

A Sneak Peek into the Orthodontic Photography Room

¹Prof. Dr. Kuldeep DMello, HOD & Professor, Department of Orthodontics and Dentofacial Orthopedics, K D Dental College and Hospital, Matura, India

²Dr. Sayeri Hossain, PG, Department of Orthodontics and Dentofacial Orthopedics, K D Dental College and Hospital, Matura, India

³Dr. Nibedita Biswas, PG, Department of Orthodontics and Dentofacial Orthopedics, K D Dental College and Hospital, Matura, India

⁴Dr. S.M. Shahnawaj Tahir, PG, Department of Orthodontics and Dentofacial Orthopedics, K D Dental College and Hospital, Matura, India

⁵Dr. Piyush, PG, Department of Orthodontics and Dentofacial Orthopedics, K D Dental College and Hospital, Matura, India

Corresponding Author: Dr. Sayeri Hossain, PG, Department of Orthodontics and Dentofacial Orthopedics, K D Dental College and Hospital, Matura, India

Citation of this Article: Prof. Dr. Kuldeep DMello, Dr. Sayeri Hossain, Dr. Nibedita Biswas, Dr. S.M. Shahnawaj Tahir, Dr. Piyush, “A Sneak Peek into the Orthodontic Photography Room”, IJDSIR- September - 2020, Vol. – 3, Issue - 5, P. No. 187 – 194.

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Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Clinical orthodontic treatment planning involves collection of patient records including a set of extraoral and intraoral photographs. All other records aside, pretreatment and post treatment photographs provide the easiest manner of evaluation of the changes that took place in the dentofacial region; hence are most convenient for case representations. Often times, most skilled clinicians with great cases are unfortunately not able to depict the changes owing to technical faults in the photographic technique that fail to give them their due credit. This article aims at enabling orthodontists to

overcome technical shortcomings when it comes to orthodontic photography to represent their cases better.

Keywords: Orthodontic treatment, Extraoral and Intraoral, Dentofacial, Photographic, Technical

Introduction

Ideal photography demands a proper set up, with all the right equipments, proper lighting and technically skilled photographer to serve the purpose. There are certain criteria to be met that extends from the standardization of orthodontic photographs to the designing of the ideal photography room.

Method of Standardization as suggested by Wolfgang Bengel[1]

–Photographic apparatus

- 35 mm Single Lens Reflex Camera
- 100 –135 mm Lens
- Lateral Flash for Extra oral Photographs
- Ring Flash for Intra oral Photographs

The Studio [19]

The most important requirement for the photo studio was that no light bouncing of the walls, the floor, or the ceiling should illuminate the scene. This means that as much light as possible must be absorbed by the walls, the floor, and the ceiling of the room. Furthermore no light from the outside (i.e. the computer lab) should get inside the photo studio. Goesele et al[19] used a **24 m²** sized area as photo studio. The walls and the ceiling were to be covered with black cloth. Two black curtains allow for easy access to the photo studio. For the selection of the black materials the following issues were considered:

- The correct exposure for a scene is usually determined by measuring the light that is reflected from a 18% reflectance gray card. If this value is put on Zone 5 of the Zone system²⁰ the lowest useful density of a negative is at Zone 1 which corresponds to 1.125% reflectance.
- The dynamic range of a digital sensor is potentially even higher
- The second requirement for the materials was that the remaining light should be reflected in a diffuse way. As curtains tend to be in a curly shape arbitrary combinations of incident light and viewing direction will appear. If this leads to specular highlights the measurements will be incorrect.

Goesele et al[19] used a black needle fleece carpet Since the curtains block any kind of air flow, and the lamps

radiate a serious amount of heat, a good ventilation or air conditioning of the room is mandatory.

Photography Studio Features

- i. An ideal studio room should be at least 25 feet wide on both sides without any columns
- ii. Ceiling height: it should be at least 12 feet or else, it will be difficult to use cranes, booms and overhead lighting. To install ceiling rail system for strobes we require high ceilings as well.
- iii. Ceiling colour: In order to get a reflection from the ceiling, it is preferable to paint the ceiling in black.
- iv. Powerful wall sockets are a must as some the lighting equipment can be very power consuming. If we use lightings higher than 2000W, generators can be considered.
- v. Walls : They should be painted either matte white or matte gray. Using any other colour is strictly contraindicated as light might bounce on to the subject and leave undesirable color casts.
- vi. Background[12] :The background should be plane and non distracting. Black or white matte backgrounds are recommended, as mentioned previously. If a white background is used,it should be levelly lit with no distracting shadows hiding the patient's profile.
- vii. Miscellaneous: considering safety and security issues is equally important as some pretty expensive equipments are stored in the studio. So, it is advised to have a secured storage facility as well.

Equipment

1. Camera[13]

The best results can be achieved with a digital single lens reflex (DSLR) camera. This type of camera has interchangeable lenses, providing great flexibility. To

choose the proper body for dental photography, important elements to consider include size, weight, custom shooting modes, sensor type and size, built-in wireless controller, and manufacturer.

My recommended settings for Orthodontic photography

Shutter Speed	About 1/250 of a sec while used in M Mode
Aperture	Extraoral – f/8-f/11
ISO	100-200
Exposure mode	Manual Mode(always preferable)
Image size	>4MP
File type	RAW is preferred to JPEG for documentation purposes
Flash Units used	TTL Flashes, Ring flashes

The average sensor of digital cameras used in dental photography is close to 20 megapixels. For different media, images must be optimized to achieve the best results.

File settings:

- Format: .jpg
- Quality: 100 (best)
- Limit files size to 500kb
- Color space: Srgb

Image sizing:

- Resize to fit: long edge 2000 pixels
- Don't enlarge
- Resolution: 72 pixels per inch

File settings for jpg:

- Format: .jpg
- Quality: 100 (best)
- Limit files size: unchecked (no limit)
- Color space: Adobe RGB

Image sizing:

- Frame : 6" x 4"
- Resolution: 240 pixels per inch

2. Lens[13]

Available lenses in the market include macro lenses such as Nikon and Canon and others. Lenses generally are not inexpensive, but it should be possible to find one that will fit your budget. A few features to consider before buying the lens are the desired focal length, magnification ratio, image stabilization, and lens speed.

Focal length

It is represented in mm by the side of the lens. It can be in the range of 18-55mm , or a single focal length in a macro lens of 100 mm

Magnification ratio

For dental photography, the best lens is a macro lens with a magnification ratio of 1:1. This means that with minimum focusing distance, a real life 1cm object forms an image with the same size on your sensor.

Image stabilization

Newer lenses have built-in systems that can compensate for image blur caused by small, involuntary movements known as camera shake. In dental photography, this feature doesn't have a big impact because the shutter speeds vary in the range from 1/60 to 1/250 of a second

Tip: while shooting from a tripod, it is advised to switch off the image stabilization mode on the lens to avoid blurry images. Otherwise the lens by default will try to detect shaking and can give a false reading.

Lens speed: Two features influence the so-called lens speed

- The aperture number or maximum lens opening influences the amount of light entering the lens barrel and the camera and, ultimately, how easy it is for you to look through the camera's viewfinder and see a bright image that is easy to compose).
- Auto focus speed : More expensive lenses have ultrasonic motors built-in. They allow for very fast

and accurate adjustment of the focus to get a sharp image when you are shooting in auto focus mode.

Recommended lenses for a Nikon DSLR camera:

- Nikon AF-S VR Micro-NIKKOR 105mm f/2.8G IF-ED Lens

Recommended lenses for a Canon DSLR camera:

- Canon EF 100mm f/2.8L Macro IS USM Lens(Fig 1)
- Canon EF 100mm f/2.8 Macro USM Lens

3. Flash[13]

In dental photography, flash is used to illuminate the oral cavity and the patient's face. When choosing flash equipment, consideration should be given to the type of flash, availability of a wireless option, and optional accessories.

Modern flash units are a handy source of light for all occasions. These can be in the form of Flash gun with bulbs of different sizes, clear or blue; or Electric flash units, for several exposures without changing the bulb

Flash types

- A ring flash(fig 2.1) is mounted on the front of the lens with dedicated mount rings. It is available with wireless communication.
- A dual flash(fig 2.2) is more advanced, and with the help of additional accessories like brackets it enables control over the distance of the flash head from the lens.
- External flash (fig 2.3) is a very good choice for portrait photography.

4. **Reflectors**[16] (fig 3A,B) A reflector is any surface that is used to bounce light onto the shadow areas of a subject. A wide variety of reflectors are available commercially, including the kind that are collapsible and store in a small pouch. The surface of reflectors can be white, translucent, silver foil, black or gold foil. The silver- and gold-foil surfaces provide more light than matte white or translucent surfaces. Gold surfaced

reflectors are also ideal for shade, where a warm-tone fill light is desirable. Mirrors are also used to bounce light. These reflect a high percentage of the light that strikes them, so they can be used outdoors to channel backlight into a key light. When using a reflector to produce fill light, it should be placed slightly forward of the subject's face, not directly beside the face. If the reflector is next to the face it will create a secondary light source (and second set of shadows) coming from the opposite direction of the key light. Properly positioned, the reflector picks up some of the key light and wraps it around onto the shadowed side of the face, opening up detail even in the deepest shadows.

Because the reflector can be positioned in an L-shape to be freestanding, it can even be used as a gobo and reflector simultaneously. Another way the reflector can be used is to position it beneath the subject's chin so that it reflects light up into the subject's face. If using a tripod, one plane of the reflector can be rested on or taped to the tripod, or an assistant can be used to precisely position the reflector.

5. Scrims[16]

Scrims are translucent diffusers. Light is directed through the material of the scrim to diffuse the light. In the movie business, huge scrims are suspended like sails on adjustable flats or frames and positioned between the sun (or a bank of lights) and the actors, diffusing the light over the entire area. A scrim works the same way a diffuser in a softbox works, scattering the light that shines through it. Scrims can also be used in window frames for softening sunlight that enters the windows. Tucked inside the window frame, the scrim is invisible from the camera position.

6. Light Source[4]

Personally, I prefer that the light source for extra oral photography must be made larger, either by using a

diffuser(soft box) or indirect flash by using a foam sheet or reflector. It is also possible to bounce the flash off white wall or ceiling, but this results in images with less contrast. It is sufficient to light the face with one light source. A second light source is required if the background needs to be lit separately.

7. Soft boxes[14] (fig 4 A,B,C,D)

Sometimes a translucent umbrella, called a shoot-through umbrella that is turned around so that the light shines through the umbrella and onto the subject.

This gives a more directional light than when the light is turned away from the subject and aimed into the umbrella (bouncing it out of the umbrella and back onto the subject). There are many varieties of shoot-through umbrellas available commercially and they act very much like softboxes.

It is like a tent housing for one or more undiffused strobe heads. Often, fiberglass rods provide rigid support for the housing. The frontal surface is translucent nylon, usually a double thickness. The sides are black on the outside and white on the inside to gather and diffuse more light. Softboxes come in many sizes and shapes. Although most are square or rectangular, there are also a few round and octagonal ones out there. The size ranges from 12-inches square all the way up to 5x7 feet.

Softboxes are the ideal means of putting a lot of diffused light in a controlled area, and provide much more precise control over the light than umbrellas, which lose much of their light intensity to scatter.

A strip light, a popular tool in today's photography, is a long skinny softbox. Strip lights are used as background and hair lights in portraiture, as well as edge lights for contouring in tabletop photography. Sometimes they can be used as odd-shaped key lights, although they are usually so small and light that they can be tricky to use for this purpose

Other Camera Characteristics

Depth of Field [12]

This is the zone of sharpness that extends in front of and behind the subject in which the image is sharp. The depth of field of any lens increases when:

- a) Distance between the object and the lens increases.
- b) Focal length of lens decreases and
- c) Aperture is stepped down.

The depth of field does not extend equally in front of, and behind, the point of focus but approximately 1/3rd in front of the point of focus, and 2/3rd behind it. It is maximum when the aperture is minimum and vice versa.

Positioning [12] (Fig 5)

Correct positioning of instruments such as mirrors, retractors, and contrasters is very important for good access and to avoid obstacles interfering with the photo axis. Instruments can be held by the patient but also by the assistant or photographer. To avoid distortion of portraits and images of the teeth, the photo/lens axis should be perpendicular to the teeth.

- Patient's coats and jumpers should be taken off and shirt collars turned down. Head scarves should be removed, if this is acceptable for the patient, or arranged so that the patient's ears, jaw line are clearly visible.
- Removable appliances should be taken out unless otherwise required
- All kinds of jewelry, glasses, piercings and glasses must be removed
- The hair should be clear of the patient's face and ears
- Patient's eyes must be open
- The patient should have swivel seating arrangement with his/her back straight
- The patient's lips and chin must be in a relaxed state
- The patient's teeth must be occluded

- The patient's Frankfurt Horizontal Plane must be parallel to the floor and his/her median plane should be vertical(FIG 6)
- DO NOT try to alter the position of patients with asymmetrical faces
- The patient should look directly ahead in their natural head position (NHP) while sitting upright

Patient Positioning[12] (Fig 7 A,B,C,D)

Anterior Posterior

- The patient should look straight ahead
- The median plane of the face should be centred in the frame
- The lens should be focused on the outer canthus of the patient's eye

Anterior Posterior Smiling

- Ensure patient's head is in the same position as for the anterior full face view
- He/she should be in full smile in order to assess the lip line

Face Right and Left Lateral views

- The patient must sit straight looking directly ahead
- The median of the face should be perpendicular to the camera axis
- Include the patient's ear and nose tip must be included in the frame
- Focus the lens at the patient's outer canthus of the eye

Face Right and Left Oblique views

- The patient should be sitting up straight and looking straight ahead
- The Median Plane of the face should be at 45 degrees to the camera axis. For this, the outer canthus of the patient's eye, which is furthest from the camera should be just out of view.
- The patient's ear and nose tip should be included in the frame

- The lens should be focused on the outer canthus of the patient's eye which is nearest to the camera
- The 'Frankfort Plane' or 'Reid Horizontal Plane' can be used as a guide to obtain an accurate alignment for standardised facial views. Since both planes are parallel, either may be used for correct alignment.

Camera Positioning

Extra oral Views[2]

•Frontal view

- ❖ Camera should be positioned in front of patient's head –on the same level as the patient
- ❖ There should not be any tilt in the camera position
- ❖ Distance of patient from camera about 180cm
- ❖ Mandible of the patient must be in resting position—Two photographs must be taken in frontal view

➤ Lips in relaxed state

➤ Smiling

❖ Profile view

- Camera and head orientation are same as for frontal view
- Eyebrow on the side of photograph should be visible only and not the opposite side eyebrow
- Focus should be at patient's eye
- Lips should be in resting state

Common Errors in Capturing Images and Solutions

Correct orientation of the camera is important. Extra-oral photos are taken using a tripod. For intraoral photos, camera should be adjusted as being perpendicular to the reference point.[6,7] Portrait mode should be used for capturing extra-oral photos, whereas landscape or macro modes should be used for capturing intraoral photos.[6,7,8] In addition, 35-mm cameras are important to compare extra-oral, intraoral, and mirror images captured at varying time points and to perform fixed magnification.[6,8,9,10]

Errors in Extra-Oral Photos[17]

Based on a previous study of the photos taken in orthodontics clinics, 60% are taken by the orthodontist, 35% are taken by the assistant, and only 5% are taken by professional clinical photographers. During capturing images, errors such as those due to position of camera, weak focus, darkness, or excessive brightness can occur. Other errors caused by position of patient include those resulted from difference of height between patient and photographer, failure to adjust Frankfort plane or neutral head position, hair masking the ears, closed eyes, or smooth tissues at undesired position.

Clipping errors[11]

Clipping errors include lack of desired area on image or those resulted from insufficient manipulation of photo on computer. This error can be prevented by including a larger area than desired into the image and clipping unnecessary areas on the computer.¹¹

Auto-Focus problems[8]

Options of automatic or manual focusing are available in most digital cameras. Manual focusing is preferred due to some reasons. One should focus on lateral teeth when using commercial cameras and on canines when using professional cameras. In intraoral photos, auto-focus problems occur due to lack of sharp demarcations within the mouth. Attempts to capture images fail as auto-focus light turns off (which generally appears as a green light) when focusing occurs. In clinics, manual focusing is used to address such problems. Availability of focusing throughout the lens in state-of-art cameras make it easier to focus. The distance between the patient and the camera is adjusted by the clinician in commercial models. For example, the focal length is adjusted to 20 cm manually and the photo is taken when sharpest focusing is achieved by moving camera slowly back and forth. It should be focused on the lower eyelid in frontal, oblique, and profile

photos. It is intended that the area from ears to the nose should be within the field of depth.

Charge Coupled Device (CCD) Problems[8]

Dust can accumulate on CCD of the camera as lenses on digital cameras do not need to change. The dust accumulation appears as small, black spots when intraoral and extra-oral images are evaluated. In SLR cameras, CCD can be cleaned by using optic cleaning solutions since it is possible to reach CCD.

Positional problems

Most errors in profile photos occur due to the posture of patient. Tilting head anteriorly or posteriorly as well as different magnification values cause erroneous assessment in skeletal and morphological manner[8,15]

Several errors[21] including head position, shadow, photo composition etc are depicted in fig 8 -13.

Conclusion

Orthodontic treatment encompasses functional effectiveness, structural integrity and esthetic harmony with increasing emphasis on the latter, especially considering the age range of the patients we cater to. Ephebodontics is almost always driven by patient motivation rather than that of the parents' which, at this stage is mostly for esthetic improvement. Photographs form not only an essential part of orthodontic treatment planning from the clinician's aspect but post treatment photographs are definitely a major tool for patient satisfaction after self comparison and self evaluation of his/her dentofacial transition.

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