Photographic Fundamentals

• Photography is important to dentistry!

• Good photographs are important for dentists and dental records, so we all need to know how to get them when we need them.

• How?

The Definition of Exposure

Exposure: The total amount of light captured by a camera through a lens for a single image.

UNDEREXPOSED = Not enough light
GOOD EXPOSURE = Proper amount of light
OVEREXPOSED = Too much light

There are MANY different ways to capture the proper amount of light for each good exposure.
Photographic Fundamentals

**Exposure** The total amount of light captured by a camera through a lens for a single image.

Getting the correct **Exposure** should be the goal or TARGET we are shooting for with each press of the button.

Photographic Fundamentals

There are many things that go into hitting the target of a "good" **Exposure**

So let's break it down into digestible pieces.

Photographic Fundamentals

- Fundamental Concepts we all should know

  EVERY camera has three fundamental components

  A **LENS** with an **APERTURE**
  This gathers and directs light into the camera

  A **SENSOR** either **FILM** or **DIGITAL**
  This captures and records the image

  A **SHUTTER** which is **GATE** in front of the sensor
  This opens and closes allowing the light to pass in

Photographic Fundamentals

So because of these three physical parts, each exposure has THREE components

- The "**TRIAD**"
- **ISO / Sensor Sensitivity**
- Shutter Speed
- Aperture

Photographic Fundamentals

**TRIAD**

**LEG 1 = Sensitivity**

Photographic Fundamentals

**ISO / ASA**

This is the sensitivity to light of the film or the digital sensor in the camera.
Photographic Fundamentals

- Definition
- **ISO** (International Standards Organization)
- **ASA** (American Standards Association)
  - These are equivalent standardized ratings of the efficiency in capturing light, or its *sensitivity*.
  - These apply to both *film* and digital CCD/CMOS sensors
  - The *higher the ISO* number,
  - the *more sensitive* it is to light,
  - or the *faster* the film/sensor is.
  - Each full increment (or *STOP*) in the ISO rating scale *doubles* or *halves* the sensitivity to light.

Photographic Fundamentals

- The most commonly used film and film ISO speeds are:
  - 25 *slower* (Fine black & white)
  - 50
  - 100 (AKA Outdoor)
  - 200
  - 400 (AKA Indoor)
  - 800
  - 1600 *faster* (Modern digital)
  - These increments are considered *FULL STOPS*

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**Sensor Size**

All sensors are NOT the same size and can cause a multiplication factor to standard lenses

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**TRIAD**

**LEG 2 = Shutter Speed**

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Photographic Fundamentals

- Definition
  The shutter speed controls the amount of time the shutter will remain open to allow light to pass through.
  - Shutter speeds are indicated in seconds, and fractions of a second on the camera’s dial or indicator.
    - The higher the fractional number, the faster the shutter moves.
    - Or the shorter the OPEN time is.
  - Each full increment (or STOP) in the speed scale doubles or halves the amount of time the shutter is open allowing light in.

Photographic Fundamentals

- The most commonly used shutter speeds are:
  - 1/8th of a second (Motion can be blurry)
  - 1/15
  - 1/30
  - 1/60
  - 1/125
  - 1/250
  - 1/500th of a second (Good to freeze motion)
  - These increments are considered FULL STOPS

Photographic Fundamentals

LEG 3 = Aperture

Aperture
This is the size of the opening in the iris of the lens that will conduct light into the camera.
**Photographic Fundamentals**

- **Definition**
  
  The **aperture** is the *size of the opening* in the camera lens, that allows light to pass through to the film/sensor.
  
  - Aperture size is described by a series of "f" numbers.
  
  - The higher number, the tighter the iris, or the smaller the opening is.

  - Each full increment (or STOP) in the aperture scale doubles or halves the amount of area in the opening allowing light in.

- **Photographic Fundamentals**

  - The most commonly used aperture values are:
    - f/2.8 (Very OPEN)
    - f/4
    - f/5.6
    - f/8
    - f/11
    - f/16 (Very CLOSED)

  - These increments are considered **FULL STOPs**

- **Photographic Fundamentals**

  - The lowest f number of a lens denotes the maximum amount of light it can let in, therefore lenses with very low f #s are considered “FAST” lenses.

  This is because they can let light into the camera in higher volume.

- **Photographic Fundamentals**

  - Exposure

    - The total amount of light captured by a camera through a lens for a single image.

    - So because of these three physical parts, each exposure has **THREE components**.

      - The "TRIAD" makes the exposure!

      - ISO / Sensor Sensitivity
      - Shutter Speed
      - Aperture

- **Photographic Fundamentals**

  - **RECIPROCITY**

    - If you change 1 leg, you can change the other the same amount and have the **SAME EXPOSURE** with a different visual effect.

    - ISO / Sensor Sensitivity
      - f/2.8
      - f/4
      - f/5.6
      - f/8
      - f/11
      - f/16
    
    - Shutter Speed
      - f/2.8
      - f/4
      - f/5.6
      - f/8
      - f/11
      - f/16
    
    - Aperture
Photographic Fundamentals

- Each of the three exposure components has a troublesome attribute or counterpart.
  - The EVIL TRIAD
    - Grain / Artifacting
    - Motion Blur
    - Depth of Field

- These other attributes are why different “equivalent” exposures don’t have the same visual appearance in the final image.

Photographic Fundamentals

- Definition
  - **Film Grain** = The particles of silver halide on the surface of film that capture light get larger as the film speed goes up.
  - The larger the grains of silver the more noticeable the random texture will be in the printed photograph.
  - So the slower the film, the sharper the image.
  - **Lower ISO = Higher Sharpness**

- Definition
  - **Sensor Artifacting** = The sensors in digital cameras converting optical light into a digital signal become less accurate as the sensitivity is increased.
  - The faster the sensor speed is set the more noticeable the random texture will be in the printed photograph.
  - So the slower the sensor, the sharper the image.
  - **Lower ISO = Higher Sharpness**
Photographic Fundamentals

- **Motion Blur**: The longer the shutter is open, and the greater the motion of either the subject or the camera during the shot the more likely it is that the image will be distorted.

  The faster the shutter speed is set the more any motion is frozen in time in the image, thus increasing sharpness!

  **Faster Shutter Speed = Less Blur**

Low ISO vs High ISO

**EVIL TRIAD**

**LEG 2 = Blur**

Photographic Fundamentals

- **EVIL TRIAD**
- **LEG 3 = D.O.F.**

Low S-Speed vs High S-Speed

ISO=100 1/8 @ 1/15th sec
ISO=100 12.5 @ 1/500th sec
Photographic Fundamentals

Focus and Depth of Field
- The amount of space in front of and behind the focal plane that is captured in sharp focus.
- VERY IMPORTANT TO DENTISTS!! And most difficult to understand.

Photographic Fundamentals

What is Focus?
What does it mean “to be IN FOCUS”?
- The answer is SHARPNESS AT A SPECIFIC DISTANCE!
- The lens collects light rays coming from a certain set “focal distance” or “focal plane” and changes their direction to gather and be “FOCUSED” onto the film/sensor in a way that makes a sharp, clearly defined image.

Photographic Fundamentals

So how do you change or adjust the focal distance?
Adjusting the Focus
Turning the knob MOVES THE LENS and thus MOVES THE FOCAL PLANE with it!
This changes what you see focused in the image.

Photographic Fundamentals

What is Focus?
SHARPNESS AT A SPECIFIC DISTANCE!
CLOSE CENTER FAR

Photographic Fundamentals

So how do you change or adjust the focal distance?
Adjusting the Focus
Turning the RING MOVES ONE LENS and thus MOVES THE FOCAL PLANE with it!
This changes what you see focused in the image.

Photographic Fundamentals

• Definition
Depth of Field = The zone of distance in a photograph that is considered acceptably “in focus” and looks “sharp”.
Focus is set in an image at a DISTANCE from the lens, and that distance is called the FOCAL PLANE, and the depth of space(field) in that image that is sharp is impacted by:
Wider Aperture = Shallower Depth of Field
Closer Subject = Shallower Depth of Field
Longer Lens = Shallower Depth of Field
Photographic Fundamentals

**Depth of Field** = is most affected by the size of the APERTURE!

- Depth of Field = The Zone of Acceptable Sharpness
  - The wider the aperture the SHALLOWER the D.O.F.
  - The D.O.F. is not centered, but shifted AWAY from focal point

Photographic Fundamentals

- **Focal Distance** = SAME
- **Depth of Field** = DIFFERENT!

Shallow D.O.F. vs Deep D.O.F.

D.O.F. Demo Sequence
Photographic Fundamentals

- Fundamental Concepts we all should know

**SHOOTING MODES**

**Macro**

For Point-& Shoots and entry level SLRs this FLOWER icon is the universal symbol for MACRO MODE. This mode puts the camera into the CLOSE FOCUS mode.

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Photographic Fundamentals

- What is a histogram?
  - **Left** side is DARKS and SHADOWS
  - **Right** side is HIGHLIGHTS and REFLECTIONS
  - **Amplitude** is the Intensity/Quantity of each tone

Now **YOU** know how capture what you **WANT** to in your photographs!

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SECTION #3

**The Gear**

- There are many other levels of complexity that can be used for intra oral photos.
  - Point and Shoot
  - Entry level SLR
  - Pro-Sumer level SLR
  - PRO level SLR
  - Single vs multiple flash sources
  - Standard vs macro lenses

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What is available at Residency?

- My residency program also has wand cameras by QSI for intra-oral shots.
What is available in Practice?
- My practice has Kodak EasyShare P&S camera, with an add on macro ring light.

What is available at Residency?
- My Practice also has wand cameras by Kodak for intra-oral shots.

What do I use?
- This is the gear that I use: Canon Prosumer level 6D body with a vertical grip and hand strap, and Ring Flash + Second Slave Flash.

Other Accessories
- Also prepare Background if you can. – What is seen BEHIND your pt can make a big difference in how professional they look.

SECTION #4

A Photo is Worth 1000 Words!

What we will do with the image determines a lot about how it must be shot?

The Application

WHAT IS THE PURPOSE OF THE IMAGE?

For head shots a simple piece of black felt will work.
A Photo is Worth 1000 Words!

GET PERMISSION TO USE Pt IMAGES!

If you shoot a patient of record, and want to use their images for demonstration purposes such as this

YOU MUST GET A SIGNED CONSENT!

Don’t forget your HIPPA Laws.

Preparing to Shoot

• When you are getting ready to shoot any photograph, including that of a patient, what do you need to think about and prepare in order to get the shots that you want or need?

What is available at Dispensing?

• Metal Lip and Cheek retractors

Preparing to Shoot

• Retractors and Mirrors

Preparing to Shoot

• Put the Mirrors in a Bowl of Warm Water
Preparing to Shoot

- Also prepare **Oral Contrastors** if needed
  - These are for the **LIP** and **CHEEKS**

Preparing to Shoot

- Also prepare **Oral Contrastors** if needed
  - These are for the **Palate for Occlusals**

Settings

- The only thing left to do is set the controls. The settings (seen in the image above) are:
  - **MANUAL** mode
  - **SHUTTER SPEED** of 1/200 of a second
  - **APERTURE** = f/32
  - **ISO** = 100
- I also store both **RAW** and **JPG** files on the card for each shot
- These settings allow for maximum depth of field with minimal blur.

Shooting

**Using the Camera with a Live Patient**

WHAT IMAGES DO YOU NEED!

- Documentation
- Patient education
- Case analysis
- Case presentation and acceptance
- Risk management
- Portfolio
- Consultation
- **What you need dictates what you shoot!**
What is a “Photo Essay”? 
- Standardized set of photos that record the current esthetic and dental status of a patient
  - Facial
    - (rest, CO, normal smile, exaggerated smile)
  - Profile
    - (rest, CO, normal smile, exaggerated smile)
  - Anterior teeth
    - (relaxed, interdigitated)
  - Lateral views
    - (interdigitated, working & balancing)
  - Occlusal
    - Views (maxillary and mandibular)

Photographic Positioning
- My resident is a tall guy at 6’6”.
- His angles take different considerations, but the thought process applies to everyone

Other Accessories
- Remember the Background if you can.
  - Get the Pt to stand between the background and your camera in a way that works.
  - Dark hair needs a light background
  - Light hair needs a dark background

Photographic Positioning
- Full Face
  - Get the Pt away from the drop.
  - Fill the frame with Neck to forehead.
  - Focus on the LIPS and reframe if needed.
SHOT # 1
Frontal Face
C.O.

SHOT # 2
Frontal Face
Relaxed

SHOT # 3
Frontal Face
Normal Smile

SHOT # 4
Frontal Face
Exaggerated Smile

**Photographic Positioning**

**Profile**

- Rotate the Pt 90 degrees.
- Fill the frame with Neck to forehead.
- Don’t worry about the entire head.
- Focus on the LIPS and reframe if needed.

SHOT # 5
Profile Face
C.O.
“Photo Essay”

SHOT #: 6
Profile Face
Relaxed

SHOT #: 7
Profile Face
Normal Smile

SHOT #: 8
Profile Face
Exaggerated Smile

Photographic Positioning

CloseUps

Get mouth perpendicular to the front of the lens at a good focal distance to And
FILL THE FRAME.

“Photo Essay”

SHOT #: 9
CloseUp Face
C.O.
"Photo Essay"

SHOT #: 10
CloseUp Face
Relaxed

SHOT #: 11
CloseUp Face
Normal Smile

SHOT #: 12
CloseUp Face
Exagerated Smile

Photographic Positioning
CloseUps

Over head light aimed at mouth
Lip retractors straight out
And
FILL THE FRAME.
**Photographic Positioning**

Occlusals

Lay the patient prone

Find a viewing angle where you can see the upper teeth clearly in the mirror

**“Photo Essay”**

SHOT #: 13 - Teeth Front - CO

**“Photo Essay”**

SHOT #: 14 – Teeth Front - Separated

**“Photo Essay”**

NO
Photographic Positioning

Occlusal

Does this look like a comfortable position for his neck?

Is this a good setup?

NO

Photographic Positioning

Upper Occlusal

This is a much better angle for the camera,

Good angle on the lip retraction,
Mirror against lower teeth

Good air spray from the DA to keep the mirror from fogging.

"Photo Essay"

SHOT #: 15 – Occlusal Mirror - Max

NO
**Photographic Positioning**

**Lower Occlusal**

- Move around the Pt.
- Move angle on the lip retraction.
- Move mirror against upper teeth.
- Good air spray from the DA to keep the mirror from fogging.

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**“Photo Essay”**

SHOT #: **15 – Occlusal Mirror - Max**

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115

116

117

118

119

120
SHOT #: 15 – Occlusal Mirror - Max

SHOT #: 16 – Occlusal Mirror - Mand

Photographic Positioning

Right Lateral Mirror

Turn the Pt nose a bit AWAY from the lens

Opposing lip retractor

Mirror tail away from the back molars

Air spray on mirror

SHOT #: 17 – Teeth Right - CO

“Photo Essay”

“Photo Essay”

“Photo Essay”

NO
SHOT #: 17 – Teeth Right – CO

SHOT #: 18 – Teeth Right - Working

SHOT #: 19 – Teeth Right - Balancing

Photographic Positioning

Left Lateral Mirror

Switch everything to the opposite side

Lens angle to see back molars without obstruction.

SHOT #: 20 – Teeth Left - CO
**“Photo Essay”**
SHOT #: 21 – Teeth Left - Working

**“Photo Essay”**
SHOT #: 22 – Teeth Left - Balancing

**Photographic Positioning**
- **Inferior to Superior**

  • In cases where Ortho is being considered I like to shoot a shot that shows relative position of mandible, lips, maxilla, and zygomas all in one view.

**Photographic Positioning**
SHOT #: 23 – Inferior-to-Superior

**Contact Coordinates**

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