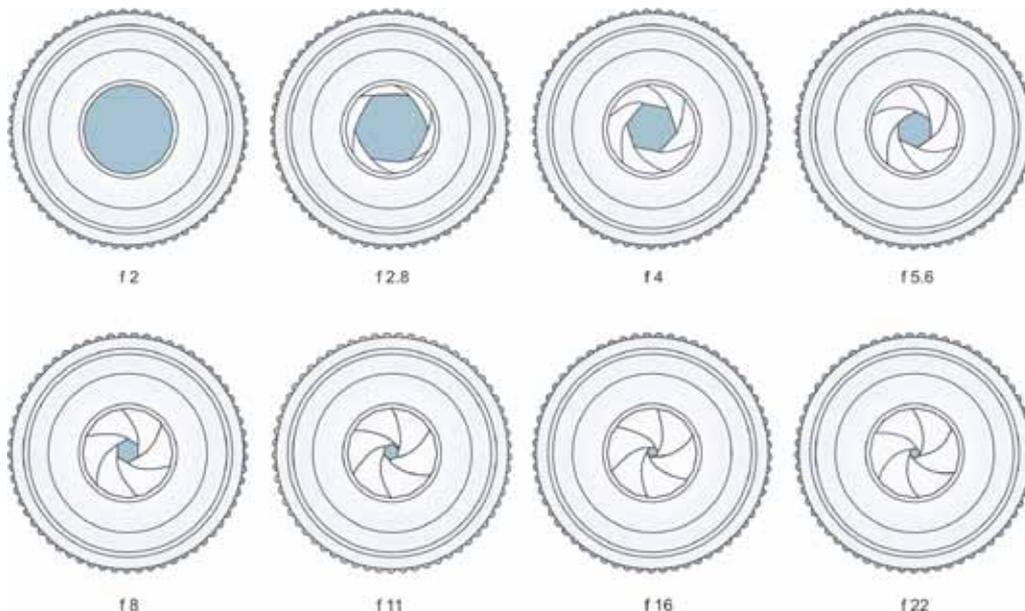


Fig. 5: Depth of field



features of a common digital SLR camera. Although the features of a DSLR camera are definitely far superior to point and shoot cameras but for orthodontic photography even the photographs shot from a mid range point and shoot cameras does valid justice to the need, by offering acceptable photographs that are in decent contrast, well exposed, in focus and having good depth of field. The more important thing is that the orthodontist should know all the features of his point and shoot camera to achieve good photographs and avoid hefty expenses in terms of buying a digital SLR camera. When we put value for money filter, the thought process signifies that digital point and shoot cameras are

sufficient to cater to the needs of an orthodontic practice and that a digital SLR camera is just an added flavor. So digital SLR cameras are perhaps an evolutionary trend as far as their presence in orthodontics is concerned and the rise of digital technology, *in toto*, is a revolution.

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