IMI National Guidelines

A Guide to Good Practice

Cleft Lip and Palate

Audit Review

These guidelines have been developed by the Institute of Medical Illustrators, in consultation with specialist advisors. They should be considered a guide to good practice, providing a baseline for auditable standards. If necessary, adaptations may be made to take into account your local conditions.

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Introduction

The Clinical Standards Advisory Group Cleft Lip and Palate U.K. Study (CSAG, 1998) carried out by a multidisciplinary cleft team examined care and outcomes in children born with a unilateral cleft lip and palate (UCLP). They recommended reliable audit review including taking high quality, standardised medical photographs of children born with a cleft lip and/or palate at recommended ages of 0 (pre-first operation), 5, 10, 15 and 20 years of age.

The standardised medical photographs within this Guideline have been established in collaboration with multidisciplinary cleft teams comprised of: Consultant Orthodontist; Speech and Language Therapist; Cleft Surgeons and Medical Photographers (see Acknowledgements).

1. Background: Cleft Lip and/ or Palate

Approximately 1 in 700 babies (1,200 babies) in the U.K. are born with Cleft Lip and/ or Palate (CLP) malformations; it is the most common craniofacial congenital abnormality in the U.K. (NHS, 2018).

A **cleft lip** is a split or gap, which affects one or both sides of the upper lip and may extend into the base of the nose and the alveolar ridge (gum). A **cleft palate** occurs when the palate fails to fuse and may affect the soft palate and the hard palate. The result is a gap in the roof of the mouth (palate) that connects the mouth directly with the nasal cavity.

Often, the cause of the cleft is not known but there may be a family history of clefts, environmental factors or a genetic diagnosis; up to 50% of babies with isolated cleft palate have been found to have a genetic cause for the cleft. The Cleft Registry and Audit NEtwork (CRANE) was set up by the Department of Health in 2000 to collect information about all children born with a cleft lip and/ or palate in England, Wales and Northern Ireland. CRANE (2018) states:

“CRANE collects information on these children at birth or at diagnosis, and into childhood. This includes information about the surgical treatments children have had, and how they are getting on in terms of their speech, hearing, growth, dental health and overall health.”
The figures acquired by CRANE for births have remained consistent over many years (see Appendix 1); the average distribution of cleft types between 2008 and 2017 are demonstrated in Figure 1 and are approximately: **CL 24% CP 45% UCLP 21% BCLP 10%**

![Figure 1. Cleft type of children born with a cleft lip and/or palate in England, Wales and Northern Ireland average between 2008 and 2017 (CRANE, 2018)](image)

Many clefts occur in isolation, i.e. without any other anomaly or syndrome; however, there are more than 300 syndromes associated with cleft lip and/or palate, common examples are: Stickler’s syndrome, 22q11 deletion syndrome (DiGeorge syndrome) and Van der Woude syndrome. A standard set of medical photographs of all cleft types at an early (pre-operative) stage could also enable identification of altered craniofacial morphology or associated syndromes.
1.1 Main categories of cleft lip and palate

Figure 2 demonstrates the main categories of cleft lip and palate.

![Diagram showing different categories of cleft lip and palate](image)

**Figure 2. Main categories of cleft lip and/ or palate**
The manifestation of each patient’s condition is very individual as demonstrated in Figure 3a.

Other abnormalities of the palate that may also be imaged include submucous cleft palate, palatal fistula and oral damage following illness or injury. It may not be immediately obvious that the palate is affected from the facial appearance, see Figure 3a.
1.2 Classification of cleft lip and palate

There are different methods of describing cleft types e.g. the LAHSAL code (Figure 4a.). This ‘code’ indicates the area of the mouth affected by the cleft. An uppercase letter indicates a complete cleft, a lowercase letter indicates an incomplete cleft, and a dot or dash indicates a non-affected area. Therefore, expressed as (Figure 4a.):

- **LAHSAL** complete bilateral cleft lip and palate;
- **......l** left incomplete unilateral lip only, no palate involvement;
- **...S..** soft palate only, no lip involvement.

![LAHSAL Code system with patient examples](image)

1.3 Photographic involvement in cleft patient treatment plan

A treatment and surgical plan will have been devised for each patient in consultation with the multidisciplinary team and the patient/ parent or legal guardian.

Babies with a cleft are usually photographed for the first time at their initial clinic/ multidisciplinary clinic visit, pre-operative assessment clinic or on admission to hospital for their first operation. This could range from when the baby is around 6 weeks old to 12 months old.
Sets of medical photographs will be required at each stage of treatment dependent upon clinical need (see Figure 5) e.g. orthodontic treatment (see IMI National Guidelines Orthodontic Photography, 2008), and rhinoplasty (see IMI National Guidelines Rhinoplasty Photography, 2018).

All cleft patients regardless of cleft type will have a set of medical photographs (as in this Guideline, Figures 11a and 11b) taken at audit review ages* of 0 (pre-first operation), 5, 10, 15 and 20 years of age (CSAG, 1998). However, this is dependent on individual cleft unit preference.

<table>
<thead>
<tr>
<th>Age</th>
<th>Treatment (if required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-first operation</td>
<td>0 year audit review*</td>
</tr>
<tr>
<td>3 months</td>
<td>Cleft lip repair</td>
</tr>
<tr>
<td>9 months</td>
<td>Cleft palate repair</td>
</tr>
<tr>
<td>4 years +</td>
<td>Lip scar revision</td>
</tr>
<tr>
<td>4 years +</td>
<td>Pharyngoplasty, buccal flap, ‘speech surgery’</td>
</tr>
<tr>
<td>5 years</td>
<td>5 year audit review*</td>
</tr>
<tr>
<td>7-11 years+</td>
<td>Alveolar Bone Graft (ABG)</td>
</tr>
<tr>
<td>10 years+</td>
<td>Orthodontics</td>
</tr>
<tr>
<td>10 years</td>
<td>10 year audit review*</td>
</tr>
<tr>
<td>15 years</td>
<td>15 year audit review*</td>
</tr>
<tr>
<td>Age 16 years+</td>
<td>Maxillary Osteotomy (+/- orthodontics)</td>
</tr>
<tr>
<td>Age 16 years+</td>
<td>Restorative Dentistry (+/- orthodontics)</td>
</tr>
<tr>
<td>Age 16 years+</td>
<td>Rhinoplasty, lip revision</td>
</tr>
<tr>
<td>20 years</td>
<td>20 year audit review*</td>
</tr>
<tr>
<td>20 years+</td>
<td>Further surgical revision</td>
</tr>
</tbody>
</table>

*Figure 4b. Cleft patient treatment plan that may include photographic involvement – audit review ages*
1.4 Considerations for photography of patients with a cleft

As with all accurate medical photography, consider the following: background; lighting; equipment; patient and photographer positioning; communication; informed consent and confidentiality; safe and appropriate storage of images; data protection (GDPR, 2018; DPA, 2018); health and safety and infection control, i.e. the decontamination or disposal of intra-oral equipment – see relevant IMI Guidelines for more detailed advice. Many of these considerations are as for orthodontic photography (see IMI Guidelines Orthodontic Photography, 2008).

Good communication with the parent and child is essential to gain trust and co-operation. It is important that they are confident that the photographer is comfortable with handling their child. This helps them to relax and feel less anxious about the session (this is especially true of new parents). It will also help when they return three to five months later for the post-op assessment clinic when further photography will be necessary.

If possible, request that the baby is not fed directly before photography as this increases the risk of reflux when the baby is laid on the mat. This may result in milk being visible in the oral cavity possibly obstructing anatomical structures. The baby may also be too relaxed and possibly be incapable of opening their mouth, making the palatal shots impossible.

Ask the parent to remove any of the baby's clothes that may obscure the face, especially loose vests (the chin must be fully visible), unless this distresses the baby or child. Babies may start to cry and portray a distorted facial aspect that can render the image clinically invalid. Although it is best to have an unobstructed view of the face and head, young babies may need their heads to be gently held to obtain correct positioning for photography. A cleft consultant’s opinion is: “Having a settled baby is more important to the clinicians than minor distractions such as fingers or clothes at the periphery of photos.”

Consideration should be given for patients with additional problems such as a tracheostomy or nasogastric (NG) tube/ nasopharyngeal airway (NPA). Ensure any equipment/ tubes are placed away from the lip/ nose where possible. Some syndromes or conditions associated with clefts may require additional considerations for positioning of the head so as not to compromise the baby's airway. A clinical nurse specialist/ parent/ assistant may need to help.
2

Photographic techniques

2.1.1 Cleft Audit Review

Photographic sets of views
Cleft Audit Review Photographic Guideline
Core Views for babies

Full face views 1:8
03 01 04

Lip/ nose views 1:4
05 07

Palate views 1:2
11 12 13

Template 1a. Cleft Audit Review core views for babies
Template 1b. Cleft Audit Review core views for babies and young children (alternative)
Cleft Audit Review Photographic Protocol

Core Views

Facial Views 1:8

Lip/ Nose Views 1:4

Intra-oral Views 1:2

Occlusal (Upper and Lower Arch) Mirror Views 1:2 or 1:2.5

Template 2a. Cleft Audit Review core views for children and adults
Cleft Audit Review Photographic Protocol
Optional Views

Facial Views 1:8
18 17 18 19 20

Lip/ Nose Views 1:4
21 22

Teeth Mirror Views 1:2
23 24

Overjet Teeth Views 1:1.5
25 26

Alveolus View 1:2
27

Template 2b. Cleft Audit Review optional views for children and adults
2.1.2 Photographic background

Plain black or white backgrounds are recommended. Most departments now use paper or disposable backgrounds. If photography is not taking place in a studio, a temporary background may be made from a white sheet or a plain wall. Cluttered backgrounds are distracting.

Studio electronic flash is recommended for photographing a patient’s facial views. Output with reflectors, soft boxes or umbrellas should be capable of producing sufficient light for an aperture of at least f/16 and positioned to give uniformity and contrast. Ideally, lights should either be suspended on a ceiling-mounted system or on mobile stands to provide a safe and convenient working environment for photographer and patient.

Position the two key lights at approximately 45° to the patient and level to the patient’s head. To obtain 'softer' repeatable lighting without prominent specular highlights, large reflector umbrellas or soft-boxes may be used, Figures 6a and 6b. (Also see IMI Clinical photography studio, design and planning guideline, 2012).

With a black background two rear lights must be used to provide 'rim-lighting' and separate the subject from the background, a hair light should also be used if available, see Figure 6a.

Figure 6a. Lighting set-up for black background (AP views)
With a white background the two rear lights should be directed at the background to produce a shadowless white background, see Figure 6b. Care should be taken not to over light the background as this will result in flare. However, if the background is underlit it will appear grey.

Figure 6b. Lighting set-up for white background (AP views)

2.1.3 Equipment

All camera equipment in this guide is based around a full-frame sensor CCD, i.e. Nikon DSLR and Canon DSLR with 105mm Micro-Nikkor 1:2.8 lens/ Canon 100mm 1:2.8 Macro lens respectively and Macro ring-flash units. It is essential that the lens be capable of producing magnifications of up to 1:1 and must have a minimum working aperture of at least f/22 for optimum depth of field. By using a lens with an effective focal length of between 100mm and 135mm sufficient subject to camera distance is maintained, which avoids distortion and ensures the correct perspective, as well as providing a convenient working distance for both the facial and intra-oral views.

For cameras with non-full-frame sensors, typically 1.5x crop factor (Nikon DX), a set focal length and fixed focusing distance should be chosen to give the same view as shown in these guidelines e.g. the Nikon DX DSLR with 60mm Micro-Nikkor 1:2.8. will have a similar working distance as the full frame (FX) DSLR with 105 Micro-Nikkor 1:2.8.

If the working distance does not allow for the use of a 100mm/105mm lens on a full-frame sensor, i.e. in small clinic rooms, then a shorter focal length of 50mm/60mm (macro lens) or equivalent can be used, however, this will result in subject distortion.
2.1.4 Magnification ratio

Table 1 demonstrates the magnification ratios for all views.

<table>
<thead>
<tr>
<th>Core views</th>
<th>View</th>
<th>Magnification ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td>01 - 04</td>
<td>1:8</td>
</tr>
<tr>
<td>Lip / nose</td>
<td>05 - 07</td>
<td>1:4</td>
</tr>
<tr>
<td>Teeth buccal</td>
<td>08 - 10</td>
<td>1:2</td>
</tr>
<tr>
<td>Palate</td>
<td>11 - 13</td>
<td>1:2</td>
</tr>
<tr>
<td>Occlusal mirror</td>
<td>14 - 15</td>
<td>1:2, 1:2.5, 1:3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Optional views</th>
<th>View</th>
<th>Magnification ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td>16 - 20</td>
<td>1:8</td>
</tr>
<tr>
<td>Lip / nose</td>
<td>21 - 22</td>
<td>1:4</td>
</tr>
<tr>
<td>Teeth mirror</td>
<td>23 - 24</td>
<td>1:2</td>
</tr>
<tr>
<td>Teeth overjet</td>
<td>25 - 26</td>
<td>1:1.5</td>
</tr>
<tr>
<td>Alveolus</td>
<td>27</td>
<td>1:2</td>
</tr>
</tbody>
</table>

Table 1. Magnification ratios

If the camera has a full frame sensor, a scale of 1:8 should be used for the full-face views of babies, children and adults (core views 1 to 4 and optional views 16 to 20). Do not try to fill the frame with the image in camera. Using the same magnification from the first pre-operative views ensures consistency through to adulthood (see Figure 7a). The image may be cropped when presented to eliminate distracting space around the features.

Similarly, a scale of 1:4 should be used for the lips/ nose core views 5, 6, 7 and optional views 21, 22. For intra-oral core views 8-15 and optional views 23-28 use 1:1.5, 1:2, 1:2.5 and 1:3.
2.2

Photographic Techniques: Babies and young children
2.2 Photographic techniques: babies and young children

All facial views should be taken in portrait format for the children and adults (see Figure 8a), although, some units/individual cleft surgeons may prefer the close-up views (5 and 7) of the nose and lips to be taken in landscape format (see Figure 8b.).

Figure 8a. Core set of views for babies

Figure 8b. Core set of views for babies and young children (alternative)
2.2.1 Photographic techniques:
Babies and young children lying down

- Babies and young children may be photographed sitting up or it may be easier to photograph them lying down at least until the age of 6 months when they begin to sit up unsupported as described.

- Use a lighting technique that is flexible such as a hand-held flash with studio lights bounced off the ceiling/ walls as fill-in to reduce the harshness of the shadows, rather than direct studio lighting. Ensure the flash is positioned so that the shadows are in the correct orientation, i.e. from top to bottom and front to back, see Figure 8c.

- Provide a baby changing mat or a gym mat covered with either a paper towel or a sheet (as in Figure 8c); only plain black or white should be used. Check that the background material covers the area that you are photographing. The parent will need to kneel to one side of the baby so as not to be in view or obstruct the lighting.

- The parent should place the flat of their hand alongside the baby's arms; this keeps them out of shot and prevents the baby from wriggling too much. Generally, young babies are quite happy to be in this position as they feel secure with their parents' hands supporting them.

Figure 8c. Hand-held flash in the studio
2.2.2 Facial views 01, 03, 04 at 1:8 lying down

View 01  Face AP  1:8

- You may need to place a small pillow or padding under the baby’s shoulders to allow the head to rest back in the correct anatomical position or photograph the head at an angle to ensure that you are parallel to the Frankfort plane as in Figure 8d.

- When changing the magnification for a different view, the photographer should step away from the child so that the alterations to lens and aperture can be made safely.
Views 03 and 04  Face right and left lateral at 1:8 lying down

- Ask the parent to turn the baby onto their side at an angle of 45° to 60°; the photographer is able to adjust their position to achieve a lateral view (Figure 8e). The parent should gently hold the baby’s arms close to their body. The other hand should be placed along the baby’s back to support them. Do not get the parent to prop the baby at 90° to the mat, as the baby will invariably turn their face to the mat. A parent or colleague may be able to help by attracting the baby’s/ child’s attention.

![Figure 8e. Rolled sheet/ parent’s hand for support](image)

- Studio lighting or hand-held lighting (with or without studio lighting fill-in) may be used.
- The photographer should stand behind the child when photographing a baby lying on the mat and position the flash so that shadows fall in the correct anatomical orientation. With a hand-held flash, this will mean crossing arms to achieve the correct position for one of the lateral views (Figure 8f). This technique may also be adapted and applied when using hand-held flash for (sitting) children and adults on location, i.e. in a clinic room.

![Figure 8f. Photographer, camera and hand-held flash positioning](image)
2.2.3 Facial views 01, 03, 04 at 1:8 sitting (aided)

- Babies and very young children may be photographed sitting on their parent's lap (Figure 9a) or sitting up next to a parent rather than lying down.

![Figure 9a. Patient sitting on parent's lap](image)

- Suitable seating would be a bench without a backrest to avoid obscuring the back of the head. Alternatively, turn a chair so that the backrest is on the lateral side of the patient with the parent supporting the baby or young child.
- The photographer may need to kneel or find alternative seating to be at the same level as a small child.
• Use Figure 9b as a guide for the black background set-up.

![Figure 9b. Lighting diagram for black background AP view – patient sitting on parent's lap](image)

• Use Figure 9c as a guide for photographing the AP face on a white background.

![Figure 9c. Lighting diagram for white background AP view – patient sitting on parent's lap](image)
Views 03 and 04  Face right and left lateral sitting (aided)

- Move the two key lights around the patient to light the lateral face (Figure 9d) to ensure there is adequate lighting.

![Figure 9d. Lighting diagram for black background lateral view – patient sitting on parent’s lap](image)

- Move the two key lights around the patient to light the lateral face (Figure 9e).

![Figure 9e. Lighting diagram for white background lateral view – patient sitting on parent’s lap](image)
2.2.4 Lip/ nose views: 05 and 07 at 1:4

Lying down

- Babies are best photographed lying down for these views. A parent may need to hold the child's head but avoid obscuring any part of the face.

- Position the baby on the mat as before. A towel or other kind of padding may be placed beneath the background material to fit in the nape of the baby's neck as for the AP view. This will allow their head to be tilted back slightly for ease of photography to ensure the chin is not tilting down towards the chest as would be a more natural position in a young baby.

- This method may be used for babies or very young toddlers. However, if a toddler or young child is not comfortable with this method or with tilting their head back, they may be happier sitting rather than lying down; this is particularly apparent in babies once they are able to sit up by themselves.

Sitting (aided)

- A parent may need to stand behind the child so that they can rest their head on the parent when looking up for the worm’s eye view (WEV), some children feel 'safer' doing this. A suitable material background may be held in front of the parent to ensure an even background (must comply with Trust’s health and safety and infection control policies).
2.2.5 Babies and young children intra-oral photography:
   Palate views: 11, 11a and 12  1:2

- The photographer must familiarise themselves with the anatomy of the face and mouth. Observe the main reference points of the palate, (Figure 10a), see Appendix 2.

![Figure 10a. Anatomy of the palate](image)

- Align the camera perpendicular to the relevant point of focus (x) of the palate, i.e. hard, hard and soft, soft, see Figure 10b.

![Figure 10b. Focus points (x) of the palate](image)
• These views are generally easier to obtain whilst the baby is lying down as with the WEV and when the baby cries or yawns, see Figure 10c.

![Figure 10c. Yawning to view palate](image)

• Alternatively, the young baby may be held lying down on the parent’s lap so that the baby’s head rests on the parent’s knees.

• Use a ring-flash and set the lens aperture to at least f/29/ f/32.

• If it has not been possible to obtain a good view of the palate pre-operatively then take the photograph in theatre (see Figure 10d) once the baby is anaesthetised.

![Figure 10d. Photography of a cleft palate taken in the operating theatre](image)
2.3

Photographic Techniques:

Children and adults

Background, lighting and patient/photographer positioning
2.3 Photographic techniques: children and adults

Audit Review photographs to be taken at ages 5, 10 and 15 years, see Figures 11a and 11b.

Medical photographers should familiarise themselves with the main anatomical features of the face, see Figure 11c, see Appendix 2 for terms.
2.3.1 Patient and photographer positioning: facial views

- The AP view of the face is a key view for the surgeons as a benchmark of the patient’s appearance. This view and the worm’s eye view (view 07) are essential when the cleft team is auditing aesthetic outcomes.

- Remove coats and head scarves (where acceptable to the patient), turn down collars to ensure that the patient’s ears and jaw line are clearly visible. Glasses, all visible jewellery and body piercings should be removed.

- 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.

- Ensure correct posture and positioning for patient and photographer. The patient should be sitting up straight with both feet on the floor (not crossing legs). A small child may prefer to sit cross-legged on a stable chair, they are used to sitting cross-legged at school and this can improve their posture. Allow young children to keep their favourite toy with them, see Figure 11d.

Figure 11d. Correct seating and posture, young child with toy
Hair should be pulled back off of the face and neck. The ears should be visible so that the tragus may be aligned correctly. This is especially important in the lateral views (see Figure 11e.). Use plain hair accessories and comply with infection control policies – some Trusts only allow single-use accessories. The most common error by the photographer is not holding the camera at the same level as the patient’s head.

![Incorrect patient positioning and inadequate retraction of hair](image)

Figure 11e. Incorrect patient positioning and inadequate retraction of hair

Also apply these principles to male patients, see Figure 11f. They do not usually mind using hair accessories when you explain that you need to see all of the face and neck. The photographs will be of no clinical value if they do not show the full features of the patient.

![Correct compared with inadequate retraction of hair in male patient](image)

Figure 11f. Correct compared with inadequate retraction of hair in male patient
• 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 should be sitting upright and looking directly ahead, in their natural head position.

• The patient’s teeth should be at rest, i.e. the patient should have their mouth closed in a relaxed position and not clenching their teeth or pressing their lips together.

• Adjust the patient's chin position until the head is correctly aligned. The patient’s head should not be tilted, i.e. the median plane should be vertical and should be level and aligned to the Frankfort Horizontal Plane or Reid Plane (Figure 11g).

• The mid-vertical grid line should pass through the mid-sagittal plane or median plane of the face. The mid-horizontal passes through the Frankfort horizontal plane, see Figure 11g.

Figure 11g. Correct patient positioning and effective retraction of hair

• Ensure both camera lens and photographer are aligned and parallel to the subject; this reduces the possibility of image perspective distortion due to poor positioning and viewpoint.
2.3.2 Core facial views: 01 to 04  1:8

Views 01 and 02  Face AP and AP smiling  1:8
- Views 01, 03 and 04 should be at rest, also with teeth in a relaxed position, i.e. teeth not biting down (not in occlusion).
- View 02 should be a full smile to show the teeth.
- Use the lighting, positioning and background as previously described, see pages 32 – 34.

Views 03 and 04  Face right and left lateral 1:8
- Ask the patient to rotate 90°. Ensure the head is aligned using the Frankfort Plane, the distal eyebrow should not be visible in this view, see Figure 11g.
- Use the lighting, positioning and background as previously described.
### 2.3.3 Core lip/ nose views: 05 to 07  1:4

**View 05  Lips/ nose AP  1:4**

- Apply the lighting and alignment techniques as for the full-face AP views. Ensure that the chin is included in this view. In adult patients the eyebrows may only just be in the frame at this magnification to enable the chin to be included. In a small child more of the forehead will be visible in addition to the chin (see Figure 12a).

![Figure 12a. Comparison of view 05 to accommodate the chin](image-url)
View 06  Lips blowing 1:4

- Ask the patient to blow or whistle. A younger child will usually understand 'blowing out a candle'.

View 07  Lips/ nose Worm’s Eye (basal) view (WEV) 1:4

- Move the key lights to be level with the orbit and turn off the hairlight if possible. The patient should tip their head back. The horizontal grid passes along the base of the nose and the vertical grid through the mid line of the face.

- The base of the columella should be aligned at 90° to the camera lens axis (see Figures 12a and 12b), the correct position may need to be estimated if the patient has a ‘slumped’ septum as in Figure 12a. Figure 9b demonstrates the lip obstructing the base of the columella because the head has been tipped back too far (see Figure 12c).

Figure 12b. Correct Worm’s Eye View (WEV) in patient with and without a cleft

Figure 12c. Incorrect WEV: lip obstructing base of columella
2.3.4 Optional facial views: 16 to 18  1:8

Apply lighting and align face as for AP views. Views to assess 3D facial asymmetry and specifically occlusal cants linked to asymmetry.

**View 16  Face AP with mouth open**
- To demonstrate jaw asymmetry. When the patient opens their mouth wide there may be a tendency to tip their head back; ensure that their head is in the neutral position.

**View 17  Face AP with spatula**
- To demonstrate jaw asymmetry and an occlusal cant, therefore, place the spatula in the mouth evenly.

**View 18  Face AP with retractors**
- To demonstrate the relationship between the teeth and facial symmetry (or asymmetry). Place the retractors in the mouth evenly (see intra-oral section).
- Observe infection control and consent procedures when placing intra-oral equipment in a patient’s mouth.
2.3.5 Optional facial views: 19 and 20 1:8

Optional Views 19 and 20  
**Face right and left oblique (45°) 1:8**

- Apply lighting techniques as for lateral views (Figures 9e and 9f). Align face with the tip of the nose to the cheek, or a 45°angle may be measured on the floor of the studio and marked, again use the Frankfort Plane to gain accurate alignment (Figure 12d). Typically, patients with a cleft have a misaligned nose or a deficient columellar length pulling the nasal tip down. The angle of the alar wings may be too acute to align with the cheek; therefore, this method should be used as a guide, but the judgement needs to be made as to the position of the nose with the cheek (Figure 12e).

Figure 12d. Incorrect and correct oblique view

Figure 12e. Correct oblique view (patient with a cleft)
2.3.6 Optional lip/ nose views: 21 and 22 1:4

- Apply lighting and alignment: as for views 05 and 06.

**View 21  Lips AP in repose 1:4**

- To demonstrate relaxed view of mouth and teeth. Patients tend to pull their lips together if feeling tense, encourage the patient to fully relax their lips/ mandible.

**View 22  Lips AP smiling 1:4**

- To demonstrate movement or lack of movement of the lips. Ensure that the patient shows their teeth when smiling.
2.4

Photographic Techniques:

Intra-oral photography
2.4 Intra-oral photography

Much of this information is also contained within the IMI Orthodontic Guidelines (2008). Patients with a cleft will need varying intra-oral surgery and treatment depending on cleft type. The treatment plan (see Figure 4b.) demonstrates the photographic involvement.

The ‘Core’ set of 15 views will be taken at each audit review age of 5, 10, 15 and 20 years with Optional views as requested.

2.4.1 Anatomical terms and Dental Notation

Figure 13a demonstrates the anatomy of the mouth and teeth. Figure 13b demonstrates the anatomical notation for the teeth.

Figure 13a. Anatomy of the mouth and teeth

Figure 13b. Anatomical notation for the (permanent) teeth
2.4.2 Palmer’s Dental Notation

Palmer’s Dental Notation is the most common tooth designation system in use in the U.K., see Figures 14a to 14d).

Alternative systems that may be encountered are the Universal system, adopted by the American Dental Association and the FDI/ International system adopted by the Fédération Dentaire Internationale.

**Palmer’s Dental Notation for Children: deciduous teeth**

- Children’s teeth are referred to as Primary or Deciduous.
- Annotated from 1 to 5 in each quarter.
- May also be annotated A to E.
- The Universal system of notation may be encountered. This annotates deciduous teeth from A to T. This starts from the upper right 2 molar and goes around in a clockwise direction.

Figure 14a. Palmer’s Dental Notation for Children: deciduous teeth buccal surface
(Adapted from IMI, 2008)
Palmer’s Dental Notation for Children:
deciduous teeth maxillary and mandibular dental arches

**Figure 14b.** Palmer’s Dental Notation for Children: deciduous teeth maxillary and mandibular dental arches occlusal surfaces (Adapted from IMI, 2008)
Palmer’s Dental Notation for Adults: permanent teeth

- 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.

- Wisdom teeth (Number 8) do not always erupt and often have to be removed; these may not be visible.

- 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 around in a clockwise direction.
Palmer’s Dental Notation for Adults:
permanent teeth maxillary and mandibular dental arches

Figure 14d. Palmer’s Dental Notation for Adults: permanent teeth maxillary and mandibular dental arches occlusal surfaces (Adapted from IMI, 2008)
2.4.3 Intra-oral photography and equipment

For intra-oral photography, a ring-flash provides even lighting without shadows and with some units, a degree of modelling can be achieved by positioning the flash unit. The ring-flash must be capable of producing sufficient light for an aperture of at least f/22 to maximise depth of field. A working aperture of f/32 or more is desirable for a good depth of field to ensure the full dentition is in sharp focus. The ring-flash is not suitable for facial views as the lighting ‘flattens’ the features and produces a ‘hot spot’ of light in the centre of the image.

The patient should be seated comfortably but should sit up straight (Figure 15a) as with the facial views to avoid any distortion due to incorrect seating position or camera angle. Some departments may have use of a dental chair. Align the head observing the Frankfort Plane; Figure 15b demonstrates the position of the teeth in relation to the Frankfort Plane.

Figure 15a. Patient and photographer correct positioning    Figure 15b. Frankfort Plane in relation to teeth position
Dental mirrors and retractors

All intra-oral instruments must be sterilised in accordance with Infection Control Trust policy.

A range of mirrors and retractors (see Figures 16a. and 16b.) are required to cope with the variety of dentitions, patient’s age, size of mouth and shape of the lips.

Patients with repaired cleft lip may have difficulty in retraction of their lips due to surgical scarring. Those patients with additional disorders, for example Pierre Robin sequence, have retrognathia (recessed chin) and patients with 22q11 deletion syndrome have extremely small mouths and may have difficulty fitting even the smallest retractors into their mouth.

- **Mirrors** (see Figures 16a) are available in either stainless steel or surface coated glass. A standard set of mirrors should include palatal mirrors for both adults and children. Palatal mirrors are necessary for photographing the palate, maxillary and mandibular dental arches. Buccal mirrors are used for the ‘True lateral’ mirror views. The buccal mirrors may also be used to image the dental arches in smaller children if the palatal mirrors are too big.

- **Retractors** are most commonly plastic and come in pairs but do not have to be used in set pairs; ‘mix and match’ combinations should be used to achieve maximum retraction of the buccal mucosa in order to image the dentition and intra-oral anatomy (see Figures 16b).
2.4.4 Intra-oral photography: young children

- Most young children are happy to let the photographer place intra-oral retractors and dental mirrors in their mouth and will tolerate these well for the entire photography session. They may be able to hold the intra-oral retractors themselves (see Figure 17) and may need a rest between views.

- Some children may need a parent to hold the retractors. The photographer may help put the retractors into the child’s mouth whilst the parent stands behind the child holding the retractors in place (see Figure 17). The parent will be reliant on the photographer to guide them as to the position of the retractors (offer gloves to the parent). Allow the child to hold their special toy in their lap to make them feel comfortable (see Figure 17).

- If the child will not tolerate any retractors, they or the parent may use their fingers to retract the lips to give a limited view of the dentition (see Figure 17); offer the chance for the child to wash their hands before placing in their mouth. Offer gloves if the child is willing; however, many do not like the smell or taste and prefer to use their fingers without gloves.

![Figure 17. Retraction techniques for intra-oral photography with young children](image-url)
Core Intra-oral views

2.4.5 Core intra-oral views buccal teeth: 08 to 10  1:2

The buccal views illustrate the patient's full dentition in centric occlusion and coordination of the 'bite'.

View 09  Teeth AP in occlusion  1:2

- Prepare all camera equipment and intra-oral instruments (including tissues) before patient enters studio.

- Set camera to correct magnification and aperture with ringflash attached.

- Ensure hands have been washed and are clean. Wear gloves (non-latex if either the photographer or patient are sensitive to latex).

- Remove intra-oral appliances or prostheses if possible: the clinician may request photographs with and without appliances. Ask the patient to pull their tongue away from their teeth to demonstrate the gaps in the dentition (Figure 18a).

Figure 18a. AP buccal teeth view with and without prosthesis
- Teeth in occlusion - patient needs to bite gently on their back teeth. Keep the lens axis in line with the occlusal plane so that the camera is not looking up or down at the teeth. The horizontal grid line should pass through the bite line (occlusal line) and equally divide the image horizontally and vertically; however, patients with a cleft of the lip and alveolus are often rather asymmetrical (Figure 18b). Do not try to overcorrect an asymmetrical bite line.

![Figure 18b. Asymmetrical dentition in patient with a bilateral cleft of the lip, alveolus and palate](image)

- Keep the lens axis in line with the occlusal plane so that the camera is not looking up or down at the teeth. Keep both retractors in a straight line, which is at 90° to the patient’s midline. Focus one third in, at the canines, to achieve maximum depth of field, see Figure 18c. Hold camera very steady with both hands to avoid ‘camera shake’.

![Figure 18c. Point of focus for core buccal teeth views](image)

- Use the largest retractors that are comfortable for the patient; however, if the retractors are too large, they may prevent adequate retraction of the lips and buccal mucosa at the molars and may prevent complete occlusion of the teeth. If the retractors are too small, the result will be lip-lag where the lips cover the teeth and alveolus. See Figure 18d.

![Figure 18d. Point of focus for core buccal teeth views](image)
• Place retractors gently around the patient’s lips. Pull the retractors forward, towards the camera and laterally (out to the side) to prevent shadows (due to lack of retraction), see Figure 18e.

• Figure 18f demonstrates incorrect retraction and tongue position. Retraction may be particularly difficult when the patient has a restrictive lip scar; the retractors should be pulled upwards to provide a clear view of the upper alveolus and teeth (rather than the lower gum) and the tongue should be pulled back inside the mouth away from the dentition to demonstrate the gaps in the dentition.
Figure 18f. Incorrect retractor and tongue position

- Figure 18g demonstrates comparative correct retraction of upper lip and correct tongue position.

Figure 18g. Correct retractor and tongue position
Views 08 and 10  Right and left buccal views teeth in occlusion  1:2

- Aim to show from the central incisor to the second molar (7) and if possible, to the third molar (8).

- It is not always possible to retract the buccal mucosa enough to show the occlusion of the rear molars effectively and obtain the correct oblique teeth position: usually due to lip scarring or a patient’s small mouth in those with associated craniofacial syndromes. 'True lateral' mirror views (views 22 and 23), may be used as an alternative or in addition to views 08 and 10 buccal teeth views in order to show the occlusion of the rear dentition. If retraction is difficult or appropriate mirrors unavailable, then the rear occlusion of the teeth may need to be imaged separately.

- As with the AP view, larger retractors may prevent adequate retraction. In addition, if the distal (furthest from the camera) retractor is pulled too far laterally then there may not be enough ‘give’ left in the lip to retract the proximal (nearest) retractor fully, see Figure 18h.
• To obtain maximum retraction, use a combination of appropriately sized retractors. You do not have to use a matching pair. For the oblique views a smaller retractor may be used in the proximal position and a larger retractor used in the distal position (Figure 18i).

• Relax the distal retractor medially and pull the proximal retractor laterally towards the patient’s ear and slightly away from their cheek pulling the buccal mucosa away from the teeth. Lift the proximal retractor in line with the dentition to obtain a clear view of the rear molars, see Figure 18i.

• Focus on the canine (3)/ first premolar tooth (4) depending on the angle of the maxillary arch.

• The camera should be positioned at 45° to the patient’s midline.

• Keep the occlusal plane horizontal and in the middle of the frame.

Figure 18i. Correct size and position of retractors with focus point (x) for buccal views
2.4.6 Core palate views: 11 to 13  

- Use a ring flash with the lens set to at an aperture of f/32 for all these views with a magnification ratio of 1:2.

- These views demonstrate the anatomy and function of the palate.

**View 11 Hard palate**

- Ask the patient to tilt their head back and open their mouth as wide as possible. A parent may need to stand behind the young child so that the child may rest their head on the parent (as with the AP teeth view), see Figure 17a.

- Focus on the upper part of the hard palate (x) not the teeth, see Figure 19a. The mid vertical line in the camera should align with the mid line of the palate.
**View 12 Soft palate at rest**

- Ask the patient to open their mouth as wide as possible. Focus on the soft palate (x), see Figure 19b. If the tongue obscures the palate, a tongue depressor may be used but patients tend to gag if this is pushed too far back into their mouth.

![Figure 19b. Focus point (x) soft palate at rest](image)

**View 13 Soft palate lifting**

- Focus on the soft palate and uvula (x) or position where the uvula should be if not present, see Figure 19c.

- Ask the patient to say a long 'aah'. Alternatively, a 'deep gasp in' causes the palate to be lifted. As for view 12, it is often difficult to keep the tongue out of the way and several attempts may be needed. Allow the patient to rest between attempts.

![Figure 19c. Focus point (x) soft palate lifting](image)
2.4.7 Core occlusal mirror arch views: 14 and 15  1:2 (1:2.5, 1:3)

Views 14 Upper occlusal mirror arch view  1:2 or 1:2.5, 1:3

- Remove dental plates or other appliances. The clinician may require intra-oral views with and without intra-oral appliances (see Figure 20a).

![Figure 20a. Mirror view of palate with and without appliance]

- Explain to the patient that the mirror needs to be warmed to prevent it from misting up, ensure it is not too hot before placing in the patient’s mouth.

- Ideally the magnification ratios should remain constant; however, if the full dentition will not fit within the frame at 1:2 then use 1:2.5 or 1:3 (see Figure 20b), also applicable to lower occlusal view. Make a note of the revised magnification to ensure that the images are comparable at the next photography session.
- If the entire dentition cannot be accommodated in one view then several images may be needed, see figure 20c.

- Open the lens aperture one stop or one and a half stops (at least f/22) to allow for the loss of flash coverage and intensity as it is a reflected mirror image. If the flash output is inadequate, then consider increasing ISO.

- If necessary, help the patient place the mirror into their mouth on the dorsum of the tongue; be careful not to push the mirror too far back as this could gag the patient. Generally, it is better for the child to do this themselves so that they can feel how far back they are pushing the mirror or ask a parent to help if necessary. Ensure the full dentition is included in the image (Figure 20c).

- 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, focus on the canines (x), see Figure 20d.
• Flare may result with some mirrors if the angle of the camera lens axis to the mirror is incorrect and is more common with acute-angled stainless steel mirrors, (Figure 20e). If the reflected image is too close to the ‘fold’ of the mirror this may also distort the image; these errors could potentially render the clinical usefulness of the image inadequate.

Figure 20e. Upper occlusal flare from mirror with acute angle (Chilton, 2018)

• Place one retractor inside the upper lip and pull forward and upwards, away from the anterior teeth, (Figure 20f). This will be needed in most patients with a cleft of the lip but may not be necessary in patients with an isolated cleft of the palate (without alveolar involvement).
Use as few intra-oral instruments as possible. It is important to reveal the entire dentition; however, patient comfort and tolerance must be taken into account – this is especially important with small children. As with the buccal views, if the patient has a small mouth or upper lip scarring it may be difficult to retract the upper lip and buccal mucosa. Retract the lip with fingers if it is not possible to use a retractor, (Figure 20g).

If the patient has a large mouth and/ or very fleshy lips, it may be necessary to use two retractors to hold the upper lip away from the teeth; ask the patient to try and smile, this will pull the buccal mucosa outwards and away from the teeth, (Figure 20h). With children, a colleague or the child’s parent will need to assist with this; provide them with gloves.
Focus on the occlusal surface of the teeth (rather than the palate), see Figure 20d. Ask the patient to hold their breath and take the shot as quickly as possible before the mirror starts to mist up. If a second shot is needed, the mirror may need to be re-warmed.

The image from the camera should be rotated through 180° and flipped horizontally in order to provide a true image, (Figure 20i).
**View 15 Lower occlusal mirror arch view to show lower dentition**

- Use scale of 1:2, 1:2.5 or 1:3. Ask the patient 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, pushing it in far enough to include the lower molars. Angle the mirror 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. Use one central retractor or two oblique retractors in the lower lip to pull the buccal mucosa away from the buccal surface of the teeth, see Figure 21a.

![Figure 21a. Positioning required for the lower occlusal view](image)

- Ask the patient to pull their tongue down to the back of their mouth or to the floor of the mouth to ensure that the tongue does not obscure the teeth. Ask the patient to try and smile to pull the buccal mucosa outwards and away from the teeth. Focus on the canines, see Figure 21b.

![Figure 21b. Lower occlusal focus points (x)](image)

- The image from the camera should be rotated through 180° and flipped horizontally in order to provide a true image, see Figure 21c.

![Figure 21c. Image rotated and flipped to show ‘true’ view](image)
Optional intra-oral views

2.4.8 Optional ‘True Lateral’ buccal mirror views: 23 and 24

Views 23 and 24    Right and left ‘True Lateral’ buccal mirror views

- Place a small buccal mirror in the patient’s mouth adjacent to the rear molars and gently move the buccal mucosa outwards (approximately 80°). Photograph the reflection of the teeth in the mirror, see Figure 22. Clinicians find this a useful view in addition to the normal buccal views of the teeth to demonstrate teeth occlusion. Flip the image 180° horizontally to present the image.
2.4.9 Optional overjet views: 25 and 26

Views 25 and 26  Teeth overjet views  1:1.5

- Aim is to demonstrate the under or overbite (malocclusion). In patients with a cleft the maxilla will often sit behind the mandible resulting in a Class III malocclusion; patients with a Class III malocclusion may find it difficult to achieve complete occlusion at the rear molars. see Figure 23a.

- Ask the patient to turn 90° laterally and ensure teeth are fully in occlusion. Use the retractors to expose teeth 1 to 4.

- Keep the occlusal plane horizontal and 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 lateral incisor, see Figure 23b.

Figure 23a. Class III Malocclusion  Figure 23b. Overjet view demonstrating retractor position and focus point (x)
2.4.10 Optional intra-oral view: 27

View 27 Alveolus view 1:2

- With the patient’s head in the same position as view 11, ask the patient to retract their upper lip and focus on the alveolar (gum) defect, see Figures 24a and 24b. A parent may need to help a young child with the retraction.

- Comparison of a bilateral cleft involving the alveolus with an unaffected alveolus, see Figure 24b.

- Additional imaging: 3D images may also be undertaken by medical photographers depending on resources available locally.
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### Cleft Audit Review Photographic Protocol

#### Core Views
- Facial Views: 1:8
- Lip/Nose Views: 1:4
- Intraoral Views: 1:2
- Occlusal (Upper and Lower Arch) Views: 1:2 or 1:2.5

#### Optional Views
- Facial Views: 1
- Lip/Nose Views: 1:1
- Teeth Mirror Views: 1:2
- Ovaloral Teeth Views: 1:1.5
- Alveolus View: 1:2

### Instructions
- Set lens to correct magnification and aperture
- Check lighting and background
- Gloves and intra-oral instruments ready
- Warm mirror
- Patient’s hair and collar pulled away from face
- Correct posture
- Align tragus
- Align camera
- Check positioning, retraction, framing
- Take the photograph
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- Figure 14b. Palmer’s Dental Notation for Children: deciduous teeth maxillary and mandibular dental arches occlusal surfaces
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- Figure 15b. Frankfort Plane in relation to teeth position
- Figure 16a. Dental mirrors (IMI, 2008)
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• Figure 20f. Upper occlusal retractor position
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• Quick Reference Guide
• Appendix 1: CRANE database: birth by cleft type
• Appendix 2: Anatomy of the face and mouth
References


Bibliography


IMI National Guidelines

Further reading

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Appendix 1. CRANE Database: births by cleft type

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>CL</th>
<th>CLP</th>
<th>UCLP</th>
<th>BCLP</th>
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Appendix 1. CRANE Database: births by cleft type. CRANE (2018)
### Appendix 2. Anatomy terms for the face and mouth

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tr>
<td>Buccal</td>
<td>relating to the cheek, or the surface of the teeth facing toward the cheek.</td>
</tr>
<tr>
<td>Buccal mucosa</td>
<td>the mucous membrane of the inner cheek.</td>
</tr>
<tr>
<td>Columella</td>
<td>fleshy external termination of nasal septum.</td>
</tr>
<tr>
<td>Gingiva(e)</td>
<td>gum(s).</td>
</tr>
<tr>
<td>Glabella</td>
<td>most forward projecting point of the forehead in the midline of supraorbital ridges.</td>
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<tr>
<td>Lingual</td>
<td>relating to the tongue, or the surface of the teeth facing toward the tongue.</td>
</tr>
<tr>
<td>Labial</td>
<td>the surface of the teeth adjacent to the lips.</td>
</tr>
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</table>
| Malocclusion       | relationship between maxilla and mandible, problem in the way the upper and lower teeth fit together in biting and chewing; it may be present with crooked, crowded or protruded teeth. It can affect a person's dental health or appearance.  
  - Class I: bite is normal, upper teeth slightly overlap lower teeth  
  - Class II: retrognathism or overbite, upper teeth severely overlap mandible and lower teeth  
  - Class III: prognathism or underbite, mandible protrudes forward causing mandible and lower teeth to overlap maxilla and upper teeth. |
| Maxilla            | the upper jaw.                                                              |
| Mandible           | the lower jaw.                                                              |
| Occlusal           | of or relating to the grinding or biting surface of a tooth.               |
| 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  
  - hard palate: bony area of the palate  
  - hard palate: soft, non-bony area of the palate |
| Uvula              | pendent fleshy lobe in the midline of the posterior border of the soft palate.  
  - bifid uvula: bisected/ grooved uvula. |

Appendix 2. Anatomy terms for the face and mouth
End