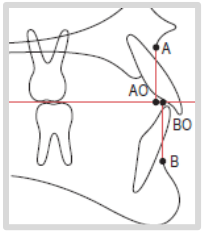
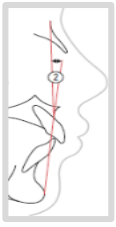




Diagnostic (Orthodontic) records:

Clinical orthodontic records are used primarily for diagnosis, monitoring of growth and development, and are a medico-legal requirement. They provide an accurate representation of the patient prior to orthodontic treatment, demonstrate treatment progress and allow communication between orthodontists, other healthcare professionals and the patient. Records also play an important role in research and clinical audit. It is essential that accurate clinical records are taken before commencing orthodontic treatment.

Study models

Impressions showing all the erupted teeth, full depth of the palate and good soft tissue extension are needed. These can be taken in alginate for study models and poured in dental stone. *The study models provide a good help to examine the teeth from the facial and lingual during articulation, in addition to the possibility of the space analysis on the study models and the size selection of the orthodontic bands. The study model also used for modulation due to treatment and explanation of that to the patients*. Accurate digital study casts are also now available, which have the advantages of occupying no physical storage space and having no deterioration over time, enabling indefinite storage.

Clinical photographs

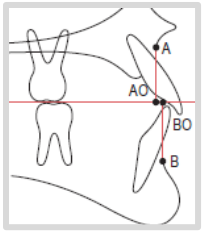
Good clinical photographs form an essential part of the clinical record. The following views should be taken:

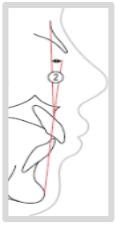
• *Intraoral, taken with the occlusal plane horizontal:*

• Frontal occlusion • Buccal occlusion (left and right)

• Maxillary dentition • Mandibular dentition.

• *Extraoral, taken against neutral background in natural head posture:*



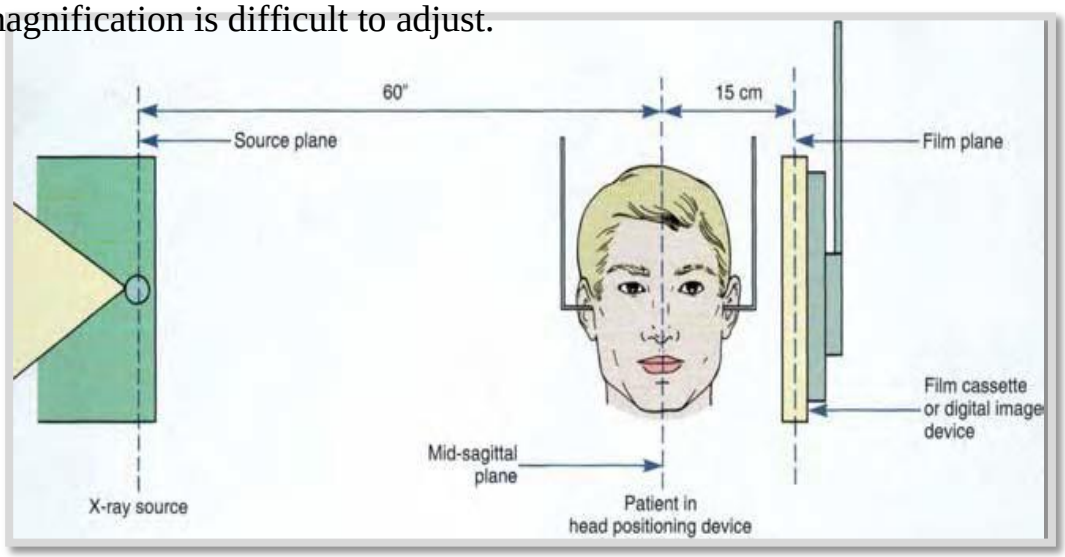


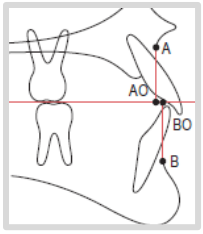
Cephalometrics

A cephalometric lateral skull radiograph is a specialized view of the facial skeleton and cranial base from the lateral aspect, with the head position at a specific distance from the film. This method aims to study a various component of the face and relate them to the cranium to see whether there is a balance and harmony between these components or not.

Radiographic assessment is based on the method of standardized cephalometric radiography pioneered by *Broadbent and Hofrath in 1931*. The purpose of this radiographic technique is to produce standardized radiographs of the head, and the equipment consist of a cephalostat, which holds the head in a predetermined position, an X-ray tube and a film.

These three components are maintained in a fixed relationship to each other, so that any angulation and magnification is standardized. By this method, hence it will be easier to compare the cephalometric radiographs of one patient taken on different locations, or those of different individuals. The cephalostat contains two ear-rods which fit into the external auditory meati of the subject and a nasal rod. The X-ray tube and the film are aligned so that, when filming a lateral view of the head, the central beam of the X-rays passes through the two ear pieces. The distances from the tube to the patient (usually between 5-6 feets) and from the patient to the film (usually around 1-foot) entirely successful to reduce the magnification, which is usually of the order from 7-8%, such a magnification is difficult to adjust.





Indications for cephalometric evaluation:

A)An aid to diagnosis

It is possible to carry out successful orthodontic treatment without taking a cephalometric radiograph, particularly in class I malocclusions. However, the information that cephalometric analysis yields is helpful in assessing the probable etiology of a malocclusion and in planning the treatment. Therefore, a lateral cephalometric radiograph is best limited to patients with a skeletal discrepancy and/or where anteroposterior movement of the incisors is planned.

In a small proportion of patients, it may be helpful to monitor growth to aid the planning and timing of treatment by taking serial cephalometric radiographs. Also it is often helpful in the accurate localization of unerupted displaced teeth and other pathology.

B) A pretreatment record:

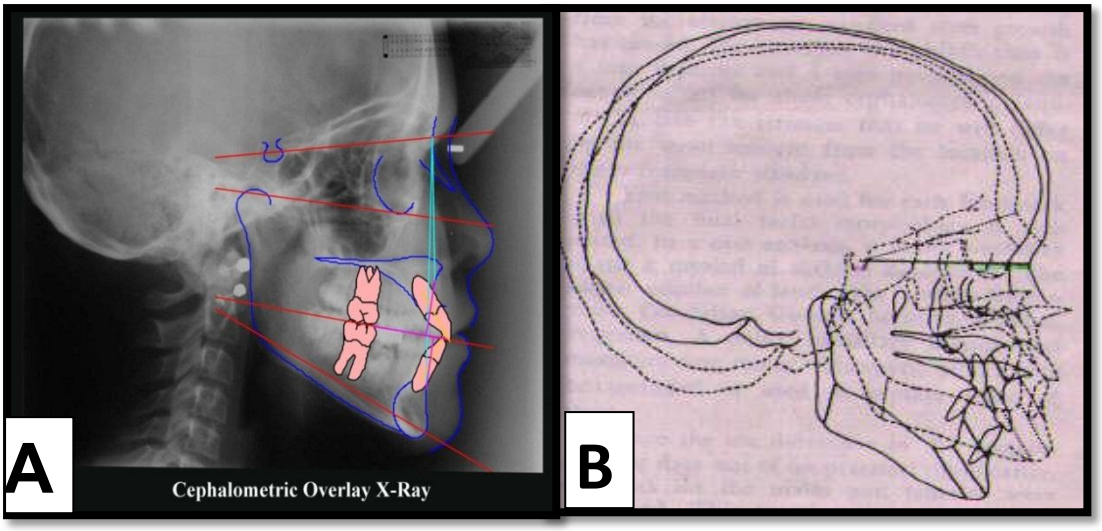
A lateral cephalometric radiograph is useful in providing a baseline record prior to the placement of the appliances, particularly where movement of the upper and lower incisors is planned.

C) Monitoring the progress of treatment:

In the management of sever malocclusions, where tooth movement is occuring in all three planes of space (for example treatment involving functional appliances, or upper and lower fixed appliances), it is common to take a lateral cephalometric radiograph during treatment to monitor anchorage requirements and incisor inclinations. Also it is useful in monitoring the movement of unerupted teeth and is the most accurate view for assessing root resorption if this occurs during treatment.

D)Research purposes:

A great deal of information has been obtained about growth and development by longitudinal studies which involved taking serial cephalometric radiographs from birth to the late teens or beyond.



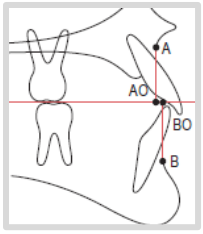
In the cephalometric assessment, certain carefully defined points are identified and linear and angular measurements are made from these points.

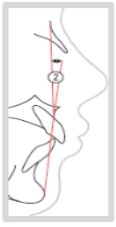
The points location and measurements have been performed simply by tracing outlines on the skull radiograph and measuring by hand, but systems are now available for computer analysis of skeletal form after the manual plotting of co-ordinates on the radiograph. More recently methods of automatic scanning of radiographs are being investigated, to avoid the need for manual point location, which is the source of most of the errors in cephalometric methods.

Some of the most commonly used cephalometric points and lines on the lateral skull radiograph.

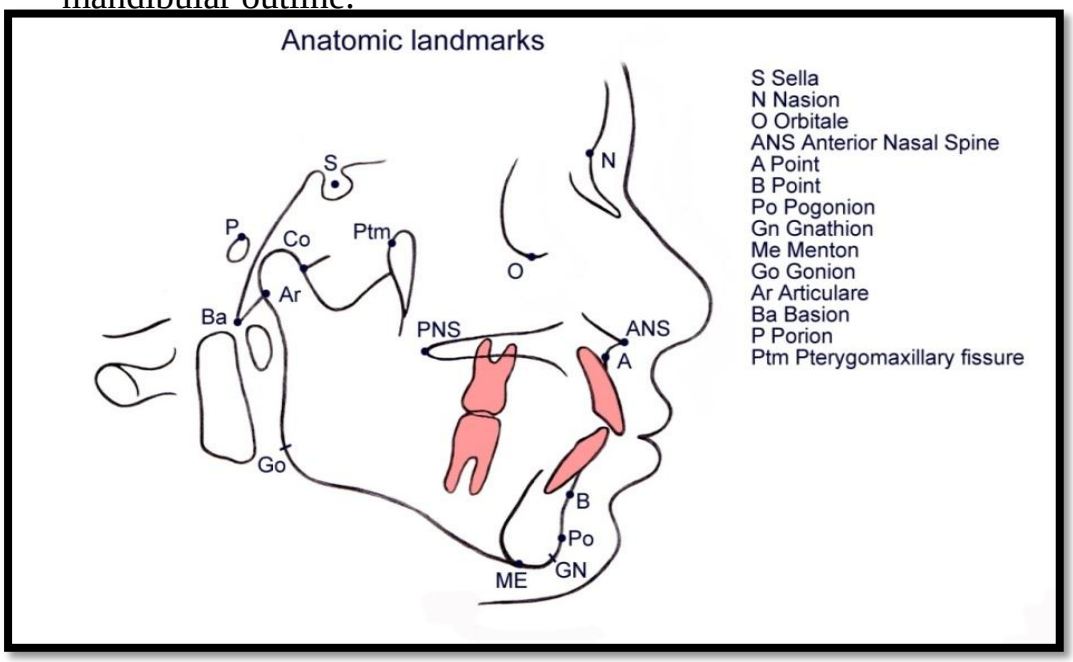
Cephalometric points

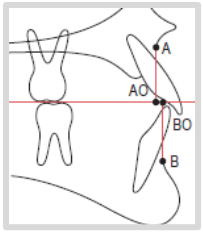
- ***Porion:*** The highest point on the margin of the external auditory meatus.
- ***Articulare:*** The point of intersection of the outlines of the posterior border of the mandible and the inferior border of the temporal bone.
- ***Bolton:*** The highest point in the concavity of the fossa behind the occipital condyle.
- ***Basion:*** The lowest point on the anterior margin of the foramin magnum in the mid-line.
- ***Pterygomaxillary point:*** The lowest point of the outline of the pterygomaxillary fissure.
- ***Sella:*** The center of the shadow of sella turcica.





- ***Nasion:*** The junction of nasal and frontal bones in the mid-line.
- ***Orbitale:*** The lowest point on the infra-orbital margin.
- *Point **A** (subspinale):* The most posterior point of the concavity on the anterior surface of the premaxilla in the mid-line, below the anterior nasal spine.
- *Point **B** (supramentale):* The most posterior point of the concavity on the anterior surface of the mandible in the mid-line, above the pogonion.
- ***Anterior Nasal Spine (ANS):*** The most anterior projection of the premaxilla in the mid-line below the nasal cavity.
- ***Posterior Nasal Spine (PNS):*** The most posterior projection of the hard palate in the mid-line.
- ***Pogonion:*** The most anterior point on the bony chin.
- ***Gnathion:*** The most inferior and anterior point on the bony chin, where the bisector of the angle made by the vertical and horizontal tangents to the chin meets the mandibular outline.
- ***Menton:*** The most inferior point on the lower border of the mandible where the shadow of the lower border of the mandible meets the shadow of the cross-section of the mandibular symphysis.
- ***Gonion:*** The most inferior and posterior point at the angle of the mandible, where the bisector of the angle between tangents to the inferior and posterior borders of the mandible meets the mandibular outline.





It will be appreciated that some of these points are in the mid-sagittal plane, and are therefore single points, while others, such as orbitale and gonion, are bilateral points. On a true lateral radiograph the bilateral points should be superimposed, and should therefore appear as a single point, but owing to facial asymmetries this is not always the case. If any bilateral point appear separately on the radiograph, it is conventional to accept a point half-way between the two as being the correct position.

The significance of certain points should also be appreciated. The lines Nasion-Sella and Sella-Basion broadly represent the slope of the center of the anterior and middle cranial bases, respectively. Point A and point B also represent the anterior surfaces of the tooth-supporting dental bases of the maxilla and mandible, respectively. The Pterygomaxillary point at the posterior surface of the maxillary antrum, represents the posterior end of the tooth bearing area of the maxilla. Other points are joined to form cephalometric lines, which are used for measurement and alignment of the head in growth and other studies.

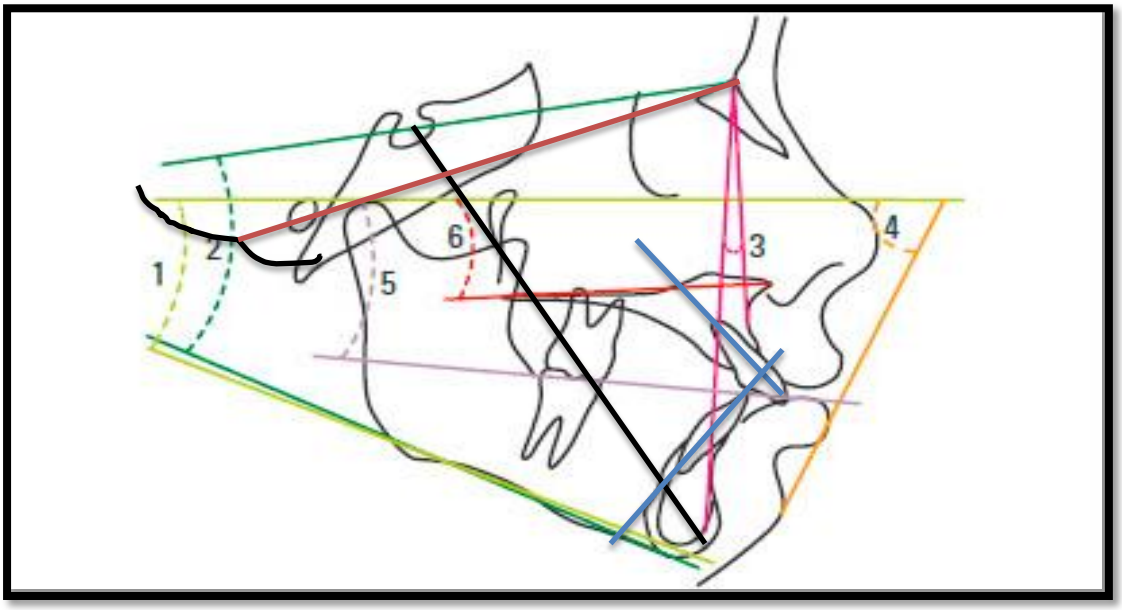
Cephalometric lines

It has been conventional for many years to refer to the various reference lines constructed by joining points on lateral skull radiographs as cephalometric planes. However, since a plane has two dimensions while a line drown on a radiograph has only one dimension, it is more accurate to refer to cephalometric lines. The following is a descriptive list of the more commonly used reference lines. There are many different systems of cephalometric analysis, and other reference lines are sometimes used.

- ***Frankfort line:*** The line joining the orbitale and porion. This is accepted by convention as the horizontal line of the head, and is commonly used for orientation of the head in clinical and radiographic assessments.
- ***Maxillary line:*** The line joining the anterior nasal spine and the posterior nasal spine. This line is sometimes used instead of the frankfort line in radiographic assessment, particularly as the frakfort line is sometimes difficult to locate accurately on a radiograph. However, the maxillary line does not bear any fixed

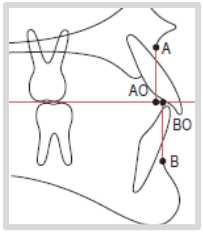
relationship to the frankfort line, and the two lines are not usually parallel. The maxillary line cannot of course, be assessed clinically.

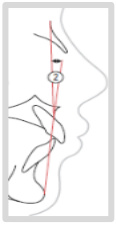
- ***Mandibular line:*** The line joining gonion and menton. It represents the line of the lower border of the mandible, and can roughly be assessed clinically.
- ***Sella-Nasion line:*** The line joining the center of the sella turcica and the nasion. It is used to represent the anterior cranial base, to which the position of the jaws and teeth are often related in cephalometric analysis.
- ***Facial line:*** The line joining nasion and pogonion. The angular relationship between the facial line and the frankfort line is used as a measurement of mandibular prognathism.
- ***Occlusal line:*** The line from the mid-point between the tips of the upper and lower incisors to the anterior contact between the upper and lower first molars in occlusion.
- ***Bolton line:*** The line joining the bolton point and the nasion.
- ***Y-axis:*** The line from sella to gnathion.



- ***De-Coster line:*** The outline of the internal surface of the anterior cranial base from the anterior border of the sella turcica to the endocranial surface of the frontal bone.

Three further reference lines are sometimes used, particularly in treatment planning, to assess the aesthetic qualities of the facial profile and tooth position:





- ✓ ***The A-pogonion line:*** Is a line joining A point and the pogonion. It is claimed that in ideal skeletal and occlusal form the incisal tips of the lower central incisors should lie on or near to this line. It is a useful guide in treatment planning, but it must be remembered that this line does not necessarily represent a position of stability for the lower incisors, particularly if the skeletal relationship in the sagittal plane is not ideal.
- ✓ ***The aesthetic line:*** Is a line joining the most anterior points of the tip of the nose and the chin. It is claimed that, for good aesthetic profile qualities, the anterior border of both upper and lower lips should lie on or close to this line.
- ✓ ***The Holdaway line:*** Is a line joining the anterior borders of the upper lip and the chin. Again, it is claimed that for good aesthetic profile qualities, the anterior border of the lower lip should lie on or close to this line.

It will be appreciated that the last two lines mentioned above have soft tissue landmarks and relate to lip position. They are therefore subject to soft tissue variation, such as lip muscle thickness and tone, and although they will be modified by variation in the skeletal relationship, and in tooth position although with a relatively smaller effect. Furthermore, they are related to aesthetic qualities, and beauty is in the eye of the beholder.

❖ *Cephalometric norms for Caucasians (Eastman standard)*

Measurement	***Mean value (in degree)***
SNA	81 +3
SNB	78 +3
ANB	3 +2
U Inc to Mx Pl	109 +6
L Inc to Mn Pl	93 +6
IIA	135 +10
MMPA	27 +4

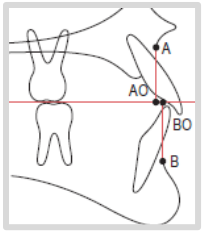
Other Diagnostic records:

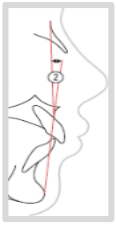
Orthopantomographs(OPG)

Exactly after the Second World War, Pattero of Finland turned to body section radiography or tomography (laminagraphy) for better radiographic visualization of craniofacial structures. It is possible to obtain radiographic image of a particular area, or a layer within 3 dimensional subject by carefully synchronizing the movement of the source of radiation and the film.

With both the X-ray beam source and the film cassette rotating, everything else is thrown out of focus except the precise level of structures of interest. The parts that in focus will appear in sharp details, while the intervening structures are blured out. The exposure factors are (80-86 KVP with 15-20 milliampers and short exposure time about 15 second, depending on the machine type).

Up to date OPG, as soon as the patients symptoms are associated with the mandibular joints and/or the maxillary sinuses you have no option other than extending the scope of X-ray investigation to these regions. Such applications are beyond the capabilities of conventional panoramic X-rays unit.





Advantages of OPG

1)*Comfort*, since no film will be inserted inside the patients mouth. and the total time needed to perform the X-ray not exceed 1.5 min.

2) *It is more easy* for the operator when he has uncooperative patients, children patient with gagging reflex and trismus (lock jaw).

3) *Least total radiation* (5.06 rad) in comparison with periapical X-ray.

Disadvantages

1)It cannot give precise information on periodontal membrane. The intaoral radiograph provide more accurate information about the .....

2) The lower incisors region is not properly reproduced due to some overlapping as a result of shifting in the axis of rotation. Additionally their inclination is usually slanted with the crown mesially inclined.

Uses of OPG

A...For growth and development studies: Delayed tooth eruption, abnormality in eruption path, abnormal resorption, supernumerary teeth, systs, 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 the mandibular plane.

B...The Tempromandibular joint: The OPG provides a sharp and accurate profile view of the condyle and the articular eminence of the articular fossa itself.

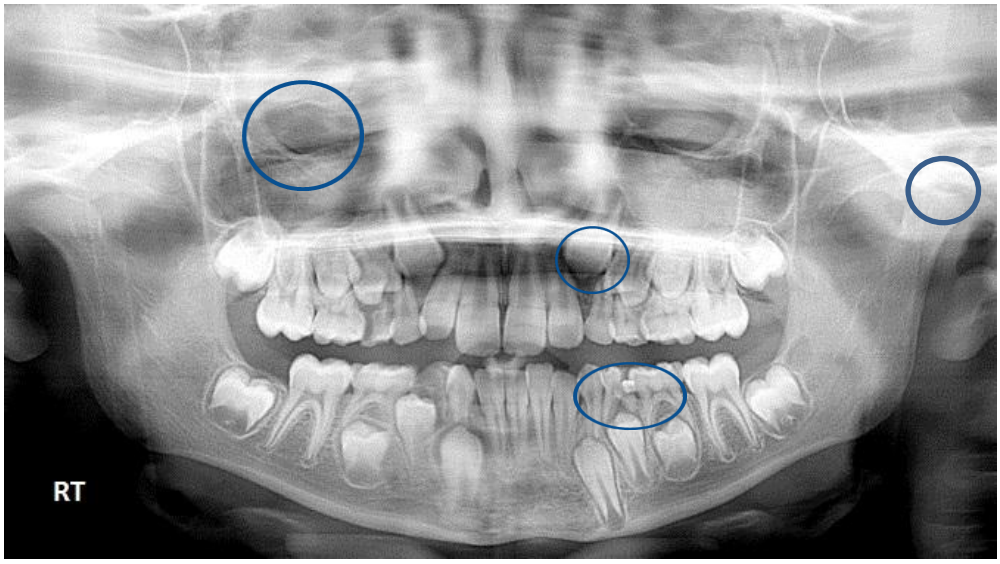
C...Sinuses and mastoid region : The importance of maxillary sinuses is very recognized by orthodontist since a reduced sinuses size related to mouth breather and collapse of maxillary segments.

D...Mandibular morphology: The OPG gives a clear picture about the bony mass of the mandible, the extent of the alveolar bone, height and width of the ramus.

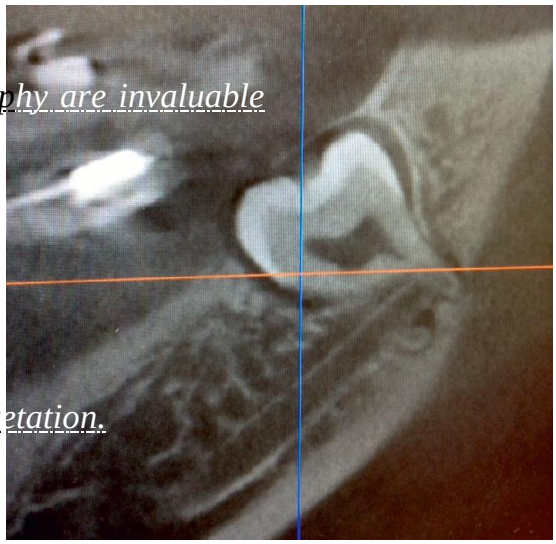
E...Space adequacy: The OPG of great benefit during the serial extraction procedure which require the removal of some deciduous teeth followed by some permanent teeth (usually the first premolars) and this require knowledge abouit the stages of root formation of the teeth.

F...Investigation of facial asymmetries and swelling.

G...Suspected fractures of the mandible and maxilla.



Three-dimensional imaging



Plain film and cephalometric radiography are invaluable for accurate diagnosis and treatment planning, but they only provide a two dimensional image of a three-dimensional structure, with all the associated errors of projection, anatomical superimposition, landmark identification, measurement and interpretation.

Cone-beam computed tomography

Imaging of the hard tissues composing the jaws and dentition using conventional computed tomography (CT) is largely impractical, due to the high radiation dosage, lack of resolution and significant cost. The introduction of cone-beam computed tomography (CBCT) has resulted in the dosage being reduced and the resolution significantly improved, with its adaption and refinement for imaging of the teeth and jaws now providing a useful three-dimensional diagnostic tool.