Diagnostic Aids

1-Study Models:

INTRODUCTION

Orthodontic study models are essential diagnostic records, which help to study the occlusion and dentition from all three dimensions. They are accurate plaster reproductions of the teeth and their surrounding soft tissues.

IDEAL REQUIREMENTS OF ORTHODONTIC STUDY MODELS

1. Models should accurately reproduce the teeth and their surrounding soft tissues.

2. Models are to be trimmed so that they are symmetrical and pleasing to the eye and so that an asymmetrical arch form can be readily recognized.

3. Models are to be trimmed in such a way that the dental occlusion shows by setting the models on their backs.

4. Models are to be trimmed such that they replicate the measurements and angles proposed for trimming them.

5. Models are to have clean, smooth, bubble-free surfaces with sharp angles where the cuts meet.

6. The finished models should have a glossy mar-proof finish.

WHY WE MAKE STUDY MODELS?

1. They are the only three dimensional records of the patient's dentition.

2. Occlusion can be visualized from the lingual aspect.

3. They provide a permanent record of the intermaxillary relationships and the occlusion at the start of therapy; this is necessary for medicolegal considerations.

4. They are a visual aid for the dentist as he monitors changes taking place during tooth movement.

5. Help motivate the patient, as the patient can visualize the treatment progress.

6. They are needed for comparison at the end of treatment and act as a reference for post-treatment changes.

7. They serve as a reminder for the parent and the patient of the condition present at the start of treatment.

8. In case the patient has to be transferred to another clinician, study models are an important record.

USES OF STUDY MODELS

1. Assess and record dental anatomy

2. Assess and record intercuspation

3. Assess and record arch form

4. Assess and record the curves of occlusion

5. Evaluate occlusion with the aid of articulators

6. Measure progress during treatment

7. Detect abnormality, e.g. localized enlargements, distortion of arch form, etc.

8. Calculate total space requirements/discrepancies

9. Provide record before, immediately, after and several years following treatment for the purpose of studying treatment procedures and stability.

DIS ADVANTAGES OF STUDY MODELS

1- Liable to fracture
2- Takes too much space in storing

PARTS OF THE STUDY MODELS

The study models can be divided into two parts for the purpose of description:

• The anatomic portion

• The artistic portion

• The anatomic portion is that part which is the actual impression of the dental arch and its surrounding soft tissue structures. This is the part, which must be preserved when trimming the model.

• The artistic portion is the stone base supporting the anatomic portion. This portion is trimmed in a manner, which depicts, in a general way, the dental arch form and is pleasing to the eye.

STUDY MODEL FABRICATION AND TRIMMING

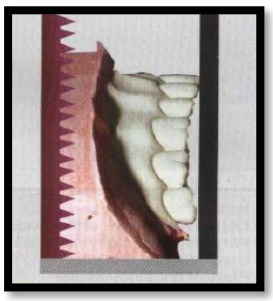
Preliminary procedures in the fabrication of study models are:

1. Remove any excess flash or obviously excessive bulk on the periphery of the models

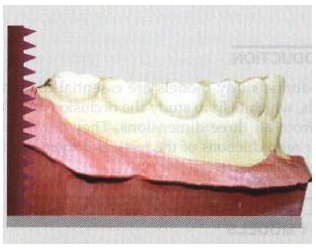
2. Remove any nodules that may be present on the occluding surfaces of the teeth

3. Remove any extensions in the posterior areas that prevent occluding of the models

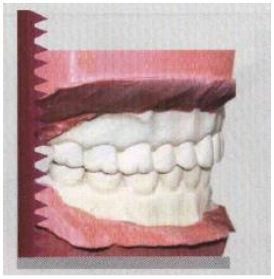
4. Using the wax bite, occlude the models.



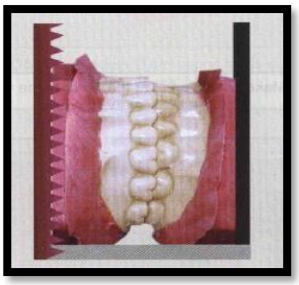
1- Trim lower base parallel to occlusal plane



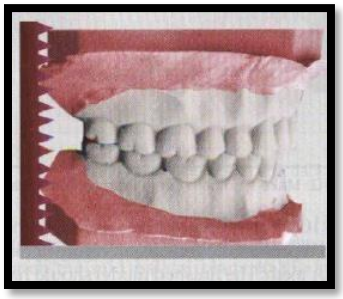
2- Trim lower back perpendicular to base



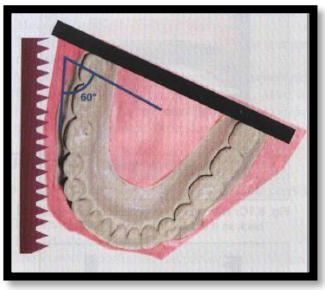
3-With models in occlusion, trim upper back so it is flush with the lower back



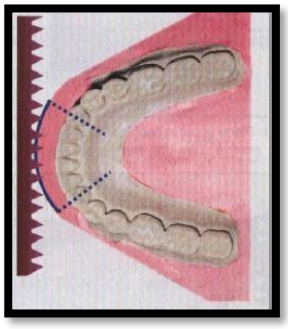
4- Place upper model (on its back) on the model trimmer. Trim until the top base is flat



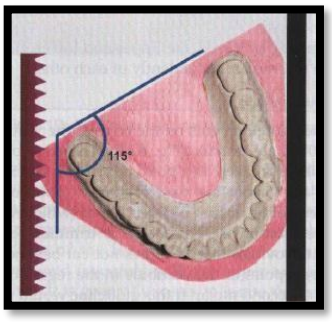
5- Occlude models. Check bases for parallelism, backs for flush plane



6- Make buccal cuts, at the edge of the vestibule 60° to the base of the model

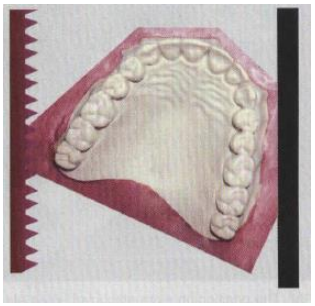


7- Make a smooth curve from canine to canine In lower models

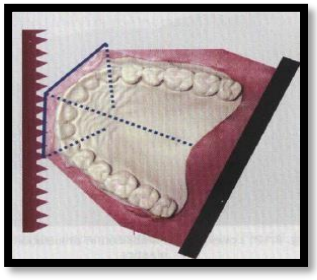


8- Move model trimmer guide to its extreme Position to make the heel

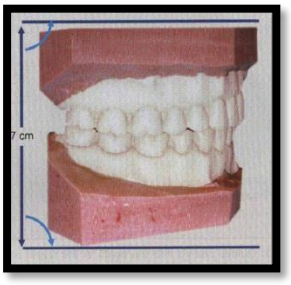
9-Make buccal cuts. at the edge of the vestibule 60°to back of the upper model



10- Occlude models. Trim upper heels so they are flush with lower heels



11- Make anterior cuts. the ends of which should be at the midline and the middle of each canine



12- Occluded models should have a sharp 90° angle between their base and back

Finishing the Models

1-The surface must be made smooth, remaining at the same time absolutely flat and at right angles to the bases of the models.

2-The finishing process should not change the dimensions or any of the angulations of the models.

3- After the surfaces have been finished, and the exact dimensions achieved, the model is set aside to dry for 48 hours or dried overnight in an orthodontic oven.

4- At this point the model should be labeled with the patient's name and date on the backs of both the upper and lower models.

5-The final glazing is put on the models by immersing them in a commercial gloss. The models are allowed to remain in this solution for one-half hour.

6-Holding each arch under cold water, the models are polished and soap solution removed by buffing with cotton.

7-The models are set on their occlusal surfaces to dry for another twelve hours, then buffed with a very light but rapid motion using cotton. The models should assume a high, even luster which will then resist soiling while handling.

Handling of the study models:

The models should be placed on a flat surface with their backs down. They should be picked up together and always returned together. Individual handling of the models is more likely to result in damage to the models.

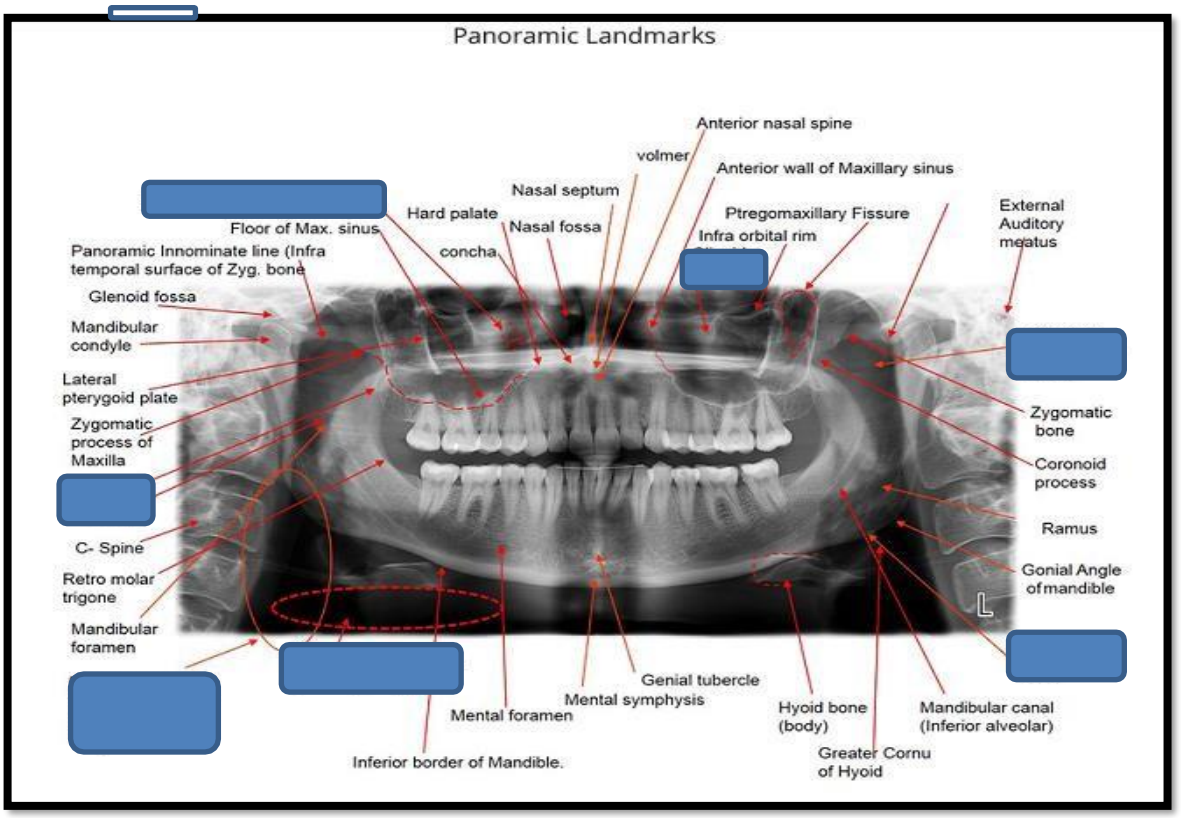
2- ORTHOPANTOMOGRAM:

(Known as an orthopantomography (OPG), pantomogram, OPT or panaromic radiograph).

It is a panoramic, two-dimensional (2-D) x-ray that captures the entire mouth in a single image, including the teeth, upper and lower jaws, surrounding structures. It is often encountered in dental practice and occasionally in the emergency department; providing a convenient, inexpensive and rapid way to evaluate the gross anatomy of the jaws and related pathology.

The orthopantomogram is considered an essential diagnostic aid and should be examined prior to undertaking any orthodontic treatment. OPG was is not always available routinely in dental clinics and the patient may require to be referred to special X-ray centers (in the past), nowadays, it become more available and may be present in most of dental clinics.

Earlier, before the advent of the OPCs, the IOPAs along with the bitewing radiographs were the main stay for an orthodontist.



Advantages of an orthopantomogram

1-A large anatomic area is visualized in a single image

2-These are probably the most frequently preserved records of any orthodontic case in areas where this facility is available

3.The radiation exposure is low, less than that for four IOPAs

4.Patient cooperation is rarely a problem

5.Inter-operator variation is minimal

Disadvantages of an orthopantomogram

1. Specialized equipment is required, needs extra space, so it is rather expensive than periapical x-ray .

2. Distortions, magnifications and overlapping of structures are a problem

3. lOPAs may still be required

4. It provides less sharp images and less accurate information about dental and oral diseases than regular intraoral periapical or bite-wing radiographs.

For any student of orthodontics, it is essential to be able to correctly read and interpret an orthopantomogram. It is advised that while reading an orthopantomogram a correct protocol must be followed so as not miss out any important diagnostic details. The most convenient and simple method is presented below.

Step 1

Orient the radiograph as when looking at the patient, i.e. with the patient's left side positioned on the clinician's right. The radiograph is then placed on a view box. It is preferred to dim the remaining lights in the room.

Fig 1. OPG viewer

Step 2

Start examining from the right condylar head and follow the outline along the neck and the posterior border of the ramus. Continue following the outline of the mandibular body to the symphyseal region anteriorly along the lower border of the mandible to the left condyle. Compare the outline for discontinueties, radiopacities or radiolucencies and most importantly from an orthodontic perspective for symmetry. Asymmetry may result from faulty positioning of the patient or that of the cassette in its holder. Note the thickness and density of the mandibular cortex and the other structures including the mandibular canals, mental foramina, and the coronoid process.

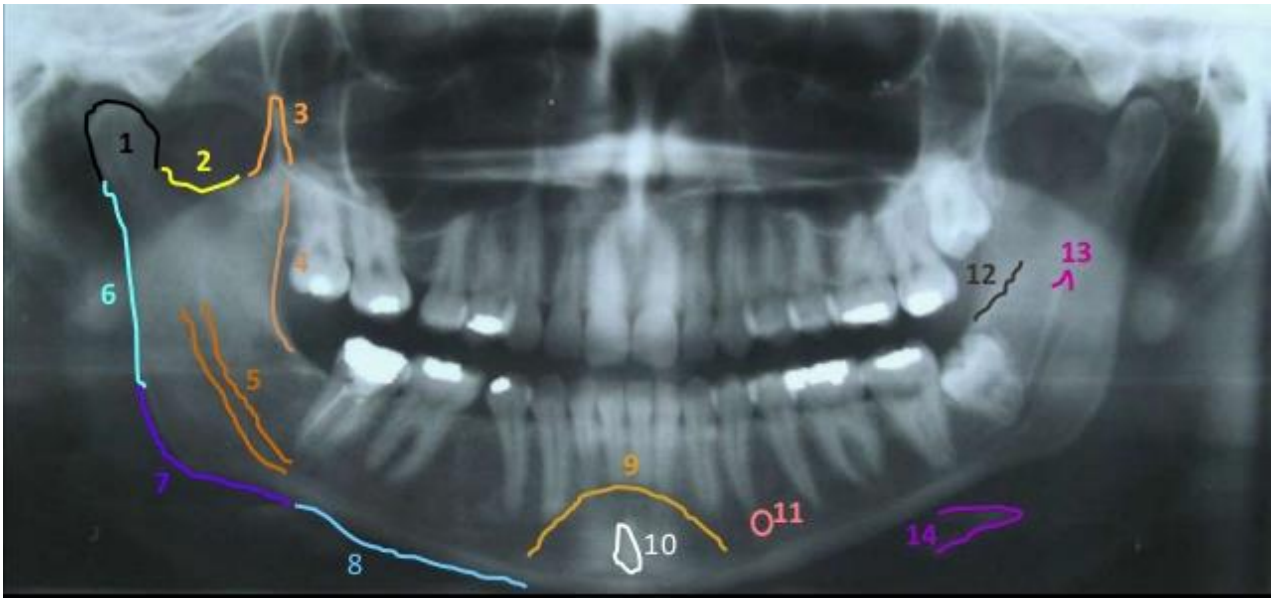


Fig. Bony landmarks in mandible 1. Condylar head 2. Sigmoid notch 3. Coronoid process 4. External oblique ridge 5. Mandibular canal 6. Posterior border of ramus 7. Gonial angle 8. Lower border of mandible 9. Mental ridge 10. Genial tubercle 11. Mental foramen 12. External oblique ridge 13. Lingula 14. Hyoid bone

Step3

Examine the medullary bone of the mandible for the usual anatomic landmarks and note anything suggestive of pathology, especially in the periapical regions of the teeth. The third molar development and position should definitely be noted as it may play an important role in determining the type of retention planned and/or their enucleation if required.

Fig. Orthopantomogram shows periapical pathology and third molar angulation

Step 4

Next, examine the cortical outline of the maxilla starting on the right side. Trace the pterygo-maxillary fissure, hard palate with the anterior nasal spine. Examine the nasal cavities and the nasal septum followed by the maxillary sinuses. It is advisable to compare the right and left sides especially of the nasal cavities and the maxillary sinuses. Radiopacities in these regions could be suggestive of pathology or sometimes the presence of foreign body. These might reflect upon the breathing pattern of the patient.

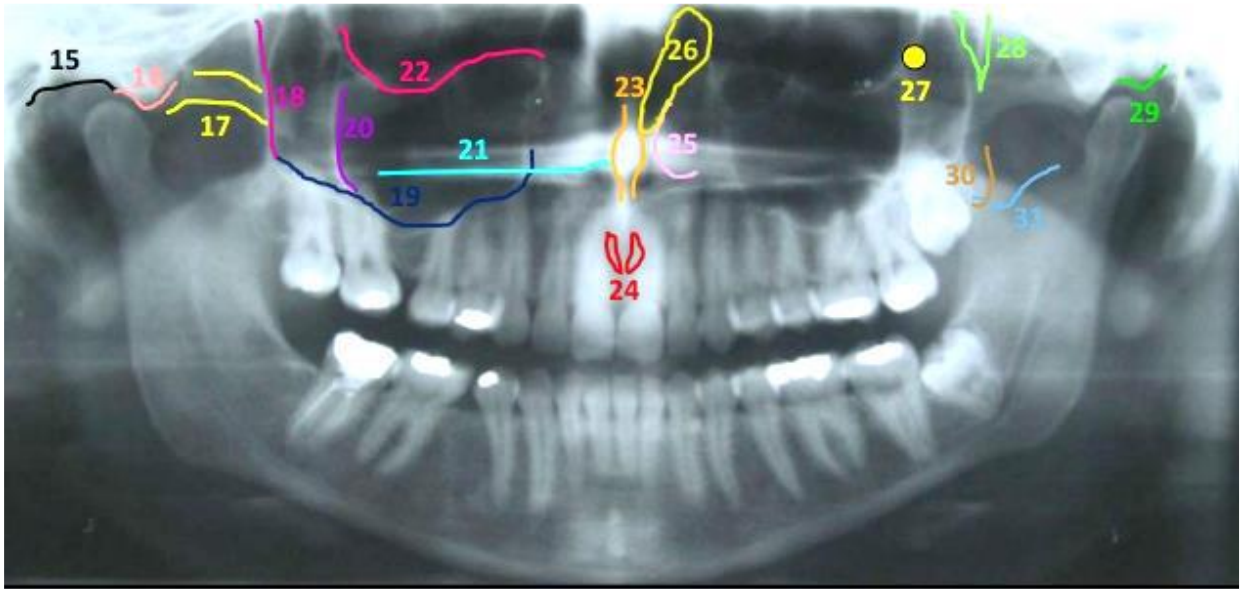


Fig. Body landmark in maxilla, 15. Glenoid fossa 19. Floor of Maxillary sinus 17. Zygomatic Arch 16. Articular eminence 18. Posterior wall maxillary sinus 20. Zygomatic process of maxilla forming innominate line 21. Hard palate 22. Floor of the orbit 23. Nasal septum 24. Incisive foramen 25. Inferior choncha 26. Meatus 27. Frontal process of Zygomatic bone 28.Pterygo maxillary fissure 29.Spine of the sphenoid bone 30. Maxillary tuberosity 31. Lateral pterygoid plate

Fig . Preoperative panoramic x-ray showing radiopacity enlarged right maxillary sinus (Arrow)

Step 5

Margins of a number of soft tissue structures may be seen on the orthopantomogram. These include the tongue, soft palate, nose and earlobes the lip lines and the nasolabial folds.

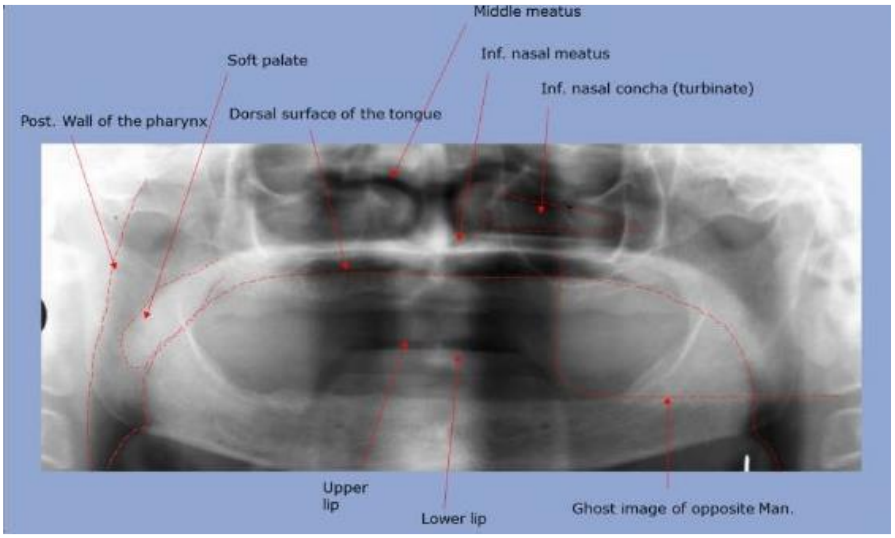


Fig 7. Shadows of the soft tissues are more prominent is OPGs of edentulous patients

Step 6

Radiopaque shadows, which superimpose on normal anatomic structures are called "ghosts" and are actually artifacts. These can sometimes pose a problem in radiographic interpretation. These are created when the X-ray beam projects through a dense object, e.g. the spinal cord and the opaque shadow of the object projects onto the opposite side of the radiograph.

Main anatomical ghost shadows in a PTG: 1, contralateral angle and body of the mandible; 2, cervical spine; 3, contralateral hard palate. Note missing or extracted dd. 15, 38, 48; persistent d. 65 and peg-shaped d. 22. Polypoid swelling or retention cyst in the alveolar recess of the right maxillary sinus

Step 7

Finally evaluate the teeth for-presence, stage of development, state of eruption unerupted or impacted teeth, placement, root morphology and position, cavities, fractures, contacts, and/or any pathology.

Teeth may appear to be magnified or minimized in the horizontal dimension depending on their position. The maxillary and mandibular cusp tips should be generally separate (unless there is a change in the cant of occlusion and there should be gentle curve to the occlusal plane.

Fig 8. Orthopantomogram showing mixed dentition

The orthopantomograrm may not be sufficient by itself. If any doubt arises it is recommended that an lOPA of the concerned region be taken