

Diagnostic records

Diagnostic aids include the use of:

1. Study models.
2. Photography.
3. Radiography.
4. 3D imaging.

Study models:

Study models should show all the erupted teeth and be extended into the buccal sulcus. They are poured in dental stone and typically produced from alginate impression.

Dental casts for orthodontic purposes are usually trimmed, so that the bases assumed in a symmetrical shape & then they are polished. This trimming will aid to detect the asymmetry within the dental arches & to analyze arch form.

The study model provide a good help to examine the teeth from facial and lingual aspect during articulation, in addition to the possibility of the space analysis on the study model & the size selection of the orthodontic bands. The study model used for modulation due to treatment & the explanation of that for the patient or parents.

Note: Computerized software are commercially available which are capable of scanning study models and storing the scanned data as 3D images. The scanned data is calibrated to the actual size of the study models. Hence, certain model analyses can be done directly on the computer. The biggest advantage of this system is to allow storage of valuable information contained in these 3D records, which otherwise may be lost due to the plaster study model breaking.

Photography:

Photographs can be:

- Extra oral photographs.
- Intraoral photographs.

Extra oral photographs:

Four extra oral (in natural head position):

- Full facial frontal at rest.
- Full facial frontal smiling.
- Facial three-quarters view.
- Facial profile.

Uses of extra oral photographs:

1. Evaluation of craniofacial relationships and proportions before and after treatment
2. Assessment of soft tissue profile
3. Detection and recording muscle imbalances
4. Detecting and recording facial asymmetry
5. Identifying patients

Note: during taking extra oral photographs for your patient:

1. The Background should be free of distractions.
2. Quality lightening revealing facial contours with no shadows in the background.
3. Ears of your patient are exposed for purpose of orientation.
4. Eyes open and looking straight ahead with glasses removed.

Intraoral photographs:

Five intra oral view, which include:

- One frontal photograph in maximum intercuspation.
- Two lateral views-right and left.
- Two occlusal views-upper and lower.

Uses of intra oral photographs:

1. Recording the structure and color of enamel.
2. Patient motivation.
3. Assessing and recording health or disease of the teeth and soft tissue structures.
4. Monitoring of treatment progress.
5. Studying of relationships before, immediately following and several years after treatment, to improve treatment planning

The requirements for intraoral photographs include:

1. High quality and standardized intraoral color prints.
2. Photographs should be oriented accurately in all three planes of the space.
3. Free of distractions - retractors, labels etc.
4. Quality lightening revealing anatomical contours and free of shadows.
5. Tongue should be retracted posteriorly.
6. Free of saliva and/or bubbles.
7. Clean dentition.

Radiography:

Radiographs commonly used in orthodontic assessment

- ✓ Orthopantomograph.
- ✓ Cephalometric lateral skull radiograph (next lecture).
- ✓ Periapical radiographs.
- ✓ Bitewing radiographs.
- ✓ Upper standard occlusal radiograph.
- ✓ Hand wrist radiographs.

orthopantomograph

❖ *Uses of orthopantomograph:*

1. For growth & development studies: Delayed tooth eruption, abnormality in eruption path, abnormal resorption, supernumerary teeth, cysts, congenitally absent teeth, ankylosis, prolong retention, density of the bone, axial inclination, inadequate space of the clinical entities that concerning to the general practitioner or orthodontist, and distant from apices to mandibular plane.
2. The temporomandibular joint, the OPG provides a sharp & accurate profile view of the condyle & the articular eminence of the articular fossa itself.
3. Sinuses & mastoid region: the importance of maxillary sinuses is very recognized by orthodontist since a reduced sinuses size related to mouth breather & collapse of maxillary segments.
4. Mandibular morphology: the OPG gives a clear picture about the bony mass of the mandible, the extent of the alveolar bone, height & width of the ramus. "All of these information are important in regards of

orthodontic treatment”, good survey for the teeth present & absent is clear in addition to the presence of any supernumerary teeth or any pathology.

5. Space adequacy: the OPG of great benefit during the serial extraction procedure which require the removal of some deciduous teeth followed by some permanent teeth (usually the fours) and this require knowledge about the stages of root formation of the teeth.
6. Investigation of facial asymmetries and swelling.
7. Suspected fractures of mandible and maxilla.

❖ **Advantages of the OPG:**

- 1- Comfort, since no film will be inserted inside the patient mouth. And the total time needed not exceed 1 1/2 min to perform the x- ray.
- 2- It is more easy for the operator when he has uncooperative patients, children patient with gagging reflex or trismus
- 3- Least total radiation in comparison with periapical x - ray.

❖ **Disadvantages of the OPG:**

- 1- It cannot give precise information on periodontal membrane.
- 2-The lower incisors region is not properly reproduced due to some overlapping as a result of shifting in the axis of rotation. Additionally the inclination of the lower incisors is usually slanted with the crown mesially inclined.

Intraoral Periapical Radiographs

They are ideal for the detection of anomalies related to changes in tooth structure and /or the lamina dura and/ or the periapical region.

They are recommended for:

1. Adult cases with periodontal disease.
2. Evaluation of the dental health of the deciduous and/or permanent teeth periapically.
3. Detection of pathologic conditions in the early stage especially dental caries.
4. Assessment of traumatized teeth after an injury (especially root fractures).
5. Calculation of the total space analysis.
6. Detection of root resorption, before during and after treatment.

Bitewing Radiographs

Bitewing radiographs are used primarily to record the coronal portion of the upper and the lower posterior dentition. They are used for:

1. The detection of proximal caries

2. The study of interdental bone height
3. The detection of secondary caries under restorations
4. The detection of overhanging margins of proximal restorations.

Intraoral Occlusal Radiographs

They are useful in localization of impacted teeth or for the study of the labio-lingual position of the root apices in the anterior segments of the upper and the lower dentition.

Hand wrist radiographs

The hand-wrist region is made up of numerous small bones. These bones show a predictable and scheduled pattern of appearance, ossification and union from birth to maturity. Hence, this region is one of the most suited to assess skeletal age.

3D imaging:

Conventional computed tomography (CT) imaging involves the use of rotating x-ray equipment, combined with a digital computer, to obtain images of the body. Using CT imaging, cross-sectional images of body organs and tissues can be produced.

Their use in orthodontic treatment has been limited due to the following reasons:

1. The dose of ionizing radiation has been high.
2. Economically costly.
3. Slices of relatively thick.
4. Distortions are produced if CT scans are done with orthodontic appliances in place.

Cone beam computed tomography (CBCT)

CBCT is a faster, more compact version of traditional CT with a lower dose of radiation. Through the use of a cone-shaped X-ray beam, the size of the scanner, radiation dosage and time needed for scanning are all dramatically reduced. The 3D views produced may be useful in certain orthodontic cases:

1. Accurate location of impacted teeth and a more accurate assessment of any associated pathology, particularly resorption of adjacent teeth.
2. Assessment of alveolar bone coverage.
3. Assessment of alveolar bone height and volume (which may be relevant in potential implant cases).
4. TMJ or airway analysis.

Although the radiation dose is considerably smaller than conventional CT scanning, the dose is still higher than for the conventional radiographs. At the present time CBCT should therefore only be used when conventional radiography has failed to give, or is very unlikely to give, the necessary diagnostic information. Other 3D imaging techniques are also being developed for use in orthodontics, such as optical laser scanning and stereo photogrammetry.

Uses of CBCT technology and implications for treatment in the future:

Cone beam computed tomography (CBCT) now allows the acquisition of detailed 3D images of the face in high resolution. Using this 'virtual' 3D information, software is being developed that could revolutionize the way that orthognathic planning and surgery is undertaken. In dentistry we are familiar with the use of CAD/CAM (computer-aided design/computer-aided manufacture) for the manufacture of complex 3-dimensional restorations. Computer-aided surgery (CAS) is now being introduced that will allow surgical planning and simulation using the information captured from CBCT.

This technology offers a number of potential exciting possibilities:

- ✓ A more detailed appreciation of the anatomy of the patient in three dimensions.
- ✓ The data from CBCT can be combined with the data captured from 3D facial camera systems. This allows the clinicians to see the relationship of the soft tissues with the underlying hard tissues.
- ✓ Virtual surgery will allow the surgeon to calculate the most appropriate and safest osteotomy lines in advance of the operation.
- ✓ This virtual setup can be used to manufacture positioning splints and construct customized fixation plates.