Institute of Medical Illustrators

Clinical Photography, Art, Graphics and Video in Healthcare

IMI National Guidelines

Orthodontic Photography

The IMI National Guidelines have been prepared as baseline guides on specific aspects of medical illustration activity and provide auditable standards for the future.

The Guidelines can be either implemented in full, or may be amended according to individual requirements.

Copies are available on the IMI website (www.imi.org.uk)

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Acknowledgements

Introduction

As with many aspects of clinical photography, the main purpose of dental photography is to help the dentist or clinician monitor and document the patient's treatment.

Standardisation is paramount to maintain high quality clinical photography. This guide will help the photographer to produce the level of consistency needed to keep an accurate clinical record.

At the end of these Guidelines there is a standard and optional set of views for orthodontic treatment.
It is recommended that individual Medical Illustration Departments work with dentists/clinicians and use the 'Standard Orthodontic View' set and in addition, if applicable, selected views from the optional orthodontic view set, taking advice from these guidelines to produce a local protocol.

Health & Safety

Each department/area should follow their local health and safety/infection control policy.
The following list provides examples of when it is advisable for hands to be decontaminated either by using alcohol gel or washed with soap and warm water. It is important to note that alcohol gel can irritate skin, so it is recommended that hands should be washed throughout the day when using the gel. When washing hands, it is recommended that soap is applied to wet hands. This reduces the likelihood of skin being irritated and damaged.

- Hands to be washed and clean at the start of the day
- Before wearing gloves
- Before handling clinical equipment
- Before entering and leaving ward/clinical area
- After removing gloves
- After decontamination of equipment/environment
- After any situation that involves patient contact
- After handling clinical equipment

It is good practice to use gloves when taking the intra-oral photographs. It is advisable that both the photographer and any assistant wear gloves. This will significantly reduce the risks of cross infection between photographer and patient.

All clinical equipment, i.e. cheek retractors and mirrors, should be cleaned by the central sterilisation department. It is recommended that such equipment be sterilised as soon as possible after use.

Equipment

Cameras

For all routine dental photography, all camera equipment in this guide is based around a full sensor CCD, together with a macro lens with a focal length of around 100mm.

This combination will ensure the correct perspective, as well as a convenient working distance, is maintained for both the facial and intra-oral views. It is essential that the lens be capable of producing magnifications of up to 1:1. For optimum depth of field, the lens must have a minimum working aperture of at least f22.

Lighting

Studio electronic flash is recommended for photographing a patient's facial and head and neck views. Output with either reflectors or umbrellas should be capable of producing sufficient light for an aperture of at least f16. Ideally, lights should be suspended on a Hi-glide system to allow ease of use and a safe working environment for photographer and patient.

Intra-oral photography requires the use of a portable electronic flash unit. For most purposes, a specialised ring flash provides even lighting and with some units, a degree of modelling can be achieved by positioning the flash unit.
It is best that the ring flash is attached firmly to the camera lens, providing ease of use and standardised illumination. The ring-flash must be capable of producing sufficient light for an aperture of at least f22 to maximise depth of field.

Retractors and Mirrors

A range of mirrors and retractors are required to cope with the variety of dentitions, patient's age, size of mouth and shape of the lips.

Mirrors (see Figure 1) are available in either stainless steel or surface coated glass. Glass mirrors are preferable for higher reflectance and are available in a wide range of shapes. A standard set of mirrors should include palatal for both adults and children.

Palatal mirrors are necessary for photographing the palate and maxillary views of the dental arch. Mirrors must be able to be autoclaved.

Retractors are most commonly plastic and come in pairs. It is important that the design ensures excellent retraction of the lips and mucosa, pulling them away from the gums and teeth, to avoid the lips obscuring the teeth.

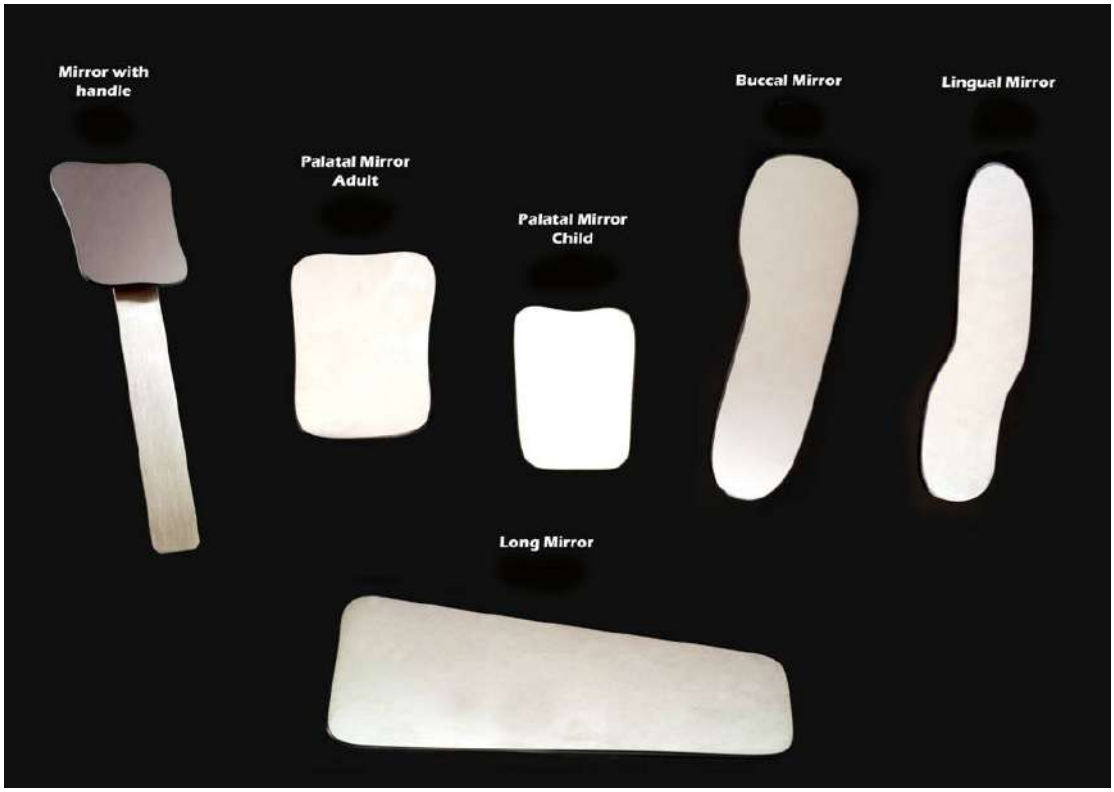


Figure 1 Selection of dental photography mirrors

Dental Monitoring Ex. 2034

Basic Dental Notation and Anatomy

Buccal – relating to the cheek, or the surface of the teeth facing toward the cheek.

Buccal Mucosa – the mucous membrane of the inner cheek

Gingiva – the gums

Lingual – relating to the tongue, or the surface of the teeth facing toward the tongue.

Labial - the surface of the teeth adjacent to the lips

Maxilla – the upper jaw

Mandible – the lower jaw

Occlusal – the biting surface of the teeth

Occlusion – both sets of teeth biting together

Palatal – relating to the roof of the mouth, or the surface of the teeth nearest to the palate.

Palmer's Dental Notation for Adults (see Figures 2 & 3)

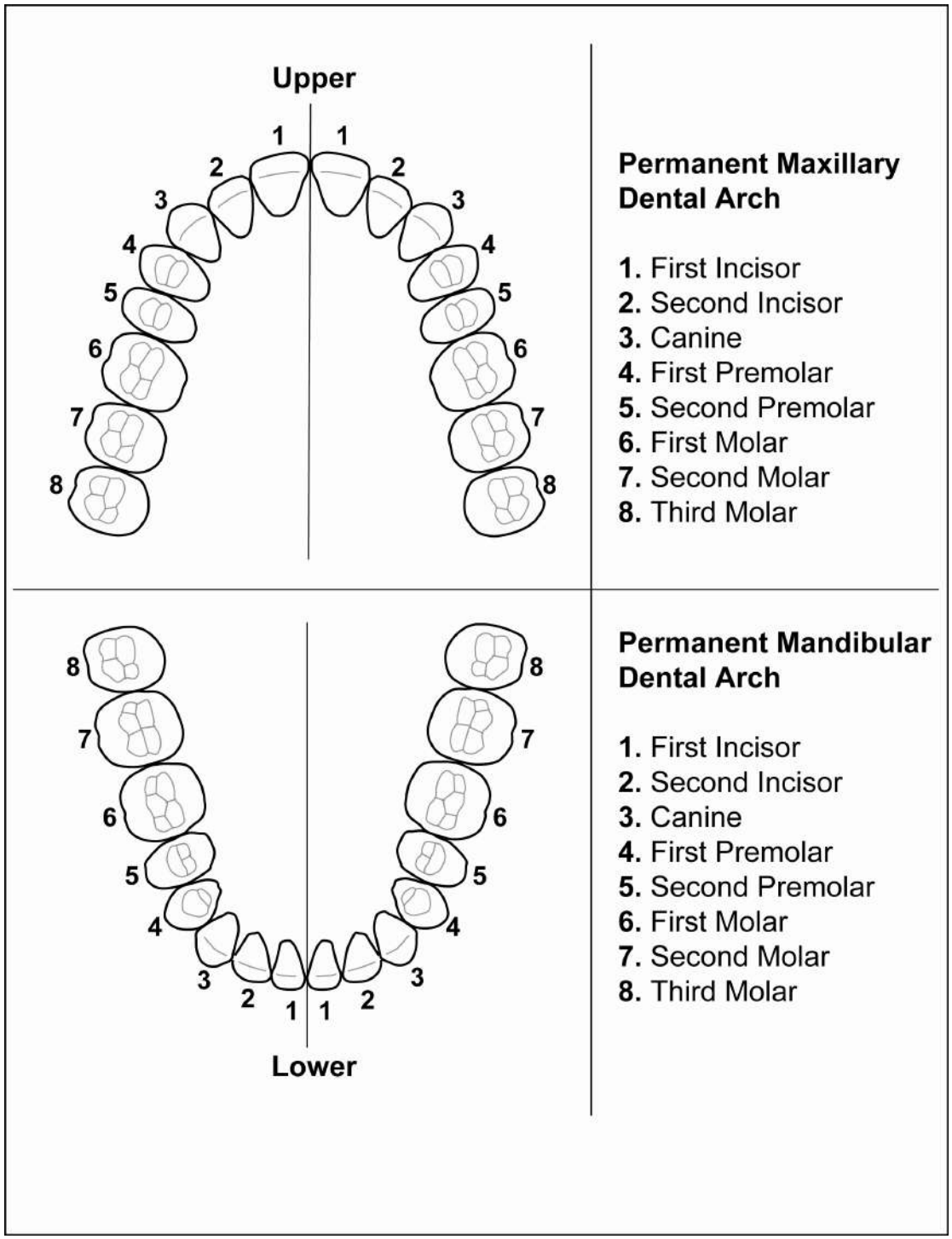


Figure 2

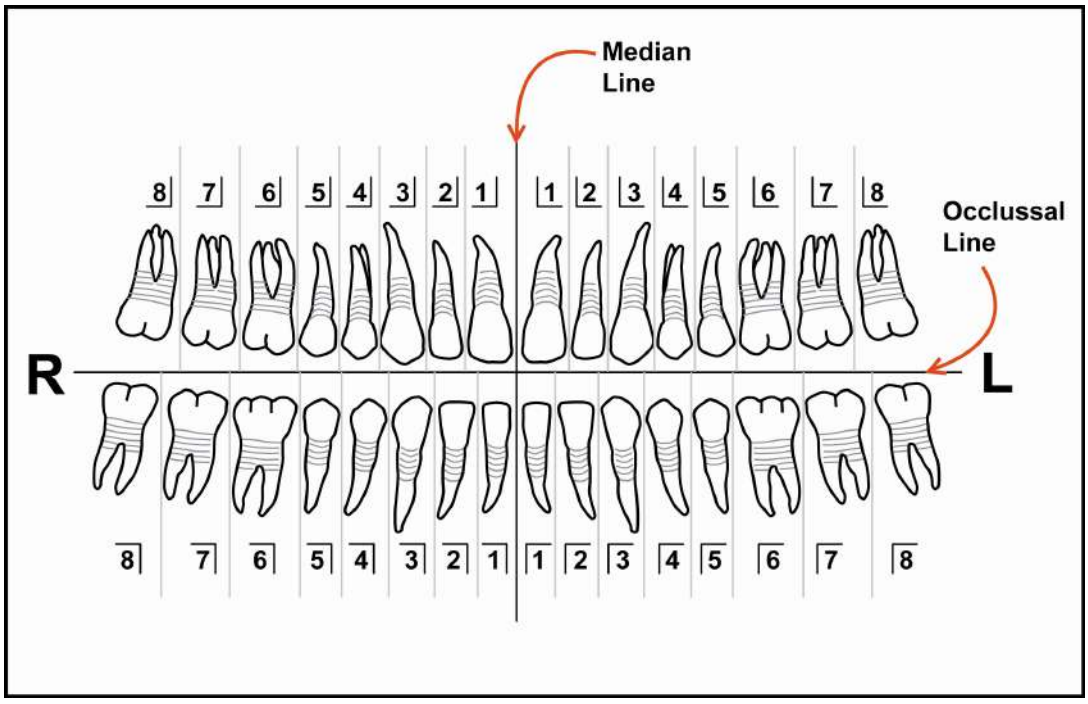


Figure 3

- Palmer's Dental Notation is the most commonly used system in the U.K
- Tooth notation is an identification and reference system to specify areas and/or teeth within the mouth.
- The mouth is divided into quarters, and the teeth within those areas are assigned a number from 1 to 8.
- The Universal system of notation may be encountered. This labels adult teeth from 1 to 32. This starts from the upper right Third molar and goes round in a clockwise direction.

Palmer's Dental Notation for Children (see Figures 4 & 5)

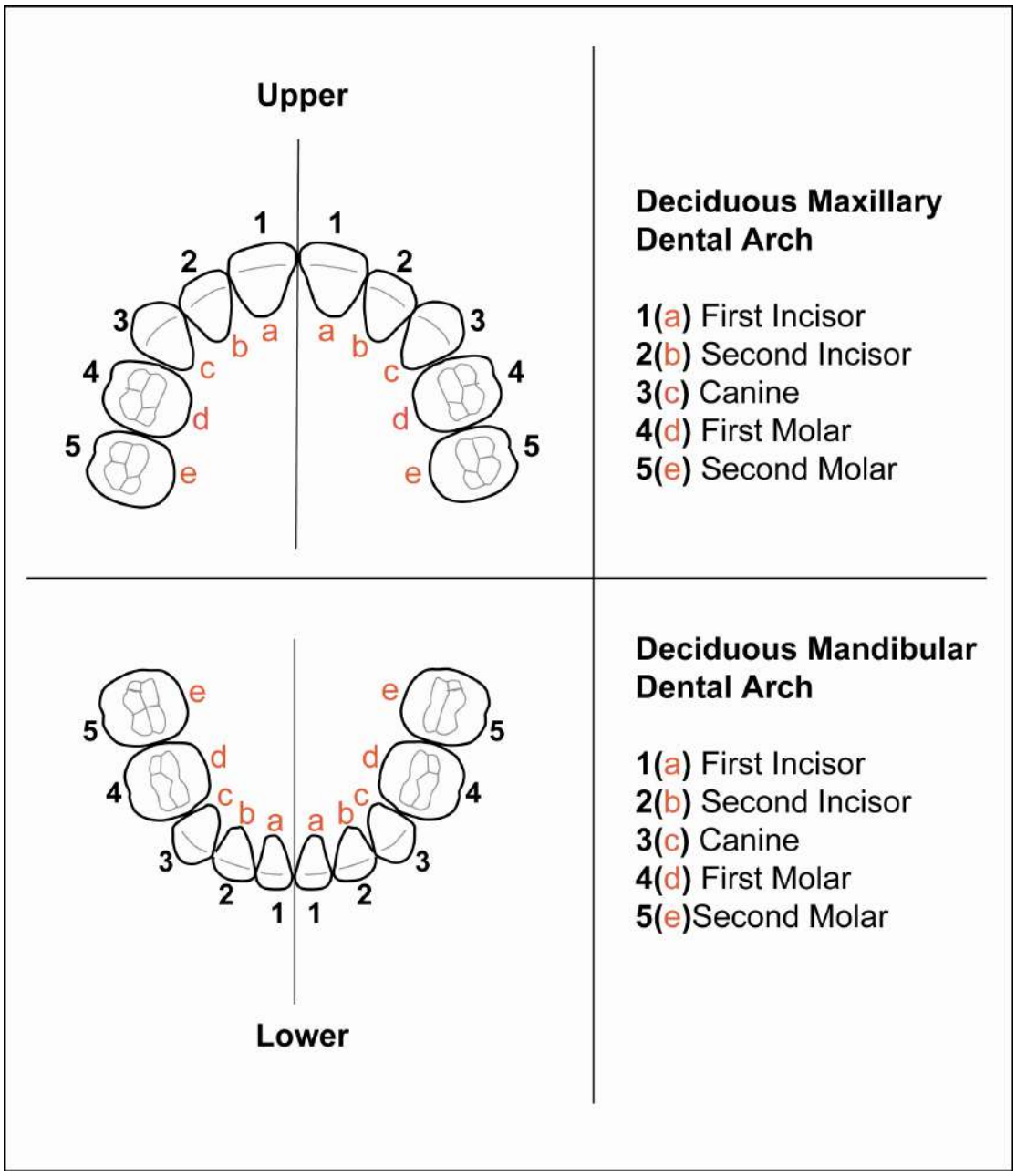


Figure 4

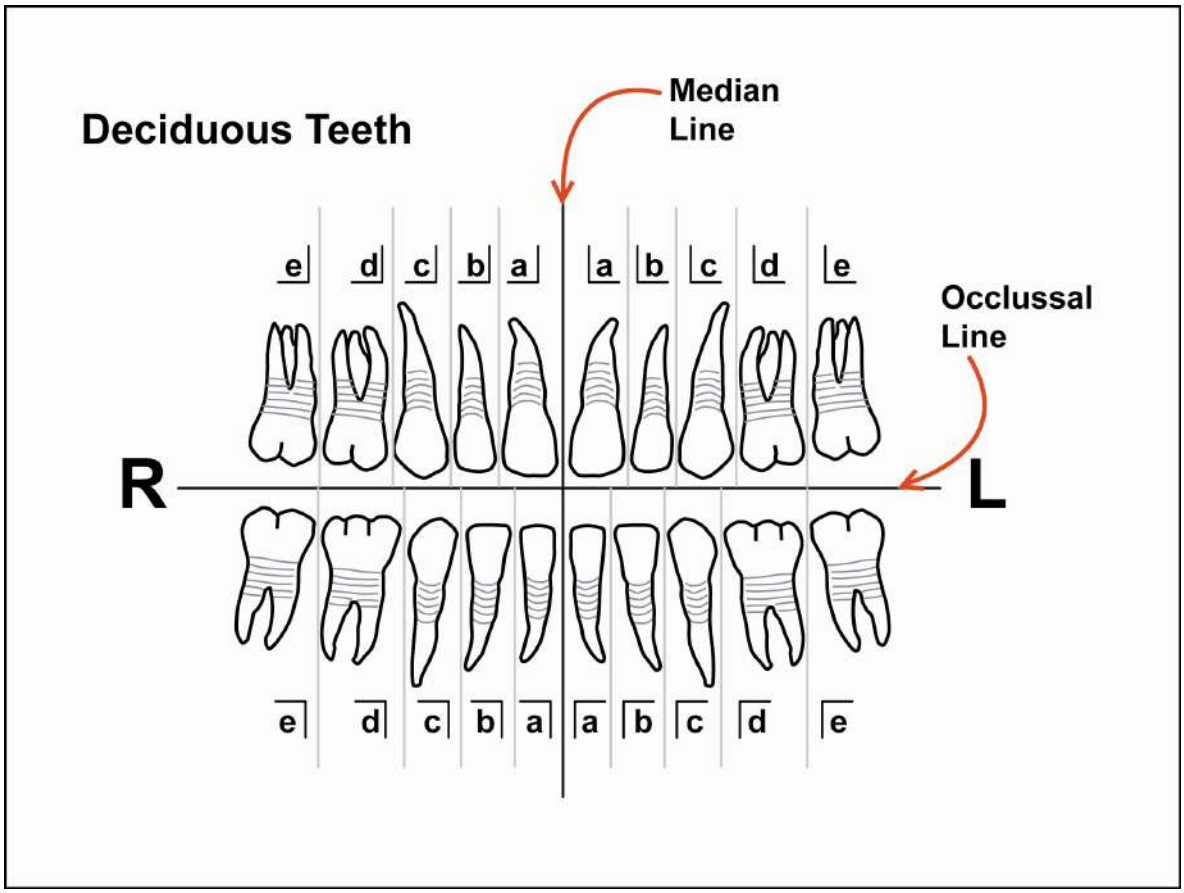


Figure 5

- Children's teeth are referred to as Deciduous.
- They are labelled from 1 to 5 in each quarter.
- They can also be labelled A to E.
- The Universal system of notation may be encountered. This labels deciduous teeth from A to T. This starts from the upper right 2nd molar and goes round in a clockwise direction.

Standards for Extra-Oral Photography

Standardisation is the key to good clinical photography. This applies to the background, lighting, magnification and patient positioning.

Background

The background should be plain and not distracting. Black or white matt backgrounds are recommended. If a white background is used, it should be evenly lit with no distracting shadows obscuring the patient's facial profile.

Lighting

Lighting should be standardised. Ideally, studio lights should be used, positioned at 45° to the patient and level to the patient's head. To obtain 'softer' repeatable lighting, without prominent specular highlights, soft boxes or reflector umbrellas should be used.

Additional back or rim lighting is recommended to improve the patient/background separation when using a black background.

There should be enough light for an aperture of at least f16 to be used, in order to obtain sufficient depth of field.

Magnification

All the extra-oral views should have the same magnification, so they form a matching set and can be repeated exactly. To achieve consistent magnification, the photographs should be taken using a lens set to a fixed focal length, switched to manual focus and turned to the predetermined focusing distance. The camera is then moved backwards and forwards, until the image is in focus.

If the camera has a full frame (24 x 36mm) sensor, a scale of 1:8 should be used. For cameras with a different sized sensor, a set focal length and fixed focusing distance should be chosen to give the same view as shown in these guidelines. The lens' focal length should be equivalent to between 100mm and 135mm (for a full frame sensor) in order to provide sufficient subject to camera distance, to avoid distortion.

The top of the patient's head and all of the jaw line should be included in the frame.

All views should be taken in portrait format.

Patient positioning – for all views

- Patients' coats and jumpers should be taken off and shirt collars turned down. Head scarves should be removed, if this acceptable for the patient, or arranged so that the patient's ears and jaw line are clearly visible.

- Removable appliances should be taken out, unless there is a specific request for photographs to be taken with appliances in place, to demonstrate their effect.

- Glasses, all visible jewellery and body piercings should be removed.

- The patient's hair should not obscure their face or ears. Long hair will need to be tied back from the face. The use of disposable plain scrunchies or hair grips is helpful.

- The patient's eyes should be open.

- The patient should have suitable seating, ideally a supportive swivel chair on fixed legs.

- The patient's face and lips should be in a relaxed natural position and not posturing, especially if they have incompetent lips, which do not close together when at rest.

- The patient's teeth should be in occlusion, i.e. the patient should be biting gently (not clenching) on their back teeth (molars).

- The camera should be positioned with the lens axis horizontal, so that it is not looking up or down at the patient.

- The patient's head should not be tilted, i.e. the median plane should be vertical
- The patient's head should be level, with the Frankfort Plane' or 'Reid Plane' being horizontal.

- If the camera viewfinder has a grid, this should be used to check that the patient's head is correctly aligned.

- Do not change position to try and "correct" for patients with asymmetrical faces.

- The patient should be sitting upright and looking directly ahead, in their natural head position.

Patient positioning – for specific views

Anterior Posterior

- The patient should be sitting up and looking directly 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.
- Patient should be at full smile, in order to assess the lip line.

Face Right and Left Lateral views

- The patient should be sitting up straight and looking directly ahead of themselves.
- The median plane of the face should be at 90° to the camera axis.
- The patient's ear and tip of their nose should be included in the frame.
- The lens should be focused on the outer canthus of the patient's eye.

Face Right and Left Oblique views

- The patient should be sitting up straight and looking directly ahead of themselves.
- The median plane of the face should be at 45° to the camera axis. To achieve 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 tip of their nose 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' (see fig 6) 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.

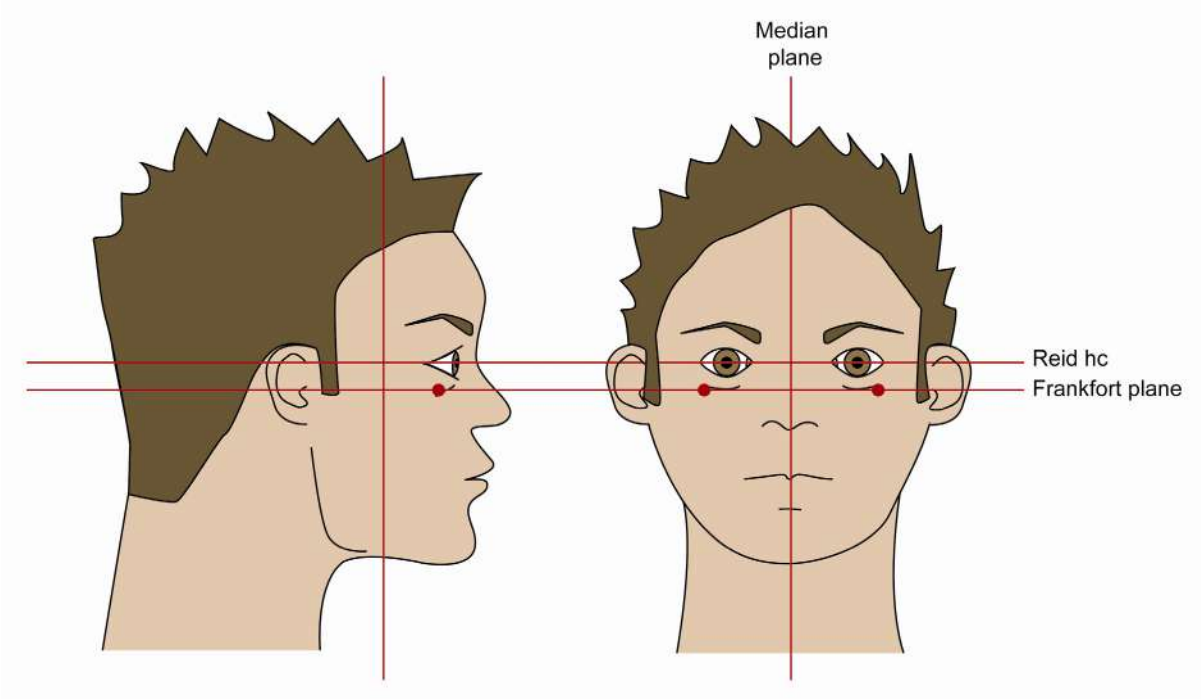


Figure 6 The 'Frankfort', 'Reid Horizontal' and Median planes

The 'Frankfort Plane' passes through the inferior margin of the orbit (orbitale) and the upper margin of each ear canal (the porion).

The 'Reid Horizontal Plane' passes through the outer canthus of the eye and the superior attachment of the ear.

Standards for Intra Oral Photography

General

- The camera and flash should be held with two hands, in order to provided stability which enables good alignment for close up photography. One hand should grip the camera body and the other should support the lens, by holding the ring flash.

- Before photographing the patient, take a photograph of their registration number, so that the photograph can be easily identified.

- Determine whether removable appliances should be removed or if they should remain in place.

- Make sure there is no impression material or food stuck to the teeth.

Alignment

- Ideally the patient should be photographed whilst in a dental chair. The chair should be raised to enable the photographer to operate easily, without having to reach or bend uncomfortably, to obtain the correct viewpoint.

- For the anterior, left and right buccal, upper occlusal and overjet views, it is easier to obtain consistent views if the patient's head is kept level, with the Frankfort plane horizontal.

Use of Retractors

- For good retraction use the largest retractors with which the patient can comfortably cope. If the retractors are too small, the lips can come together in the midline.

- To help the retractors slide easily against the patient's lips, either wet the retractors, by running under cold water, or ask the patient to lick their lips.

- Take care when inserting retractors, be aware of appliances, wires and elastics.

- For the anterior and buccal views, place the retractors on the lower lip first and then rotate them until their handles are horizontal.

- Make sure the retractor is holding the lip securely, so that the lips can be pulled forward away from the teeth.

Use of mirrors

- Ensure the patient removes any elastics before taking occlusal views.
- Warn the patient that the mirror is made of glass and that they should not bite it! Remind them they must keep their mouth open wide.
- The largest mirror that the patient can comfortably accommodate should be used. This helps to push the buccal mucosa away from the teeth.
- Gently heat the mirror by holding it under warm running water and then dry it carefully with a soft cloth or tissue. Warming the mirror will prevent it from steaming up when it is placed in the patient's mouth.
- If you do not have an assistant available, the patient is usually able to hold the mirror themselves. The mirror should be held by its edges or handle, with the fingers and thumb as far from the mouth as possible.
- To place the mirror in the patient's mouth, ask the patient to open wide, angle the mirror slightly to the horizontal and feed one corner in first, pushing this against the inside of the cheek, then straighten the mirror to feed in the other corner. Then turn the mirror so that it is horizontal and slide it slowly towards the back of the patient's mouth. Take extra care if the patient has a gagging reflex, it may help to ask the patient to breathe slowly through their nose.

Magnification

The anterior, left & right buccal and upper & lower occlusal views should all have the same magnification. These views should form a matching set which can be repeated exactly. To achieve consistent magnification, the photographs should be taken using a fixed focal length lens, set to manual focus and turned to the set ratio / pre-determined focusing distance. The camera is then moved backwards and forwards until the image is in focus.

If the camera has a full frame (24 x 36mm) sensor, a scale of 1:2 should be used for the anterior, left & right buccal views, the upper & lower occlusal views and the close up smile. A scale of 1:1.5 should be used for the overjet view. For cameras with a different sized sensor, a fixed focal length and pre-set focusing distance should be chosen to give the same view as shown in these guidelines.

For cameras with a full frame sensor, the lens' focal length should be fixed between 90mm and 160mm. For cameras with a different sized sensor, a fixed focal length should be chosen which is equivalent to between 90mm and 160mm on a full frame camera. This focal length will provide a good working distance from the patient of around 0.5m.

Problems with saliva

- Ask the patient to swallow before each view, especially for the lower occlusal view.

- Ensure the patient's tongue is not pushing against their teeth.

- If there is still excess saliva and bubbles, dry the area to be photographed with a cotton wool roll, a folded tissue or an air gun (if available).

The Anterior View (See Figures 7a & 7b)

- A scale of 1:2 should be used if the camera has a full frame sensor.
- Place retractors around the lips, ensuring they are holding the lips securely.
- Pull the retractors forward, towards the camera and out to the side.
- Keep both retractors in a straight line, which is at 90° to the patient's midline.
- Ensure that the lips do not obscure the teeth or gums.
- The teeth should be in occlusion, with the patient gently biting together on their back teeth.
- The patient's centre-line should be in the centre of the photograph.
- Keep the occlusal plane horizontal and in the middle of the frame; it should appear as a straight line all the way across the picture, from the left to the right molars.
- Keep the lens axis in line with the occlusal plane, so that the camera is not looking up or down at the teeth.
- Focus on the second incisors.
- The centre-line should equally divide the image horizontally

Figure 7a Camera and retractor alignment for anterior View of teeth

Figure 7b The Anterior view

The Right and Left Buccal Views (See Figures 8a & 8b)

- A scale of 1:2 should be used if the camera has a full frame sensor.
- One retractor should be in a central position (under the patient's nose).
- The other retractor should be pulled back towards the patient's ear and slightly away from their cheek. This should lift the buccal mucosa away from the molars.
- With some patients, it can help retraction if a smaller retractor is used at the side and a larger retractor is used in the central position.
- Aim to show from the central incisor to the 2nd molar (7) and if possible, to the 3rd molar (8).
- Focus on the first premolar tooth (4).
- The camera should be positioned at 45° to the patient's midline.
- Keep the occlusal plane horizontal and in the middle of the frame; it should appear as a straight line all the way across the picture, from the central incisors to the molars.
- Keep the lens axis in line with the occlusal plane so that the camera in not looking up or down at the teeth.

Figure 8a Camera and retractor alignment for Left Buccal View

Figure 8b The Left Buccal View

The Upper Occlusal and Lower Occlusal Views (See Figures 9a to 11a)

Figure 9a Angles required for the Upper Occlusal View

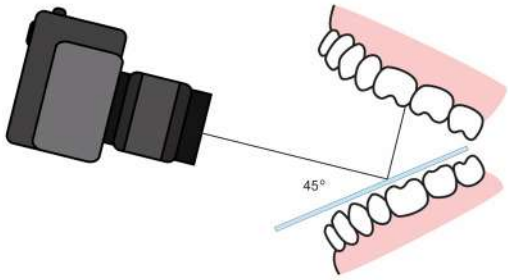
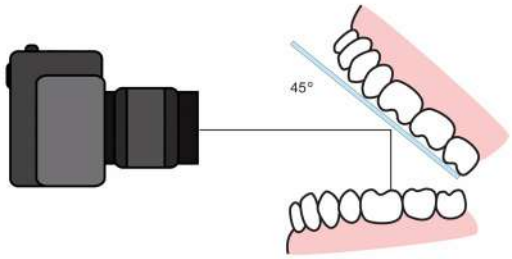


Figure 9b Angles required for the Lower Occlusal View



The Upper Occlusal View (See Figures 10a & 10b)

- A scale of 1:2 or 1:2.5 should be used, if the camera has a full frame sensor.
- Place one retractor over the upper lip and pull forward and upwards, away from the anterior teeth.
- If the patient has a large mouth and/or very fleshy lips, it may be necessary to use two retractors to hold the top lip away from the teeth (see fig. 9a).
- Place the mirror into the mouth, far enough back so that the molars can be seen.
- The mirror should be angled downwards, at 45° to the occlusal plane, with the lens axis of the camera at an angle of 45° to the mirror, in order to obtain a view that appears to be taken from 90° to the occlusal plane.
- The image from the camera should be rotated through 180° and flipped horizontally in order to provide a true image.

Figure 10a Camera, mirror and retractor alignment for the Upper Occlusal View

Figure 10b The Upper Occlusal View

The Lower Occlusal View (See Figures 11a & 11b)

- A scale of 1:2 or 1:2.5 should be used, if the camera has a full frame sensor.
- Place retractor over the lower lip and pull forward and downwards away from the lower anterior teeth.
- If the patient has a large mouth and/or very fleshy lips, it may be necessary to use two retractors to hold the lower lip away from the teeth (see fig. 11a).
- The patient should be asked to tilt their head up, or to 'look at the ceiling'. This enables the camera to be kept level rather than the photographer having to get down low and take the photograph looking up into the mirror.
- Place the mirror into the mouth, going far enough back to include the lower molars.
- The mirror should be angled upwards, at 45° to the occlusal plane, with the lens axis of the camera at an angle of 45° to the mirror, in order to obtain a view that appears to be taken from 90° to the occlusal plane (Figure 2).
- Ask the patient to take their tongue down to the back of their mouth.
- The image from the camera should be rotated through 180° and flipped horizontally in order to provide a true image.

Figure 11a Camera, mirror and retractor alignment for the Lower Occlusal View

Figure 11b The Lower Occlusal View

The Overjet View (See Figures 12a & 12b)

- A scale of 1:1.5 should be used, if the camera has a full frame sensor.
- Place the retractors around the lips; ensure they are holding the lips securely.
- Pull the retractors back towards the patient's ears.
- Ensure that the lips do not obscure the teeth or gums.
- The teeth should be in occlusion, with the patient gently biting together on their back teeth.
- You may want to hold a sheet of white card, next to the patient's face, to act as a background.
- If the flash lights can be controlled independently, turn off the left hand side in order to provide more directional lighting and to prevent a shadow being thrown onto the background.
- Keep the occlusal plane horizontal, across the picture.
- Keep the lens axis in line with the occlusal plane, so that the camera is not looking up or down at the teeth.
- Focus on the second incisor.

Figure 12a Camera and retractor alignment for the Overjet View

Figure 12b The Overjet View 1:1.5

The Close up Smile View (See Figure 13)

- A scale of 1:2 should be used, if the camera has a full frame sensor.
- The patient should be at full smile, in order to assess the lip line.
- The occlusal plane should be horizontal.
- Keep the lens axis in line with the occlusal plane, so that the camera is not looking up or down at the patient's mouth.
- Focus on the second incisors.

Figure 13 The Close Up Smile View 1:2

Standard Orthodontic Views

Extra - Oral Views 1:8

01 02 03

Intra - Oral Views 1:2

04 05 06

Upper Occlusal View 1:2 or 1:2.5

07

Lower Occlusal View 1:2 0r 1:2.5

08

Optional Orthodontic Views

Extra - Oral Views 1:8

09

10

11

12

Close-up Smile 1:2

13

Overjet View 1:1.5

14

Acknowledgements

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