Standardization for Dental Photography

Irfan Ahmad, BDS

Interpupillary line

Facial midline

Frankfort plane
Camper's plane

Occlusal plane
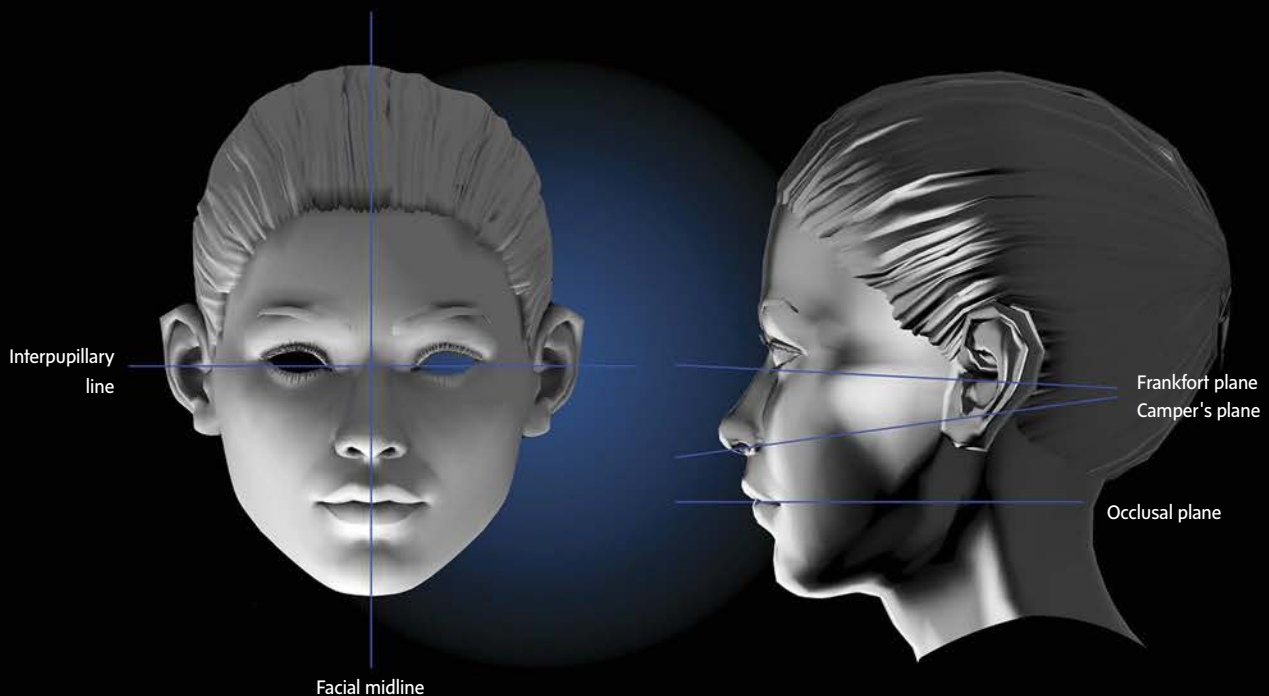
Abstract

Defining and implementing standards for dental photography is important for comparing, monitoring, and evaluating treatment outcomes. This article presents detailed guidelines for achieving standardized intraoral and extraoral images in clinical practice as well as two portfolios, the essential dental and the essential portrait portfolios. It is important to note that additional optional views may be required for specific modalities, or for a particular course of treatment.

Key Words: extra- and intraoral clinical images, clinical photography positioning, essential dental and portrait portfolios, portrait photography, dental camera setups and settings

> " Unlike conventional photography, dental photography has additional factors to consider, such as cross-infection control, health and safety, and confidentiality. "
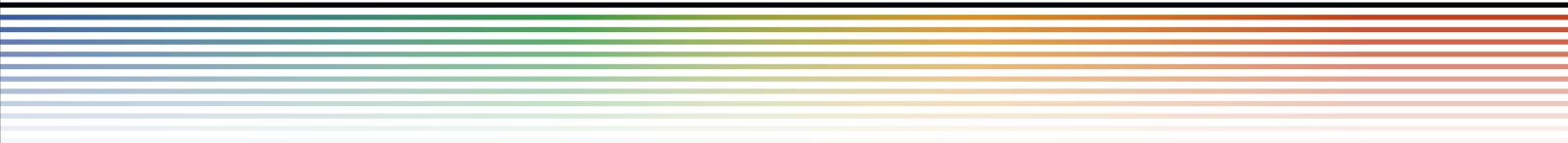
Introduction

Part 1 of this article discussed the rationale for standardization in dental photography and its benefits. In this second part, the focus is on how to realize these objectives in a clinical environment. Two portfolios—the essential dental portfolio (EDP) and the essential portrait portfolio (EPP)—covering both intraoral and extraoral (portraiture) images, respectively, are detailed. The comprehensive, step-by-step guidelines presented below can be readily mastered and routinely incorporated into daily practice.

Extraoral and Intraoral Images

This discussion covers the most frequently documented images in dentistry: extraoral and intraoral compositions.[1] The former is also referred to as the *dentofacial composition* since it includes the lips, extraoral soft tissues, and their relationship to the intraoral dentogingival elements.

Positions of Patient, Photographer, Assistant, and Equipment

Unlike conventional photography, dental photography has additional factors to consider, such as cross-infection control, health and safety, and confidentiality. Besides these fundamental requirements, positioning the patient, photographer, assistant, photographic equipment, and dental adjuncts are crucial for extra- and intraoral pictures. The position of the patient is key, and determines the positions of the photographer, assistant, and equipment.[2] The type of image dictates the position of the patient, who can be seated upright, partially reclined, or supine. For the majority of standardized extraoral and intraoral images, the ideal patient position is seated upright. This position is repeatable, whereas the degree of recline varies, and compromises standardization. However, for promotional and marketing images, positioning can be somewhat more casual, since a rigid posture is perceived as tense and possibly antagonistic.

For the majority of extra- and intraoral clinical images, the patient's head and the camera axis are perpendicular to the facial midline and parallel to the horizon **(Figs 1-3)**. The lens axis is centered exactly at the mesial contact point areas of the maxillary centrals. Using facial landmarks such as the interpupillary or intercommissure lines for orientation helps to prevent incorrect alignment of the incisal plane and/or dental midlines **(Fig 4)**. In the sagittal plane, the head should neither be pointing up, nor down (i.e., parallel to the ala-tragus [Camper's line] or Frankfort plane and perpendicular to the lens axis) **(Fig 2)**. Maintaining a perpendicular lens axis ensures correct perspective; if the lens axis is superior or inferior, the teeth appear elongated or shortened, especially the maxillary and mandibular anteriors. In addition, if a ring flash is mounted on the front of the lens, a superior or inferior lens axis will unduly illuminate the "red" oral mucosa and the light reflected onto the palatal aspects of the teeth will make them appear more reddish, conveying an incorrect color rendition that may affect precise tooth shade evaluations. Also, it is important to avoid using the occlusal or incisal planes for orientation as the latter may be misaligned. Instead, use the horizon for alignment for recording true inclination, which is essential for diagnosing cants of the maxilla or altered eruption patterns.
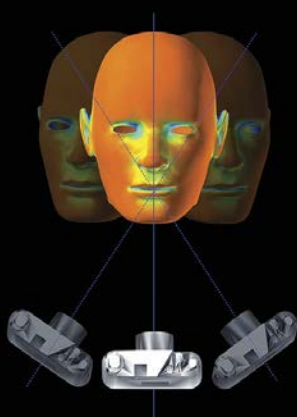

Figure 1: Incorrect angulation of the camera or the patient's head in the vertical plane causes distorted perspective or unwanted shadows.

Figure 2: Incorrect angulation of the camera or the patient's head in the sagittal plane causes distorted perspective, unwanted shadows and/or imparts a reddish color to the teeth, which are unintentional illuminated by the reflected "red" shadows of the oral cavity.
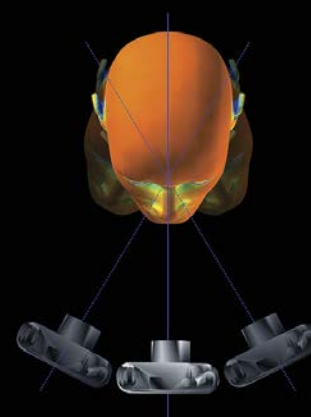
Figure 3: Incorrect angulation of the camera or the patient's head in the horizontal plane causes distorted perspective or unwanted shadows.
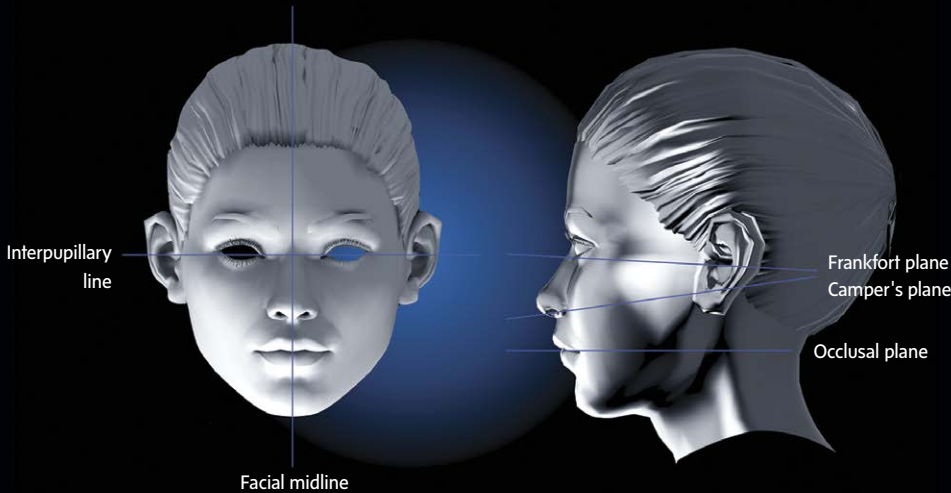
Figure 4: The imaginary facial lines are useful guides for orienting the head in the horizontal and vertical planes.

After positioning the patient, the photographer positions himself/herself accordingly with the photographic equipment, depending on the angle of view to be recorded. The assistant stands to the patient's right or left, ensuring easy access to an aspirator, three-in-one dental syringe, and other dental armamentarium. Alternatively, the assistant may stand behind the patient to hold two unilateral cheek retractors for displacing the lips and cheeks. However, the latter ties up the assistants' hands, and therefore may require another assistant for aspiration, etc. Since there are several different types of images with different angles of views, the section below graphically depicts the setups required for each type of photograph as well as the necessary equipment settings and technical notes for expediting the photo session.

The Essential Dental Portfolio (EDP)

Depending on the discipline in question, different dental organizations and clinicians advocate varying number of images for a dental portfolio.[3-8] In addition, extra images are required according to individual patient needs, clinical findings, and the proposed treatment. However, the EDP is suitable for most dental applications, regardless of the discipline. Since the intended use of an EDP is clinical photo documentation, standardization is mandatory, and the guidelines below are intended to ensure that intra- and interpatient comparisons are possible. Furthermore, an EDP should form part of the patient's dental records, no different than charting or radiographic documentation. This portfolio serves as a record, even if no treatment is contemplated, and is an invaluable reference for restoring dentition if the patient suffers acute trauma, especially involving the anterior teeth. Furthermore, an EDP can be vital for forensic identification should the patient become the victim of a fatal accident or fire.

> " The EDP consists of nine basic dental views: three extraoral (dentofacial) and six intraoral compositions. "

The EDP consists of nine basic dental views **(Fig 5)**: three extraoral (dentofacial) and six intraoral compositions, as follows:

- EDP image #1: extraoral frontal view in habitual or "resting" lip position
- EDP image #2: extraoral frontal view, relaxed smile
- EDP image #3: extraoral frontal view, laughter
- EDP image #4: intraoral frontal view in maximum intercuspation (MI)
- EDP image #5: intraoral frontal view with separated teeth
- EDP image #6: intraoral right lateral view in MI
- EDP image #7: intraoral left lateral view in MI
- EDP image #8: intraoral occlusal full-arch maxillary view
- EDP image #9: intraoral occlusal full-arch mandibular view.

The full-face, or clinical, portrait is excluded from the EDP since some patients may withhold consent to photograph their faces. However, if this is not a concern, the 7 full-face images of the essential portrait portfolio (EPP) can be added to the EDP, bringing the total number to 16 images.
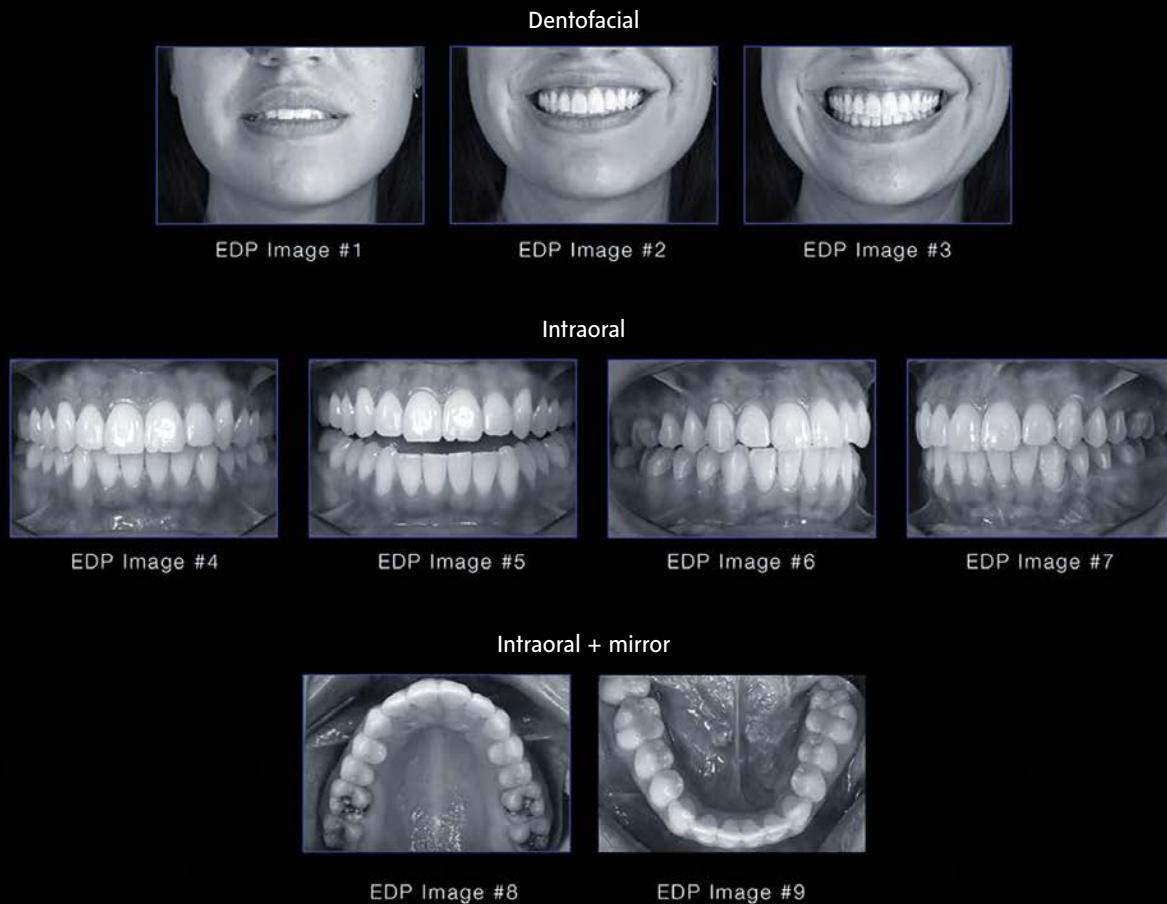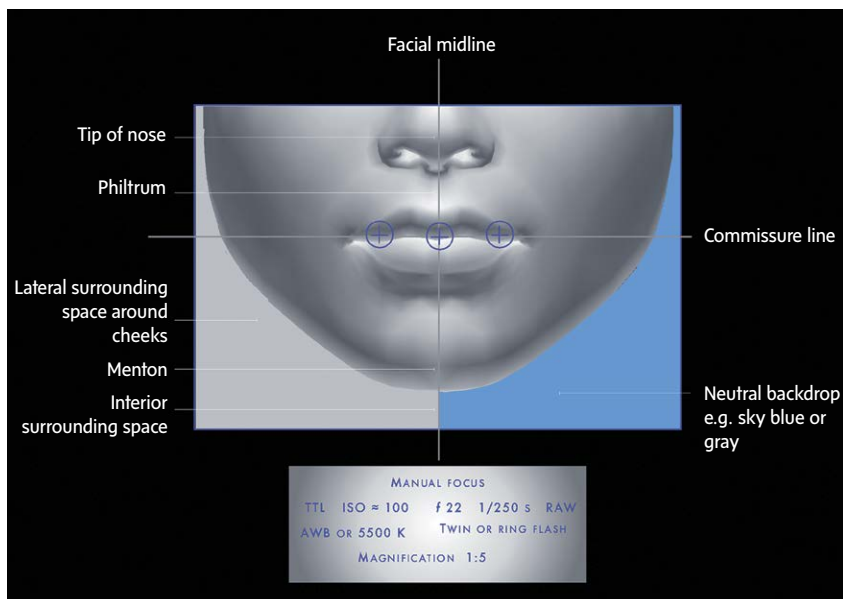
Figure 5: Thumbnails of the EDP.

Figure 6: Photographic settings and field of view (FOV) for dentofacial compositions, EDP images #1, #2, and #3. Point of focus (POF) = blue crossline reticle (a reticle is a guide found in the viewfinders of most cameras to denote the center point of the image to be photographed). For a relaxed smile, the POF is the central incisors; for laughter, the POF is the canine tips.
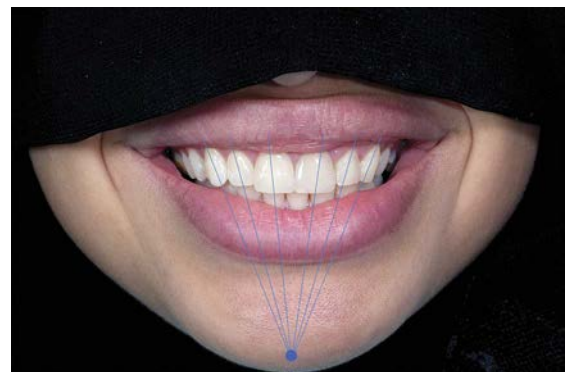

Figure 7: Imaginary lines representing the mesial axial inclination of the maxillary anterior teeth converging at the menton.

Figure 8: EDP images #1, #2, and #3 setup. The patient is seated upright facing the camera, which is tripod-mounted with bilateral flashes. The assistant is out of frame but standing to the side ready to assist and ensure patient comfort (sagittal view).
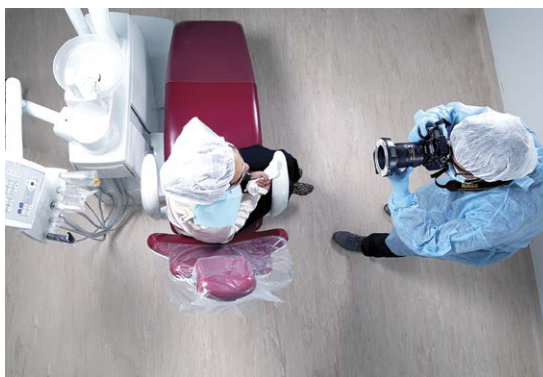
Figure 9: EDP images #1, #2, and #3 setup. The patient is seated upright facing the camera, which is hand-held with a ring flash (bird's-eye view).

Figure 10: EDP images #1, #2, and #3 setup, photographer's POV.

Extraoral (Dentofacial) Compositions

EDP image #1—extraoral frontal habitual or "resting" lip position: An extraoral or dentofacial composition centers on a commissure-to-commissure view of the lips in static and kinetic states. Although the static state is often referred to as the *resting position* this is erroneous, since the orofacial muscles are contracting and not truly at rest. The true resting position is while sleeping, when all the orofacial muscles are completely relaxed and the mandible drops down, causing the mouth to open. A more accurate term for this is the *habitual lip position* (e.g., while walking or concentrating on a task). This view is usually the starting point for most dental portfolios, and its setup is similar to that for subsequent intraoral views. Dentofacial images, together with portraits, are the most appealing and relevant to patients' esthetic sense. Furthermore, most laypeople assess the outcome of esthetic dental treatment by these compositions, rather than clinical intraoral images. The best method for attaining the habitual lip position is asking the patient to iterate the letter 'm' or "Emma" and then relaxing to achieve an interlabial gap or habitual lip separation. The composition is framed to include the tip of the nose above, and the menton below **(Fig 6)**. This allows assessment of the dental midline in relation to the facial midline (philtrum), and the axial inclination of the maxillary anterior teeth during a relaxed smile. The mesial axial inclinations of the teeth in maxillary anterior sextant ideally should converge at the menton **(Fig 7)**.

The patient is seated upright in the dental chair and asked to turn around 90 degrees toward the camera. The positioning of the photographer and assistant are shown in **Figure 8** (sagittal view), **Figure 9** (bird's-eye view), and **Figure 10** (photographer's point of view [POV]). It is advisable to take the extraoral pictures before moving onto the intraoral images to avoid transient creasing or redness of the lips caused by the cheek retractors, which may be visible in the photographs. Also, the flashes (either twin bilateral or ring) should be able to alter the light intensity output to enable the flash ratio to be adjusted to 1:2 (fill flash:key flash) for producing three-dimensional images with highlights and subtle shadows. The technical settings and guidelines for extraoral images #1, #2, and #3 are summarized in **Table 1,** and EDP image #1 is shown in **Figure 11**.

EDP images #2 and #3—extraoral frontal relaxed smile and laughter: The next two extraoral images are a relaxed and exaggerated smile (laughter). The degree of lip contraction influences elevation of the commissure line, smile line parallelism, oral mucosa visibility (bilateral negative spaces), and tooth display and amount of gingival exposure, which is particularly relevant for disciplines such as orthodontics, cranio-maxillofacial surgery, periodontics, and dental esthetics. However, the smile can be highly problematic as many patients "train" themselves to smile in a particular way. This may involve concealing dental anomalies such as excessive gingival display (gummy smile), diastemata, imbrications, discolorations, decay, fractured teeth, or the results of poor-quality dentistry (e.g., unsightly fillings, crowns, veneers). Therefore, capturing a relaxed smile is challenging, and may require several attempts until the patient feels comfortable. Nevertheless, it is important to capture smiles that have diagnostic value, including a relaxed smile as well as laughter, so that all relevant factors are visible for assessment and treatment planning. These include incisal embrasures while the teeth are separated, as well as the incisal plane inclination relative to the curvature of the mandibular lip (essential for revealing maxillary or incisal plane cants), and dental midline shifts in relation to the facial midline. This is another reason that the tips of the nose and chin should be included in the dentofacial composition for assessing the relationship of the facial midline to the dental midlines (maxillary and mandibular). The setup and settings are identical to photographing the habitual lip position shown in **Table 2**, and EDP images #2 and #3 are shown in **Figures 12 and 13**.

Table 1. Settings & Guidelines for Extraoral EDP Images ##1-3

ITEM	SETTING/DESCRIPTION	NOTES
Focus	Manual	
Exposure metering	TTL or manual	Manual: take a few test shots to ascertain correct exposure, or use histogram
ISO	50-200	
Aperture	f/22	
Shutter speed	1/125s or 1/250s	Flash synchronization speed depends on the camera brand
Image data format (file format)	RAW or DNG (digital negative graphic)	
White balance	AWB (automatic white balance), 5500 K, or manual	Manual: numerical value input, or take a reference image with an 18% neutral-density gray card
Flash	Twin bilateral with diffusers angled 45°, or ring flashes	Adjust fill light:key light ratio to 1:2. If images are too bright or too dark, adjust intensity of flashes, or move flashes closer or further away until correct exposure is achieved (only applicable for bilateral flashes as ring flashes are usually fixed on the front of the lens)
Magnification factor	1:5	Only relevant for full-frame sensors, or set predefined focusing distance on lens, or use anatomical landmarks (see field of view [FOV] below)
Point of focus (POF) represents the ideal hyperfocal distance for maximum depth of field (DOF)	Habitual lip position: central incisors Relaxed smile and laughter: canine tips (The POF will depend on the shape of the face; if parts of the image are out of focus, change the POF either anterior or posterior to the suggested areas)	Hand-held cameras: for predefined magnification or focusing distance, move camera backward and forward until focus is obtained, or use anatomical landmarks for composing (see FOV below) Tripod-mounted camera: for predefined magnification or focusing distance use macro stage for focusing, or use anatomical landmarks for composing (see FOV below)
FOV	Anatomical landmarks	Right/left: lateral aspects of cheeks (with surrounding lateral space) Superior/inferior: tip of nose to menton (if possible, with surrounding inferior space) Anterior/posterior: tip of nose to lateral aspects of cheeks
Background	Variable	Standardized clinical images: neutral sky blue or gray Promotional images: vivid colors - carte blanche

Figure 11: EDP image #1.

Figure 12: EDP image #2.

Figure 13: EDP image #3.

Table 2. Settings & Guidelines for Intraoral EDP Images #4 & #5

ITEM	SETTING/DESCRIPTION	NOTES
Focus	Manual	
Exposure metering	TTL or manual	Manual: take a few test shots to ascertain correct exposure, or use histogram
ISO	50-200	
Aperture	f/22	
Shutter speed	1/125s or 1/250s	Flash synchronization speed depends on the camera brand
Image data format (file format)	RAW or DNG (digital negative graphic)	
White balance	AWB (automatic white balance), 5500 K (photographic daylight), or manual	Manual: numerical value input for 5500 K, or take a reference image with an 18% neutral-density gray card
Flash	Twin bilateral with diffusers angled 45°, or ring flashes	Adjust fill light:key light ratio to 1:2. If images are too bright or too dark, adjust intensity of flashes, or move flashes closer or further away until correct exposure is achieved (only applicable for bilateral flashes as ring flashes are usually fixed on the front of the lens)
Magnification factor	1:2	Only relevant for full-frame sensors, or set predefined focusing distance on lens, or use anatomical landmarks (see FOV below)
POF	Maxillary canine tips (The POF will depend on the shape of the arches; if all teeth are not in focus, change the POF either anterior or posterior to the canines)	Hand-held cameras: for predefined magnification or focusing distance, move camera backward and forward until focus is obtained, or use anatomical landmarks for composing (see FOV below) Tripod-mounted camera: for predefined magnification or focusing distance use macro stage for focusing, or use anatomical landmarks for composing (see FOV below)
FOV or composition	Anatomical landmarks	Right/left: buccal corridors (negative bilateral spaces) Superior/inferior: apical to maxillary and mandibular mucogingival junctions and showing labial frenum attachments Anterior/posterior: as many teeth as possible from central incisors to second or third molars
Background	n/a	

Intraoral Compositions

EDP image #4—intraoral frontal view in MI, and EDP image #5—intraoral frontal view with separated teeth: The first two intraoral images are frontal views showing the teeth in MI[9,10] and separated approximately 5 mm to show the incisal edges, occlusal plane inclination, curves of Spee and Wilson, sphere of Monson, and incisal embrasures angles, which are particularly relevant if tooth wear or tooth surface loss is suspected due to attrition or other etiology. Both these views require cheek retractors to displace the lips and cheeks for a clear view of the oral cavity, and the assistant ready with aspiration and a three-in-one dental syringe. The setup and settings are similar to those for extraoral images, with a few exceptions such as magnification factor, field of view (FOV) and background, summarized in **Table 2** and **Figures 14 and 15**. The setups from various perspectives are shown in **Figures 16-18**, and EDP images #4 and #5 in **Figures 19 and 20**.

EDP image #6—intraoral right lateral view in MI, and EDP image #7—intraoral left lateral view in MI: The next two intraoral images are repetitions of EDP image #4, the only difference being that they are photographed from the right and left sides to show the lateral (or buccal) aspects of the teeth. Hence, the FOV is different, and ideal for showing Angle's molar, canine and incisal relationships, curve of Spee, overerupted teeth, and available interocclusal space for replacing missing teeth. There are two methods for capturing lateral views: direct and indirect. The direct method is simply to ask the patient to turn their head to the opposite side from the side being photographed and rotating the cheek retractor on the side being photographed to reveal the buccal aspects of as many posterior teeth as possible. The lens axis is positioned at a 45-degree angle to the dental midline **(Figs 21 & 22)**. The indirect method is using a narrow or lateral intraoral mirror to reflect the buccal surfaces of the teeth. This involves placing a uni-
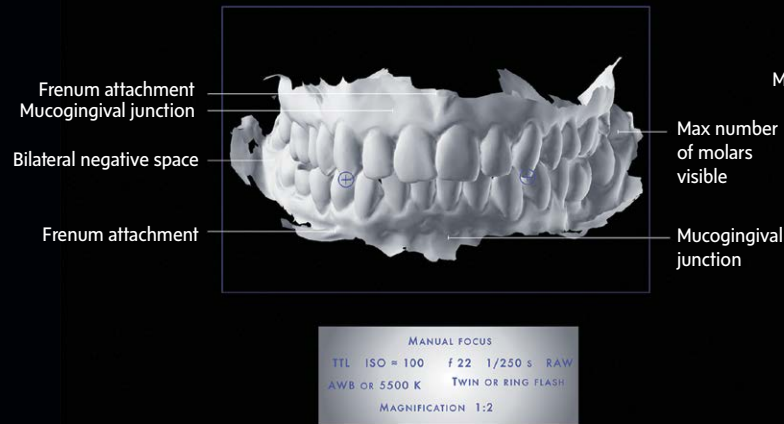
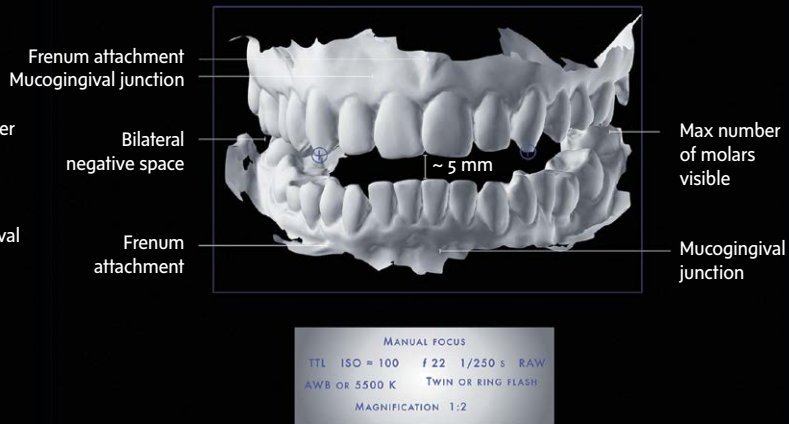**Figure 14:** Settings and FOV for intraoral compositions, EDP image #4 (POF = blue crossline reticle).

Figure 15: Settings and FOV for intraoral compositions, EDP image #5 (POF = blue crossline reticle).

Figure 16: EDP images #4 and #5 setup. The patient is seated upright facing the camera and holding the bilateral plastic cheek retractors, the camera is tripod-mounted with bilateral flashes. The assistant holds the saliva ejector and three-in-one dental syringe (sagittal view).

Figure 17: EDP images #4 and #5 setup. Positions of the patient, assistant, and photographer with hand-held camera and ring flash (bird's-eye view).

Figure 18: EDP images #4 and #5 setup, photographer's POV.

Figure 19: EDP image #4.

Figure 20: EDP image #5.

Figure 21: EDP images #6 and #7 setup (direct method). The patient is asked to rotate the cheek retractors laterally to the side being photographed. The photographer moves 45 degrees to the side, while the assistant holds the saliva ejector and three-in-one dental syringe (sagittal view).

Figure 22: EDP images #6 and #7 setup (direct method), photographer's POV.

Figure 23: EDP images #6 and #7 setup (indirect method). A narrow intraoral lateral mirror is placed on the side to be photographed and is held by the patient. The assistant holds a unilateral cheek retractor on the opposite side and prevents condensation on the mirror by blowing air from a three-in-one dental syringe. The photographer moves 45 degrees to the side, aiming the lens axis to the center of the lateral mirror (sagittal view).

Figure 24: EDP images #6 and #7 setup (indirect method). Alternatively, the patient can hold both the mirror and cheek retractor, while the assistant holds a saliva ejector and three-in-one dental syringe (bird's-eye view).

Figure 25: EDP images #6 and #7 setup, photographer's POV.

lateral buccal cheek retractor on the contralateral side to be photographed, and then sliding a mirror into the buccal corridor on the side to be photographed to displace the cheek for capturing the reflection of the lateral surfaces of the teeth. The lens axis is positioned and aimed at the center of the intraoral mirror **(Figs 23-25)**. **Table 3** and **Figure 26** detail the salient differences with previous EDP images, and EDP images #6 and #7 are shown in **Figures 27 and 28**. The reflected images also need to be laterally inverted (flipped) in imaging software to ensure the correct perspective.

EDP image #8—intraoral occlusal full-arch maxillary view, and EDP image #9—intraoral occlusal full-arch mandibular view: The last two EDP images are full-arch occlusal views of the maxillary and mandibular arches; these are the most challenging pictures for the clinician, and the most uncomfortable for the patient. For both arches, the mirror is po-

sitioned so that the incisal edges or cusp tips are clearly visible. Also, the sulci are sufficiently deflected so that the lips are off the buccal surfaces of the teeth, with a clear view of the buccal gingiva. Furthermore, whenever possible, the cheek retractors and intraoral mirrors should not be visible in the picture. For maxillary occlusal views, the nostrils should be obscured by using a contraster **(Fig 29)**. The reflected EDP images #8 and #9 also need to be laterally inverted (flipped) and rotated in imaging software to ensure the correct perspective.

For the maxillary arch (EDP image #8), the patient is asked to open as wide as possible and point their chin downwards. The reverse surface of the mirror touches the mandibular anterior teeth and the lens axis is positioned at a 45-degree angle to the center of the mirror to capture an image that appears to be taken perpendicular to the occlusal plane of the maxillary arch. If mouth opening is limited, the resulting shallow or reduced

Table 3. Salient Differences for Lateral View EDP Images #6 & #7

ITEM	SETTING/DESCRIPTION	NOTES
Aperture	f/22 (direct method) f/16 (indirect method)	Reduce aperture by 1 f-stop to compensate for using intraoral mirror with the indirect method
POF	Maxillary first premolar cusp tip (The POF will depend on the shape of the arches; if all teeth are not in focus, change the POF either anterior or posterior to the first premolars)	Hand-held cameras: for predefined magnification or focusing distance, move camera backward and forward until focus is obtained, or use anatomical landmarks for composing (see FOV below) Tripod-mounted camera: for predefined magnification or focusing distance use macro stage for focusing, or use anatomical landmarks for composing (see FOV below)
FOV or composition	Anatomical landmarks	Right/left: Extending from second or third molars to the canine on the opposite side) Superior/inferior: apical to maxillary and mandibular mucogingival junctions and showing labial frenal attachments Anterior/posterior: contralateral buccal mucosa background to buccal surfaces of the molars on the side being photographed

Figure 26: Settings and field of view for intraoral compositions, EDP image #6 (POF = blue crossline reticle).
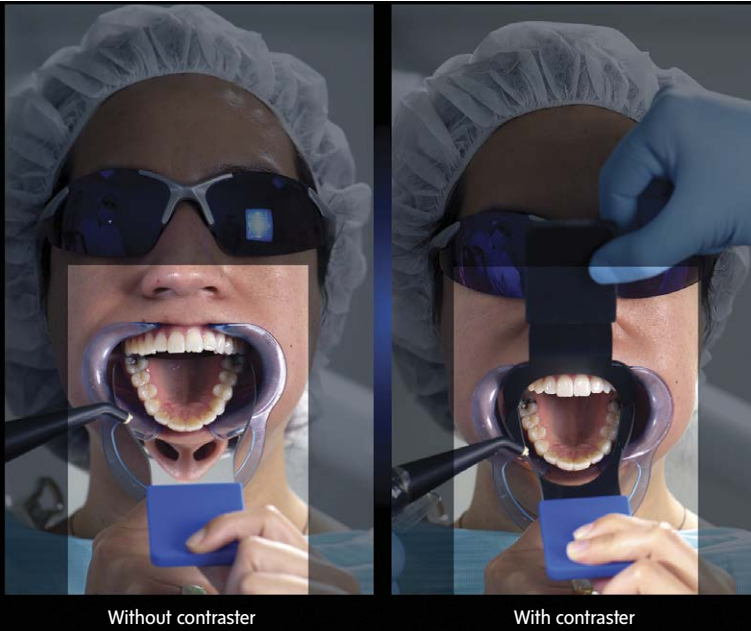

Figure 27: EDP image #6.

Figure 28: EDP image #7.

Figure 29: Contrasters are used to exclude unwanted anatomy (e.g., nostrils when using intraoral mirrors).

Without contraster   With contraster

Figure 30: EDP image #8 setup. The patient's head is titled downward and the patient holds the intraoral occlusal mirror, while the assistant holds the contraster and three-in-one dental syringe to blow air onto the mirror. The photographer aims the lens axis 45 degrees to the mirror (sagittal view).

Figure 31: EDP image #8 setup. Positions of the patient, assistant, and photographer with hand-held camera and ring flash (bird's-eye view).

Figure 32: EDP image #8 setup, photographer's POV.

intraoral mirror angle will alter perspective and prevent visualization of the teeth's buccal and lingual surfaces **(Figs 30-32)**. **Table 4** details the salient differences between EDP images #8 and #9 and other EDP images. The settings and FOV for EDP image #8 are shown in **Figure 33** and EDP image #8 is shown in **Figure 34**.

For the mandibular arch (EDP image #9), the patient is asked to point the chin upward, allowing the reverse surface of the mirror to touch the maxillary anterior teeth, with the lens axis at 45 degrees to the center of the mirror. The tongue is gently elevated and pushed back with the mirror to exclude it as much as possible from the frame so that the lingual surfaces of the teeth are visible **(Figs 35 & 36)**. The settings and FOV for EDP #9 are shown in **Figure 37,** and EDP image #9 is shown in **Figure 38**.

" Dentofacial images, together with portraits, are the most appealing and relevant to patients' esthetic sense. "

Table 4. Salient Differences for Occlusal View EDP Images #8 & #9

| ITEM	SETTING/DESCRIPTION	NOTES
Aperture	f/16	Reduce aperture by 1 f-stop to compensate for using intraoral mirror
Magnification factor	1:2 or 1:3 (depending on size of the arches)	Only relevant for full-frame sensors, or set predefined focusing distance on lens, or use anatomical landmarks (see FOV below)
POF	Maxillary and mandibular occlusal surfaces of second premolars (The POF will depend on the shape of the arches; if all teeth are not in focus, change the POF either anterior or posterior to the second premolars)	Hand-held cameras: for predefined magnification or focusing distance, move camera backward and forward until focus is obtained, or use anatomical landmarks for composing (see FOV below) Tripod-mounted camera: for predefined magnification or focusing distance use macro stage for focusing, or use anatomical landmarks for composing (see FOV below)
FOV or composition	Anatomical landmarks	Right/left: buccal sulci Superior/inferior: bordered by labial sulcus to soft palate or deflected inferior surface of tongue Anterior/posterior: incisal edges or cusp tips to buccal attached gingiva
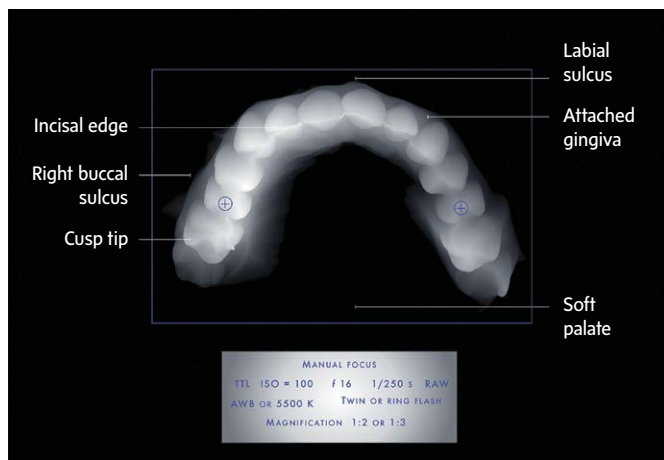
Figure 33: Settings and FOV for EDP image #8 (POF = blue crossline reticle).

Figure 34: EDP image #8.

Figure 35: EDP images #9 setup. The patient's head is tilted upwards. The assistant holds the intraoral occlusal mirror and three-in-one dental syringe to blow air onto the mirror. The photographer aims the lens axis at a 45-degree angle to the mirror (sagittal view).

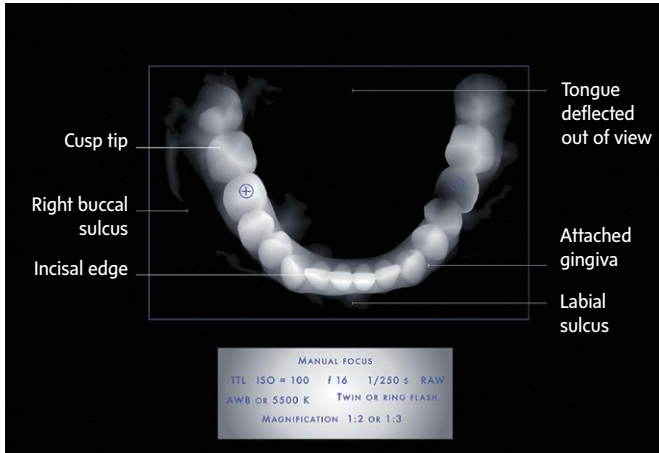**Figure 36:** EDP images #9 setup, photographer's POV.

Figure 37: Settings and FOV for EDP image #9 (POF = blue crossline reticle).

Figure 38: EDP image #9.

Portraiture

The pertinent question regarding portraiture is, should it depict harsh reality, or enhance attractiveness? The answer is both. There are two types of portraits, clinical and nonclinical, and each type serves a different purpose. The former yields unadulterated information that is essential for analysis and diagnosis; whereas the latter, influenced by the subject's wishes and the photographer's vision, is evocative and meant to please. Since clinical portraiture shows harsh reality, standardization is essential for comparison and interdisciplinary communication, as well as gauging treatment progress and monitoring treatment outcomes. Nonclinical portraiture, on the other hand, enhances attractiveness, and may veer into glamor, fantasy, artistic, and surreal territory **(Figs 39 & 40)**. Therefore, for clinical portraiture, adhering to strict guidelines is mandatory, while for the nonclinical variety, the rule book is discarded. The photographer has carte blanche, and depending on his or her artistic slant, is free to experiment and "paint" a unique picture of the patient's persona.[11,12]

Clinical Portraiture Setup

Signed consent from the patient is necessary before embarking on portrait photography. If consent is obtained, the ensuing pictures should be treated with the utmost confidentiality and archived safely and securely. However, if consent is withheld, the photography session should be abandoned.

Location and atmosphere: The ideal location for taking portraits is a dedicated room, or an allocated space within a dental practice, preferably apart from the clinical environment. This allows a more peaceful atmosphere to put the patient at ease. Music can be extremely helpful in relaxing patients; this is particularly important for taking nonclinical portraits when the patient needs to feel comfortable to express his or her true inner self.

Positions of patient, photographer, and equipment: For clinical portraits, the patient is seated upright in a swivel chair, hair back to exposure the auricles, ostentatious jewelry removed, and makeup muted or washed off to capture natural skin tones and texture. There are several reference lines that are useful for orienting the head in the vertical and horizontal planes, including the interpupillary and facial midlines, ala-tragus line (Camper's plane), or Frankfort plane **(Fig 4)**. However, it is important not to rely on the incisal or occlusal plane as a reference, as this may result in misalignment.

The photographer is situated behind camera, which can be tripod-mounted (ideal for standardization) or hand-held about 1 to 2 meters from the patient. The camera is adjusted so that the lens axis is at the same level as the middle of the face **(Figs 1-3)**. The dental assistant is at hand to help set up the photographic equipment and ensure patient comfort.

Flashes: The photographic apparatus for clinical portraits consists of three studio flashes with light-modifying soft boxes or umbrellas, trigger mechanism for simultaneously firing the flashes, and a cloth or paper backdrop. The preferred backgrounds are neutral sky blue or gray, which complement most patients' complexions. White or black backgrounds should be avoided since the former creates shadows, while the latter is not conducive for patients with darker skin tones.[4] The patient is positioned sufficiently in front of the background to prevent distracting projection shadows and to throw the background out of focus for greater visual separation between the subject and background.

Portraiture requires slave flash photography. The electronic flashes output photographic daylight at a color temperature of around 5500 K. They are either triggered wirelessly by radio controllers and apps, or cables connected from the flashes to the sync cord pin on the camera. The exposure is usually calculated manually using an incident light meter, or taking test shots at a given aperture and shutter speed, and adjusting the distance or power of the flashes until the correct exposure is attained. Some studio flashes offer TTL (through-the-lens) metering using an

Key Takeaways

- A good starting point for photo documentation is to compile two portfolios, the essential dental portfolio (EDP) and the essential portrait portfolio (EPP).

- The positioning of the photographer, patient, and equipment are crucial for achieving consistent and predictable results.

- The settings on the camera and electronic flashes can be stored as "User Presets" and recalled when taking either intraoral or extraoral images.
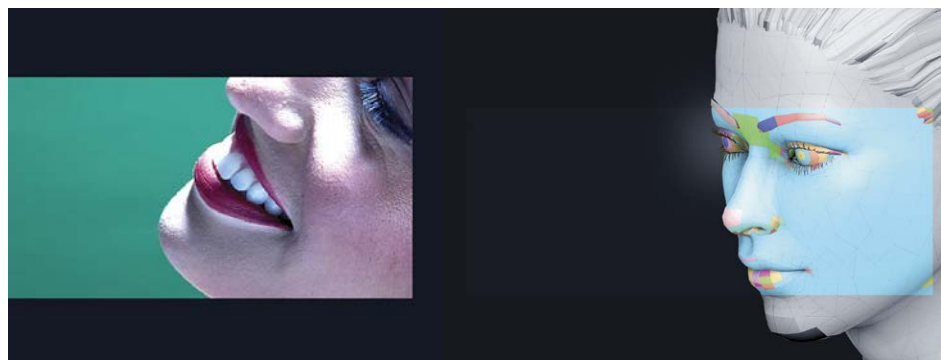
Figures 39 & 40: Nonclinical or marketing images do not always convey clinical reality, since their purpose is to entice and allure and often are stylized to attract attention.
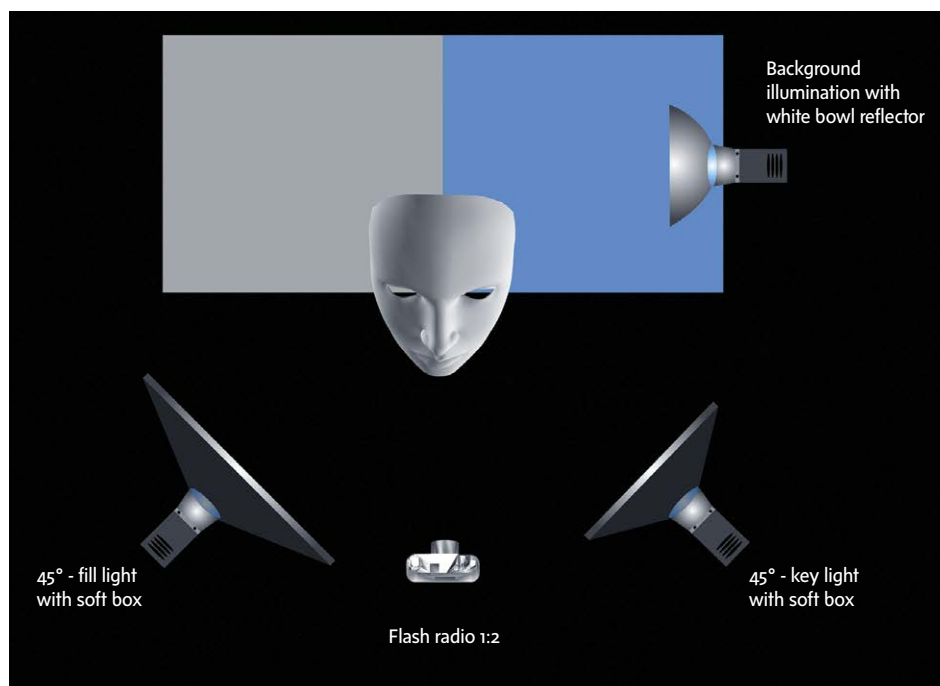

Figure 41: A standardized clinical portrait setup consists of two flashes positioned at a 45-degree angle in front of the patient with a flash ratio of 1:2, and a third flash to illuminate the background, which is usually a neutral sky blue or gray.

adapter mounted onto the hot-shoe of the camera that controls the flash bursts for ensuring correct exposure. This is similar to camera-mounted compact flashes controlled by TTL metering.

Location of studio lights: The location of the studio lights is determined by available space and funds. There are two options: The first is mounting the flash heads onto tripods placed on the floor; the second, more elaborate and expensive, is suspending the flashes from ceiling-mounted tracks. The retractable ceiling mounts are beneficial as they eliminate cables trailing on the floor but need a room with sufficient ceiling height. Tripod-mounted units have the advantage of greater mobility, especially if mounted on a dolly, but require substantial floor space. In both circumstances, a minimum of three flashes are required, two angled 45 degrees toward the patient with a fill light:key light ratio of 1:2, and the third directed to the backdrop. The key and fill light output are muted to soft light by attaching soft boxes or umbrellas onto the flash heads, while the third flash has a white bowl reflector for uniformly illuminating the background. This setup is very "clinical," devoid of distinct shadows or highlights, producing a relatively flat image. However, as the purpose of clinical portraiture is to convey reality, without either glamorizing or denigrating the subject, this lighting setup is appropriate for the intended purpose. The predefined positions of the patient's swivel chair, camera, flashes, and backdrops should be marked on the floor (or ceiling) with markers or adhesive masking tape so that their location is repeatable. The studio setup for clinical portraiture is shown in **Figure 41**.

The Essential Portrait Portfolio (EPP)

While the essential dental portfolio (EDP) concentrates primarily on the teeth, the essential portrait portfolio (EPP) consists of basic full-face images and the relationship of the teeth to the face. The EPP is suitable for a variety of dental disciplines, including orthodontics, prosthodontics, periodontics, restorative dentistry, implantology, pedodontics, smile analysis, smile design, facial enhancement, and cranio-maxillofacial procedures. The clinical portraits were previously excluded from the EDP since some patients are reluctant to give consent to photograph their face. However, if appropriate consent is obtained, the EPP can be added to the EDP to compile a total of 16 standardized images. The EPP consists of 7 views **(Fig 42)**, as follows:

- EPP image #1: frontal view with interlabial separation
- EPP image #2: frontal view with relaxed smile
- EPP image #3: frontal view, biting wooden spatula
- EPP image #4: profile right side with interlabial separation
- EPP image #5: profile left side with interlabial separation
- EPP image #6: oblique right side with interlabial separation
- EPP image #7: oblique left side with interlabial separation

The photographic equipment settings for standardized clinical portraits are as follows. The magnification factor ranges from 1:8 to 1:15, depending on the size of the patient's physical build and whether the camera has a full-frame sensor. An alternative approach is setting a predefined focusing distance on the lens barrel or framing the picture according to the FOV. An aperture of f/11 is recommended for adequate depth of field with a 1/125- or 1/250-seconds shutter speed to eliminate the influence of ambient light. The relevant camera/flash settings and guidelines for these views are outlined in **Table 5**.
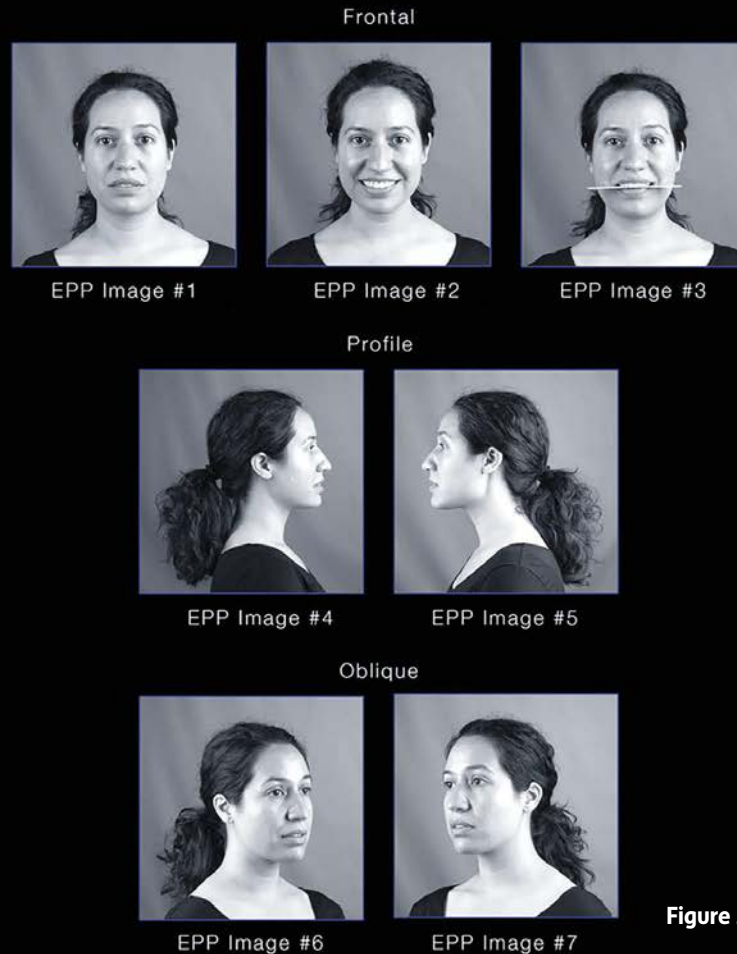
Essential Portrait Portfolio (EPP)

Figure 42: Thumbnails of the EPP.

Table 5. Settings & Guidelines for Standardized Clinical Portraits

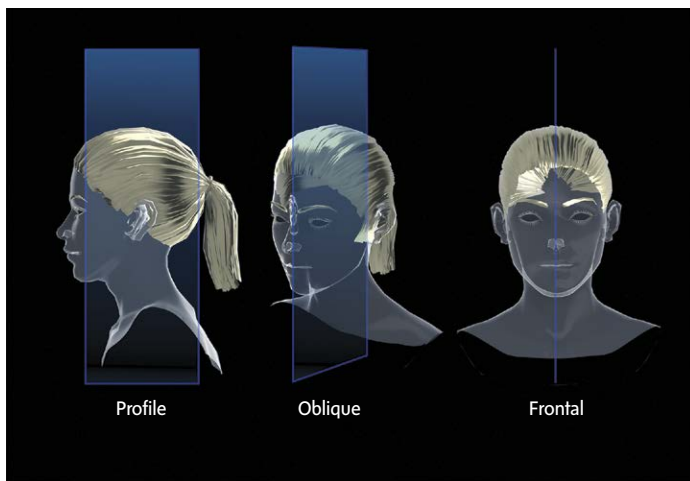| ITEM	SETTING/DESCRIPTION	NOTES
Focus	Manual or auto-focus	
Exposure metering	Manual or TTL	Manual: use light meter, histogram, or take test shots to ascertain correct exposure
ISO	50-200	
Aperture	f/11	
Shutter speed	1/125s or 1/250s	Flash synchronization speed depends on the camera brand
Image data format (file format)	RAW or DNG	
White balance	Automatic or manual	Manual options: numerical value input (5500 K), or take a reference image with an 18% neutral-density gray card
Flash	Two studio flashes with soft boxes or umbrellas, angled 45° toward patient, third flash to illuminate background	Set the two flashes aimed at patient to a fill light:key light ratio of 1:2, alter intensity or distance of flashes to achieve correct exposure
Magnification factor	1:8 to 1:15	Only relevant for full-frame sensors, or set predefined focusing distance on lens, or see below for FOV
POF	The POF will depend on the angle of view, (e.g., rhinion or bridge of the nose for frontal views)	Hand-held cameras: for predefined magnification or focusing distance, move camera backward and forward until focus is obtained, or use anatomical landmarks for composing (see FOV below) Tripod-mounted camera: for predefined magnification factor or focusing distance use macro stage for focusing, or use anatomical landmarks for composing (see FOV below) If using autofocus, ensure that the lens axis is centered on the tip of the nose for frontal views
FOV (composition)	For frontal full-face images	Right/left: bounded by background space Superior: bounded by background space Inferior: sternoclavicular joint Anterior/posterior: tip of nose to auricless
Background	Variable	Clinical images: neutral sky blue or gray

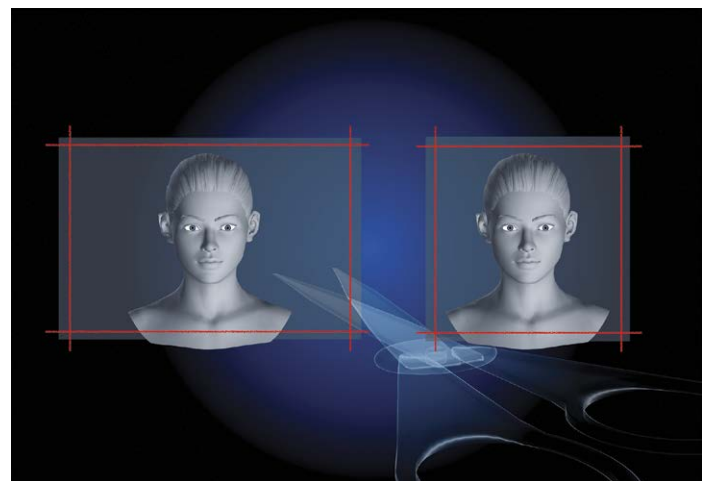**Figure 43:** Positioning the patient's head.

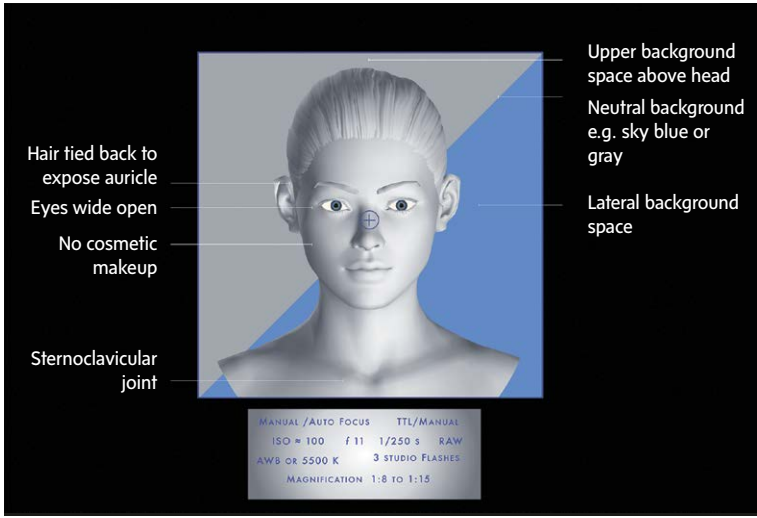**Figure 44:** Landscape versus portrait aspect ratios.

Figure 45: Standardized clinical portraiture settings, FOV, and POF (blue crossline reticle) for EPP images #1, #2, and #3.

> **To obtain perfectly standardized images requires a model patient, assistant, photographer, equipment, and environment. However, in reality, achieving all of these is a challenge, and compromises may be necessary.**

Figure 46: EPP image #1

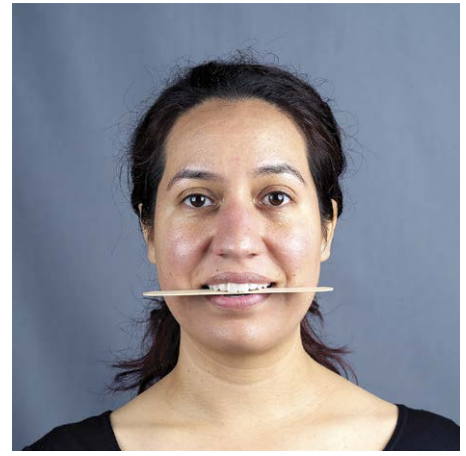
Figure 47: EPP image #2.

Figure 48: EPP image #3.

EPP images ##1-3—frontal views: The frontal views, EPP images #1, #2, and #3, are taken with the patient looking straight at the camera, whereas for profile and oblique views the patient is asked to turn on the swivel chair until the desired angle of view is obtained **(Fig 43)**. Similar to the dentofacial compositions discussed above, interlabial separation is achieved by asking the patient to iterate the letter "m" or "Emma." For EPP image #2, a relaxed smile is captured (usually accompanied by narrowing of the inter-eyelid spaces). EPP image #3 is biting into a wooden spatula with the head positioned to the horizontal. The angulation of the spatula is ideal for assessing incisal/occlusal plane alignment to the interpupillary line.

The field of view, or composition, depends on the aspect ratio setting on the camera, or the aspect ratio used in imaging software to crop the image. For portraiture, the selected aspect ratio determines the amount of background space at the upper, right, and left borders of a composition (the lower border is bounded by the sternoclavicular joint). There are two options:

The first is to be consistent with the EDP and use a landscape aspect ratio, which ensures standardization for both the EDP and EPP. However, landscape orientation for portraits results in larger empty spaces to the right and left sides of the face compared to the upper border. The second option is to frame/crop the images with reduced amounts of background on the right and left sides, using the so-called "portrait" aspect ratio, but the framing is obviously incongruent with the EDP **(Fig 44)**.

EPP images #4 and #5—profile views, and EPP images #6 and #7—oblique views: The point of focus (POF) also differs according to the angle of view. For frontal views, the POF is usually the rhinion or bridge of the nose **(Figs 45-48)**. For profile views, EPP images #4 and #5, the contralateral side should be totally invisible and the POF is on the ala-tragus line, at the midpoint between the tragus and lateral canthus of the eye **(Figs 49-51)**. Finally, for oblique views, EPP images #6 and #7, the contralateral eye and its upper and lower eyelashes are visible, and the POF is on the ala-tragus line at the intersection of the lateral canthus **(Figs 52-54)**.
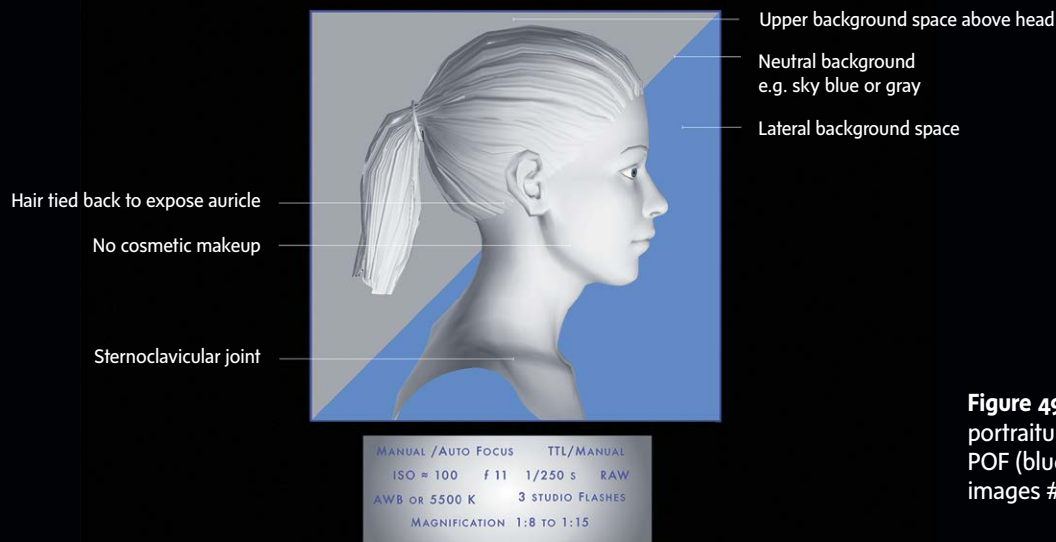
Upper background space above head

Neutral background
e.g. sky blue or gray

Lateral background space

Hair tied back to expose auricle

No cosmetic makeup

Sternoclavicular joint

MANUAL /AUTO FOCUS   TTL/MANUAL
ISO ≈ 100   f 11   1/250 s   RAW
AWB OR 5500 K   3 STUDIO FLASHES
MAGNIFICATION 1:8 TO 1:15

Figure 49: Standardized clinical portraiture settings, FOV, and POF (blue crossline reticle) for EPP images #4 and #5.

Figure 50: EPP image #4.

Figure 51: EPP image #5.

Summary

The first part of this two-part article presented the rationale for standardization in dental photography. This second part proposes two portfolios—the essential dental portfolio and the essential portrait portfolio—for photo documentation. These portfolios serve most dental disciplines, but additional optional views may be required for specific modalities, or for a particular course of treatment.

It is worth remembering that to obtain perfectly standardized images requires a model patient, assistant, photographer, equipment, and environment. However, in reality, achieving all of these is a challenge, and compromises may be necessary. These may include accepting less than ideal fields of view, visible edges of cheek retractors or mirrors, poor angulations, copious saliva, or fogging of mirrors, to name but a few. While poor photographic technique is indefensible, even an experienced operator may be confronted with insurmountable hurdles such as uncooperative patients, limited mouth opening, and technical issues with equipment. Although certain mistakes such as poor exposure or visible extraneous objects can be corrected at the editing stage, other errors such as poor framing, skewed perspectives, gross blemishes due to saliva or blood droplets, or excessive condensation on intraoral mirrors are impossible to rectify. Hence, a degree of pragmatism is necessary, and although the aim is to produce flawless images, achieving this ideal may sometimes prove elusive.

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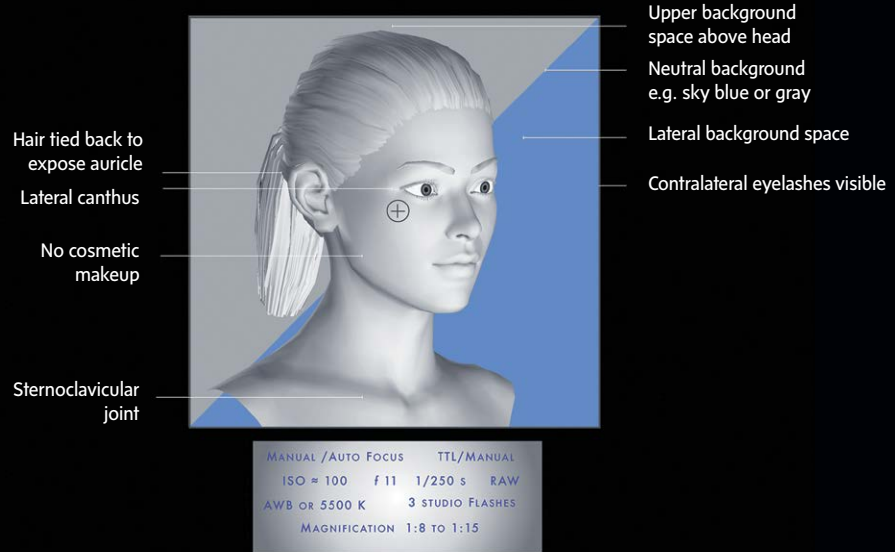3. Bengel W. Mastering digital dental photography. London: Quintessence Pub.; 2006.

Upper background space above head

Neutral background e.g. sky blue or gray

Lateral background space

Contralateral eyelashes visible

Hair tied back to expose auricle

Lateral canthus

No cosmetic makeup

Sternoclavicular joint

MANUAL /AUTO FOCUS   TTL/MANUAL
ISO ≈ 100   f 11   1/250 s   RAW
AWB OR 5500 K   3 STUDIO FLASHES
MAGNIFICATION 1:8 TO 1:15

Figure 52: Standardized clinical portraiture settings, FOV, and POF (blue crossline reticle) for EPP images #6 and #7.

Figure 53: EPP image #6.

Figure 54: EPP image #7.

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