Orthodontics

Lec 5 **Fifth Stage** **د بان غانم اغا**

Diagnostic aids

Radiographs: Continue

Localisation of impacted tooth

There are several methods for localization of impacted maxillary canine:

1. **Magnification method**

A dental panoramic radiograph (OPGs) is commonly used for assessing the presence, position and morphology of unerupted teeth and can be used to determine the bucco-lingual position of ectopic maxillary canines based on the degree of magnification of the canine relative to adjacent teeth or the contralateral canine.
This depends on the fact that objects nearer the x-ray source (and further from the film) project a larger image than objects closer to the film and further from the x-ray source (remember that the x-ray source from a panoramic radiograph comes from behind the head). The crown of a palatally displaced canine will appear magnified compared with the image of a contralateral tooth that is in the line of the arch or buccally displaced. However, this magnification technique is difficult to apply, particularly if the canine is rotated or in contact with an incisor root, or if the lateral incisor is tipped (Figure 1).

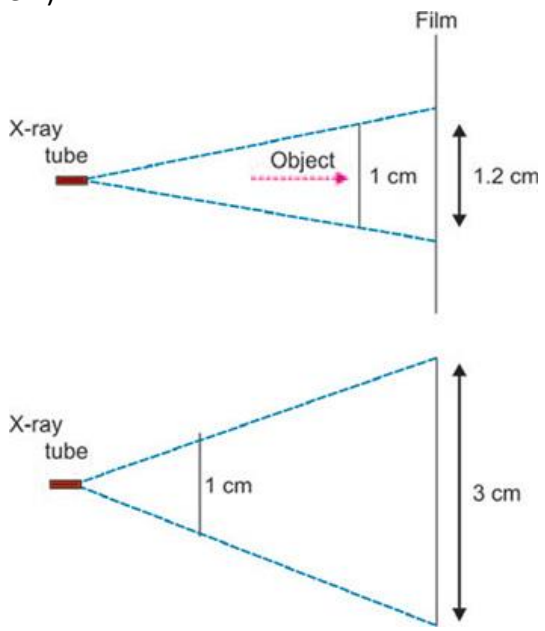


Fig 1. An illustration showing principle behind magnification, as thr object move away from the source

2. The **horizontal parallax method** is a reliable method to determine the position of an unerupted upper canine. It is done using two periapical radiographs taken at different angles with the same vertical angulation or at the same point. Based on this principle the more distant object appear to move in the same direction of the tube shift while closer object move in opposite direction. Based on SLOB (Same lingual opposite buccal) principle, if the object has moved on the same side as that of the X-ray tube, it is said to be lingually placed (Figure 2) and if it has moved on the opposite side it is on the buccal side. If the teeth does not move then it is correctly positioned.

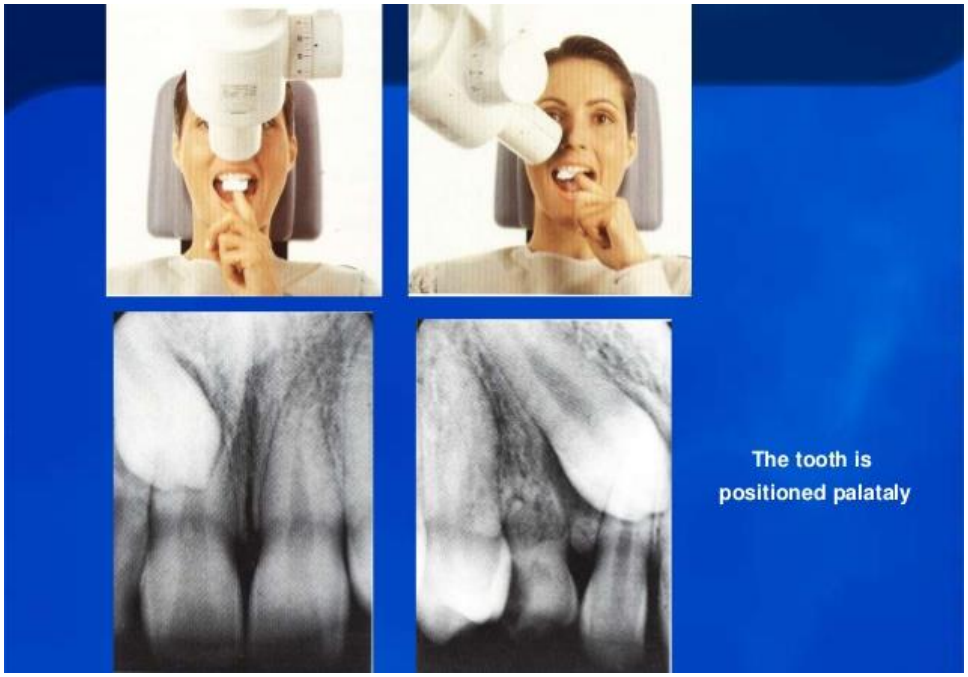


Fig 2. The horizontal parallax method. The canine located palatally. as it moved with the same direction of the tube (distally).

3. Vertical parallax method

The principal of this method is same as that of horizontal parallax method but the change in angulation is taken in vertical direction. The two radiographs for vertical parallax method could be two periapical radiographs or one panoramic view and one maxillary occlusal view.

Based on SLOB (Same lingual opposite buccal) principle, if the object has moved on the same side as that of the X-ray tube, it is said to be lingually placed (figure 3) and if it has moved on the opposite side it is on the buccal side. If the teeth does not move then it is correctly positioned.

For one panoramic view and one maxillary occlusal view, the position of the cusp tip of impacted maxillary canine is compared between the two radiographs. If the position of the cusp tip was more apical on occlusal view as compared to panoramic view, it was diagnosis as palatal impaction (Figure 4). In case of buccally positioned impacted maxillary canine, the

cusp tip is more cervical on occlusal view as compared to panoramic view. There is no change in cusp tip location in case of intermediate positioned impacted canines.

Fig 3. The vertical parallax method. The canine located palatally. as it moved with the same direction of the tube (apically).

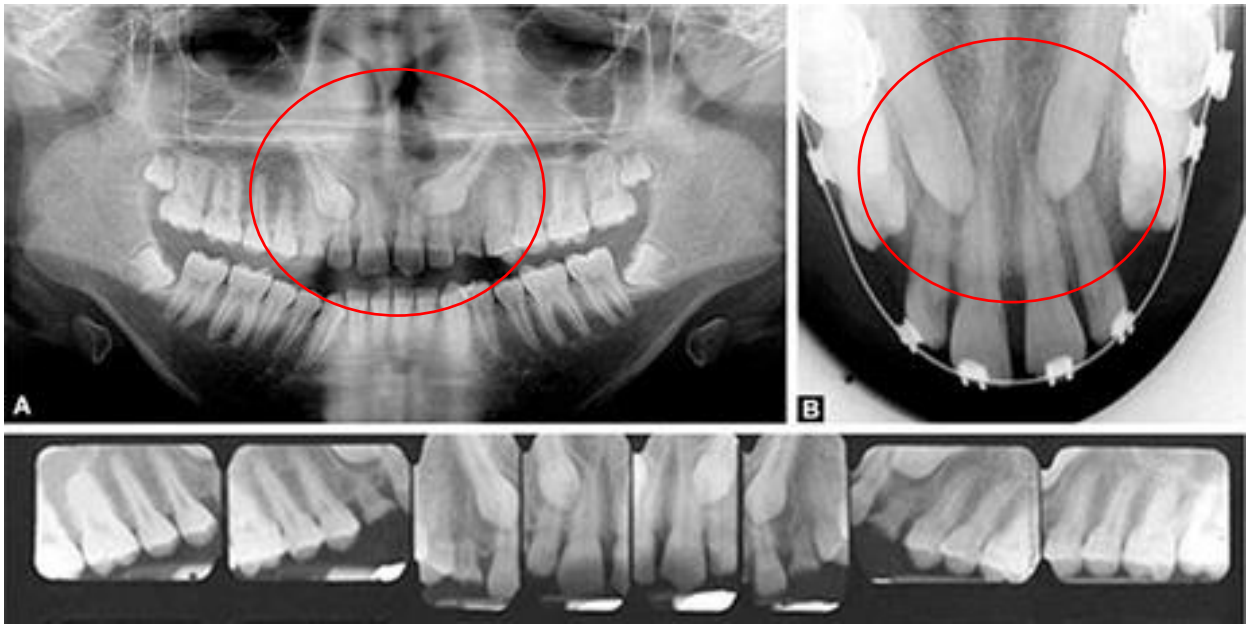


Fig 4. Palatal impaction of canine, the position of the cusp tip was more apical on occlusal view as compared to panoramic view.

4. **Cone beam computed tomography (CBCT)**
   The best tool for evaluating the status of e impacted canine is the CBCT image. It can provide a three-dimensional image in which the position of the impacted tooth and the relationship with adjacent structures.

Root resorption in Orthodontics

The aetiology of apical root resorption (ARR) is multifactorial; these factors consist of individual biologic characteristics, genetic predisposition and the effect of orthodontic forces. Risk factors for ARR can be categorized as patient-related and treatment-related. ***Patient-related factors*** include; genetics, systemic factors, asthma and allergies, chronic alcoholism, the severity of malocclusion, tooth-root morphology, a previous history of root resorption, alveolar bone density, root proximity to cortical bone, endodontic treatment, and patient age and sex.

The most common undesirable, irreversible, and adverse sequela of maxillary canine impaction is root resorption (RR) of the adjacent teeth. RR is defined as loss of tooth cementum and/or dentin associated with a physiological or pathological activity of the tooth-resorbing cells (Figure 5).

Fig 5. Illustrations of positive root resorption (lateral incisor) confirmed in axial, sagittal, and coronal views and the volumetric rendering model of CBCT

Orthodontic treatment-related root resorption is referred to as induced inflammatory resorption, and it is a form of pathological root resorption, in which orthodontic forces are transferred to the teeth and hyalinized areas are thus removed in the periodontal area (Figure 6). Risk factors include; the treatment duration, magnitude of applied force, direction of tooth movement, amount of apical displacement, and method of force application.

Magnitude of force: that heavy forces produced significantly more root resorption than light forces.

Direction of force: compressive forces cause more resorption than tensile forces. Intrusion of teeth causes about four times more root resorption than extrusion; however, it should be noted that the extrusion of teeth may also cause ARR in susceptible individuals. Intrusive

forces together with lingual root torque and jiggling movement (caused by the application of intermaxillary elastics) remain the most influential forces in causing ARR

Duration of force: duration of active treatment is also one of the risk factors related to increased level of ARR.

Recommendation: It was suggested that 2 to 3 month pauses in force, achieved with a passive arch wire allows the resorbed cementum to heal and prevents further resorption.

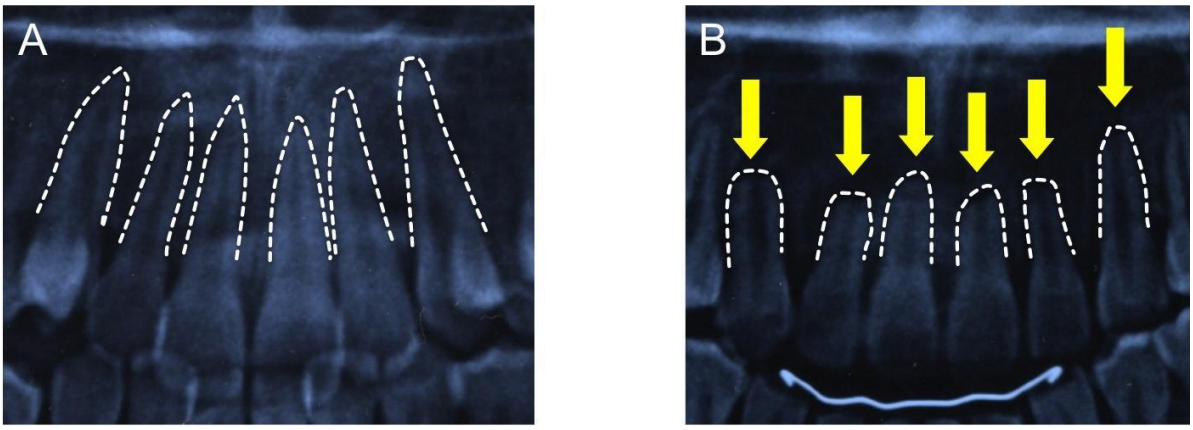


Fig 6. Orthodontic treatment-related apical root resorption ARR. A. root length before orthodontic treatment B. ARR evidenced by decrease root length after orthodontic treatment

Preventive Measures for Clinical Practice When you acquiring a new patient who has already begun orthodontic treatment and does not have his/her records, clinicians must not forget to obtain a new radiograph to assess root resorption before further treatment. A satisfactory anamnesis of the patient and family can help identify any risky situations or predispositions. It is important to inform orthodontic patients about the risks before treatment, and if ARR occurs, the patient must be informed about the situation. Recent advancements in computed tomography (CT) techniques, especially cone-beam CT (CBCT), have significantly improved the sensitivity and accuracy of the diagnosis of root resorption.

Strong evidence suggests that comprehensive orthodontic treatment causes increased root resorption, and heavy forces have especially harmful effects. It is fervently recommended to apply light forces in orthodontic treatments and to leave longer intervals between activations. Serial radiographs obtained after 6–12 months might help to detect early root resorption, and if resorption is identified, a two to three month pause in treatment with a passive arch wire might help to prevent further resorption. In addition the treatment plan should be reviewed in such situations and possible therapeutic solutions, including prosthetic restorations, should be considered to terminate orthodontic forces as soon as possible.

After debonding, passively prepared fixed retention wires should be bonded carefully. Patients should be informed about maintaining their oral hygiene, as periodontitis may progress more rapidly in teeth with ARR.

Diagnostic Aids: Facial Photographs

Facial photographs are the easiest to store, occupy the least amount of space and provide immense information to the clinician as well as the patient. Good clinical photographs form an essential part of the clinical record. They provide a baseline record of the presenting malocclusion, and are important in treatment planning especially in relation to facial and dental aesthetics, allow monitoring of treatment progress and are useful for teaching.

Photographs can be,

- Extraoral photographs
- Intraoral photographs

Clinical requirements for photographic records

1. Digital Camera
2. Double ended photo check retractor
3. Dental photograph mirror

Double ended photo check retractor (narrow and wide sides)

EXTRAORAL PHOTOGRAPHS

Extra-oral photographs are considered essential records and should be taken before starting treatment and after completion of treatment.

Uses of extra-oral photographs

1. Evaluation of craniofacial relationships and proportions before and after treatment.

2. Legal point of view.

3. Assessment of soft tissue profile

4. Proportional facial analysis and/or photographic analysis

5. Monitoring of treatment progress (if standardized)

6. Invaluable for longitudinal study of treatment and post retention follow-up

7. Detection and recording muscle imbalances

8. Detecting and recording facial asymmetry

9. Identifying patients

American Board of Orthodontics has laid down guidelines for these extra-oral photographs

· Quality, standardized facial photographs either blackened white or colour prints.

· Patients head oriented accurately in all three planes of space and in FH plane

· One lateral view, facing right, serious expression, lips closed lightly to reveal muscle imbalance and disharmony.

· Background free of distractions

· Quality lightening revealing facial contours with no shadows in the background

· Ears exposed for purpose of orientation

· Eyes open and looking straight ahead, glasses removed.

It is recommended that at least three extra-oral photographs be taken for all patients. This includes:

A- Frontal facial with lips relaxed (Natural head position, teeth and lips in relax position, head should not be tilted or face rotated, inter-pupil line should be levelled)

B- Three-quarter view, smiling (Also called ¾ view. Patient as in social interaction)

C- Facial profile with lips relaxed (The patient is asked to turn to left side, keeping head in natural position and eyes fixed horizontally at a specific point at eye level, the whole side should be visible with no obstructions with hair, hats or scarfs)

D- Frontal facial, smiling (Same as frontal view relaxed with the only exception that the patient should be smiling with teeth visible. This view aids in virtualization the patient smile aesthetic and soft tissue proportion while smiling)

A B C D

For facial deformity cases or cases likely to undergo orthognathic correction it is recommended that all the four photographs mentioned above should be complemented with the following:

1- Frontal facial in maximum intercuspal position, lips sealed.

2-Left and right, facial profile in maximum intercuspation, lips sealed.

3-Left and right, facial profile, lips relaxed.

4-Left and right three-quarter view, smiling or frontal facial, smiling.

All extraoral photographs should be taken in the natural head position, preferably without any shadows appearing in the background. The ears should be exposed (for the purpose of orientation) and the patient should not be wearing eye ware.

It would be ideal if the distance and magnification could be standardized.

INTRAORAL PHOTOGRAPHS

Intraoral photographs are considered non-essential diagnostic records yet they are simple to take, maintain and store and of course useful, this is because they are neither standardized nor three dimensional.

Must be taken before, during and after finishing the treatment.

Advantage of photographs:

1- Helpful in explaining and motivating the patient.

2- They are also used to monitor treatment progress and results.

3- They are also helpful in medicolegal cases involving the texture and color of teeth especially pre-operatively.

4- Assessing and recording health or disease of the teeth and soft tissue structures.

5- Study of relationships before, immediately following and several years after treatment, to improve treatment planning.

The American board of orthodontist's guidelines for intraoral photographs

1. Quality, standardized intraoral color prints

2. Photographs should be oriented accurately in all three planes of the space

3. One frontal photograph in maximum intercuspation (A)

4. Two lateral views-right (B) and left (C)

5. Optional-two occlusal views-maxillary (D) and mandibular (E)

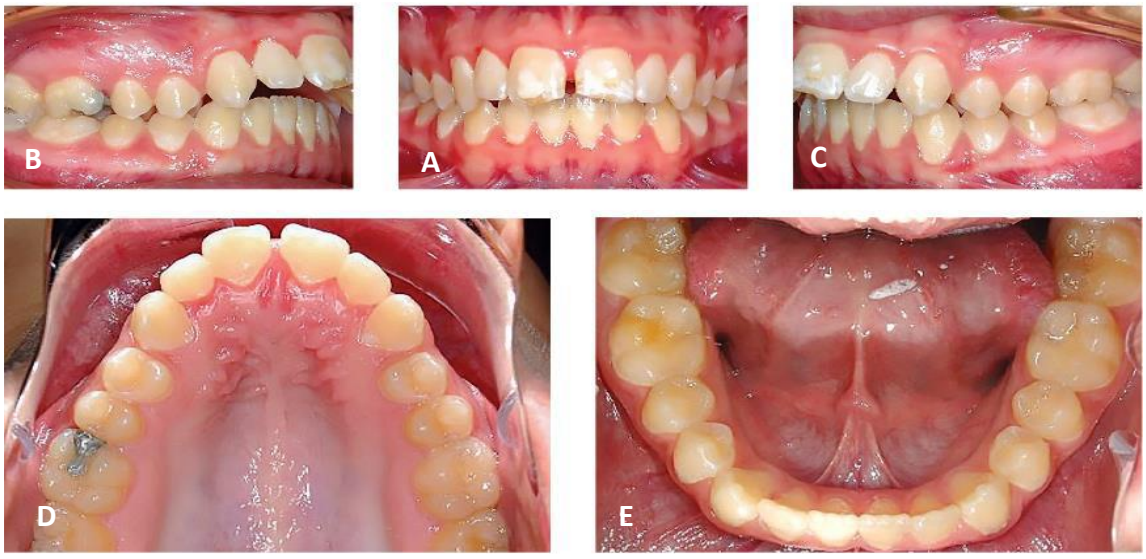
6. Free of distractions-retractors, labels etc.

7. Quality lightening revealing anatomical contours and free of shadows.

8. Tongue should be retracted posteriorly.

9. Free of saliva and/or bubbles.

10. Clean dentition.



Important guidelines for intraoral photographs

1. **Frontal in Occlusion**

Use wide side of check retractor to retract cheeks and lips from teeth and gingiva (Retractors pulled laterally and towards the photographer). Photo should be taken perpendicular to the

facial midline and central incisors using frenal attachment as a guide. Maximum virtualization of all teeth and gingiva.

Frontal in Occlusion

2. Right Buccal In Occlusion

The right retractor is flipped to narrower side, the left retractor remains in place as in frontal shot. The right retractor is stretched to an extent that the last molar is visible if possible. Shot should be taken perpendicular from canine premolar area. Patient is asked to turn his head slightly to the left to allow the right side facing the clinician.

Right Buccal In Occlusion

3. Left Buccal In Occlusion

The narrow end is on the left side, while the right retractor remains in place as in frontal shot. The left retractor is stretched to an extent that the last molar is visible if possible. Shot should be taken perpendicular from canine premolar area

Left Buccal In Occlusion

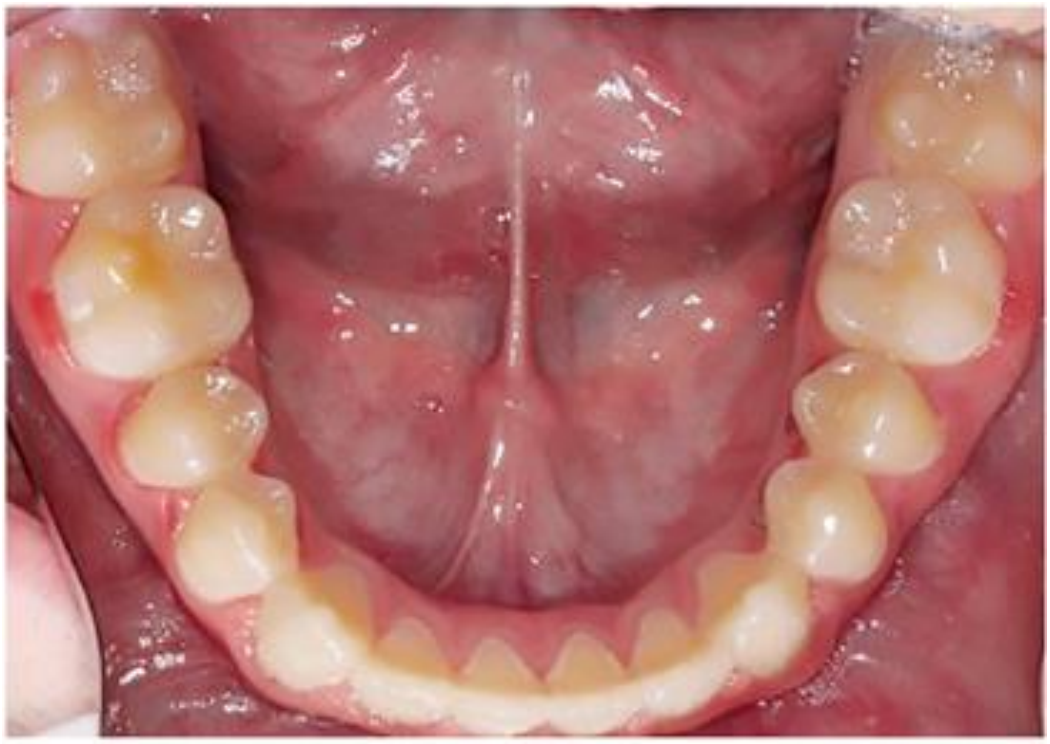
4. Maxillary Occlusal View

Small side retractor is used to retract the lips and cheek away from the teeth (Assistant pulls up, laterally and towards the photographer). Wider side of the mirror is inserted inward to capture the maximum width posteriorly. The midpalatine raphe is taken as a guide to level the shot (perpendicular to the plane of the mirror).

Maxillary Occlusal View

5. Mandibular Occlusal View

Small retractor is used to retract the lower lip away from the teeth. Lift the mirror upward to visualise the molars. Patient is asked to roll back the tongue behind the mirror for best view



Mandibular Occlusal View

Helpful Tips to Avoid Error

1. The direction of pull of retractors should be always sideways slightly forward, away from gingival tissue. This maximize the field of view and minimize patient discomfort.
2. Wetting the retractors just before insertion ease the process of positioning them properly and decrease discomfort.
3. When taking occlusal mirror shots slight warming the mirror in warm water prior to insertion prevents fogging.
4. Using saliva ejector to eliminate saliva to get a clear image
5. During Occlusal mirror shots instruct the patient to open wide just before pressing the camera button. This helps in maximum mouth opening at right time and decrease patient fatigue.
6. Alginate impression if to be taken should be done after taking all photographic records.

Full Orthodontic record should include minimum 9 photographs

4 Extraoral

5 Intraoral

Diagnostic Aids: Study Models

Study models provide vital information about patient's teeth and occlusion. They are an essential diagnostic aid when planning cosmetic dentistry, oral surgery, and orthodontics. The information given by a study model includes accurate replication of the teeth and the surrounding soft tissues. By providing a 3-D model that will allow to clearly visualize patient's dentition and occlusion, a properly-made study model is invaluable in planning treatment. Once the model is completed, you will be able to easily detect any abnormalities within the arch while objectively assessing the problems that require correction.

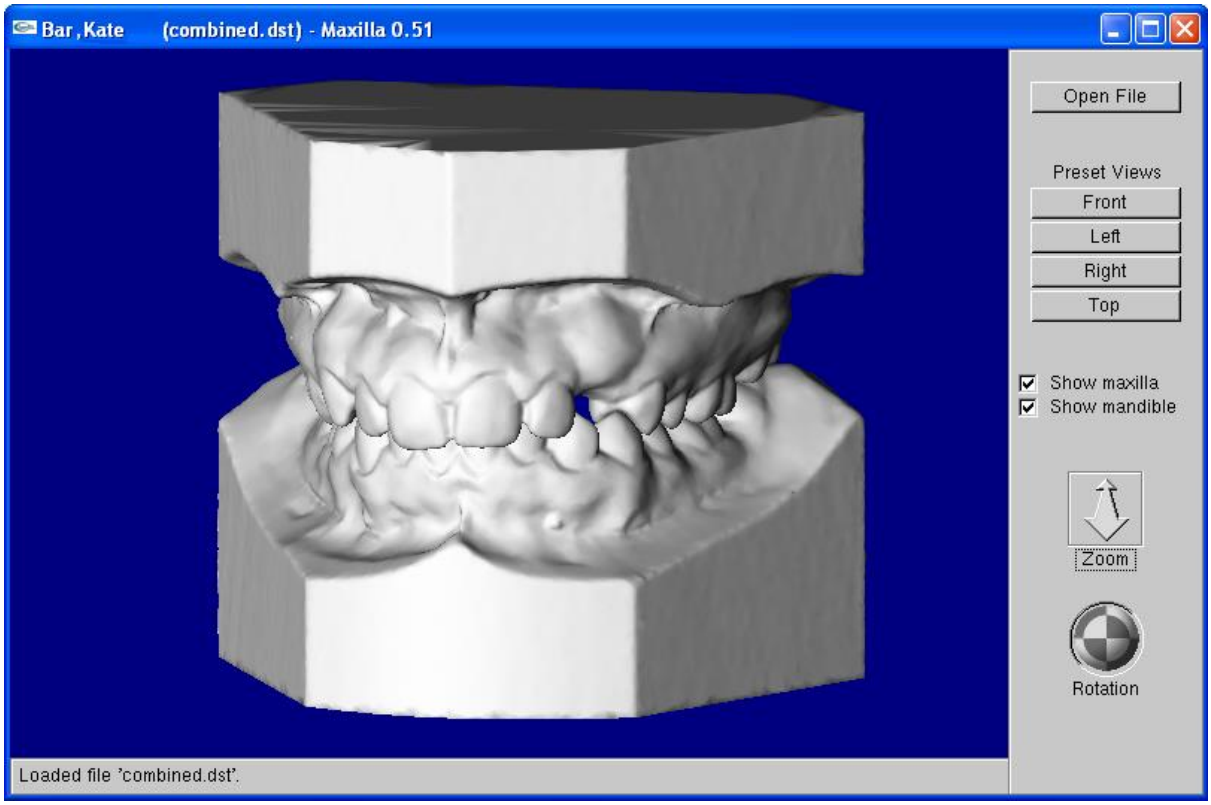
In orthodontics, the model serves as a permanent record of a patient's malocclusion and provides a visual aid, helping you to monitor the changes that will take place during treatment. Additionally, it can be useful for motivating a patient and them to accept any proposed treatment plan. A good study model can be very useful for patient education, allowing them to visualize the treatment process. Once treatment is completed, dentists will often make study models showing the completed work. This can be especially useful for helping to monitor the results of your patient's treatment during follow-up visits.

Study models should show all the erupted teeth and be extended into the buccal sulcus. Traditionally, they are poured in dental stone and are typically produced from alginate impressions. They should be mounted in occlusion, using a wax or polysiloxane bite. They are produced using a technique known as Angle trimming, which allows models to be placed on a flat surface and viewed in the correct occlusion from varying angles using Carborundum wheel.

Study Model Trimmer: Carborundum Wheel

Intra-oral scanning can now be used, instead of traditional impressions, to produce virtual study models. Software can be used to efficiently measure arch lengths, tooth size discrepancies, as well as provide virtual treatment set-ups' offering predictions of the likely occlusion at the end of treatment.

Digital versions of study models, which should not deteriorate with time, are easier to transfer, and do not take up physical space, are gradually replacing stone models.



Digital study model

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.

Advantage of study models

1. They are invaluable alone in planning treatment, as 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.

Parts of the study models

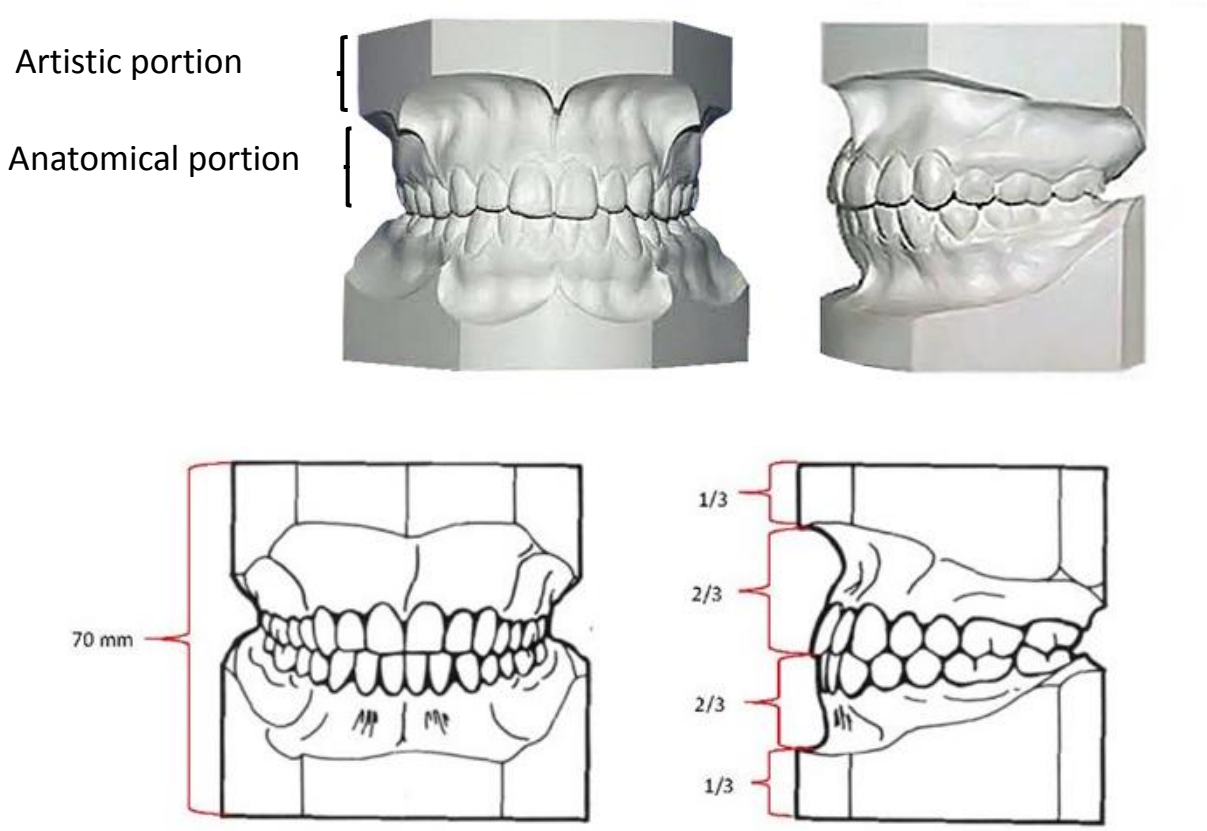
The study models can be divided into two parts for the purpose of description:

· The anatomic portion 2/3

· The artistic portion 1/3

· 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 height

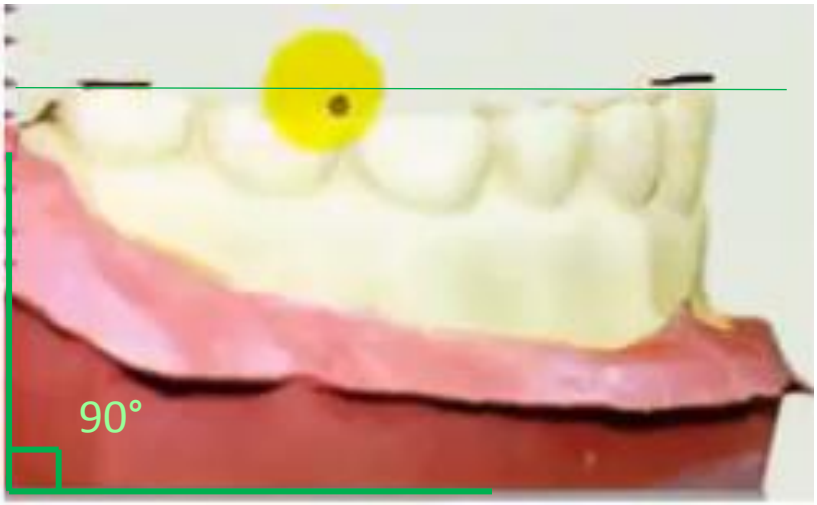
Study model fabrication and trimming

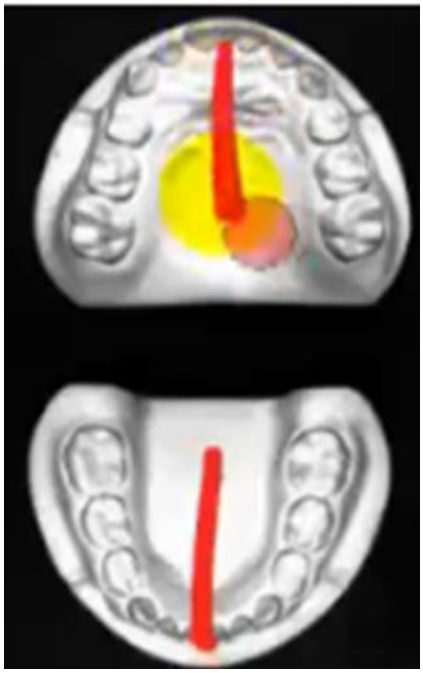
Preliminary procedures in the fabrication of study models are:

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.

Start with Lower Study Model

1. Determine the occlusal plane
2. Trim the base parallel to the occlusal plane
3. Trim the back perpendicular to the base
4. Midline of the lower model should correspond to the midpalatine suture



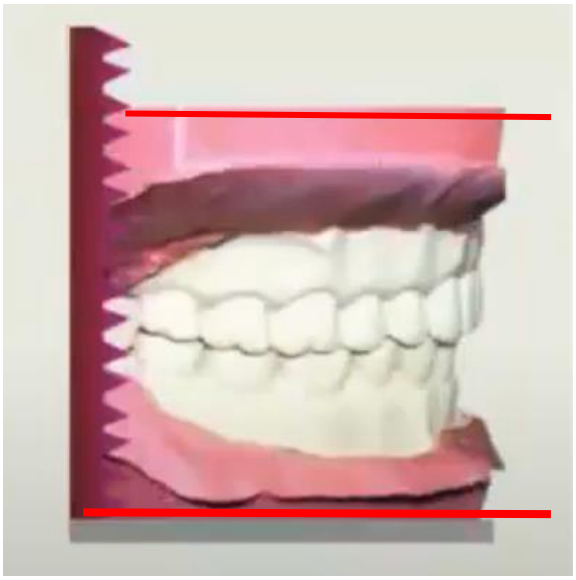


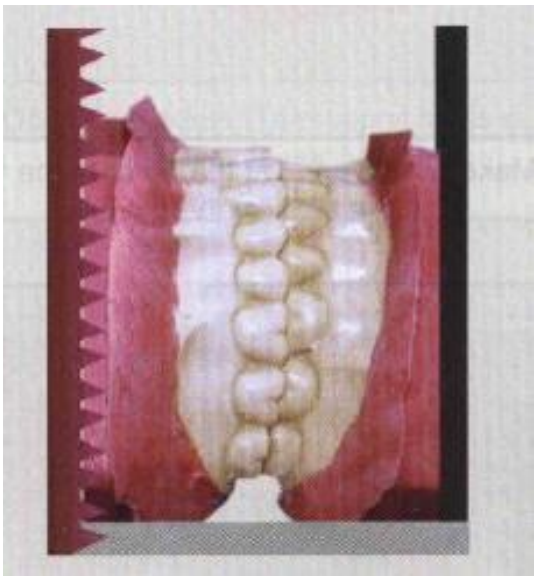
Upper Study Model follows Lower Model

1. Occlude upper and lower models using wax bite (To maintain correct inter-occlusal relationship and prevent tooth fracturing)

2. Trim the back that the upper model matches the lower model

3. Trim the base of the upper model parallel to the base of the lower model

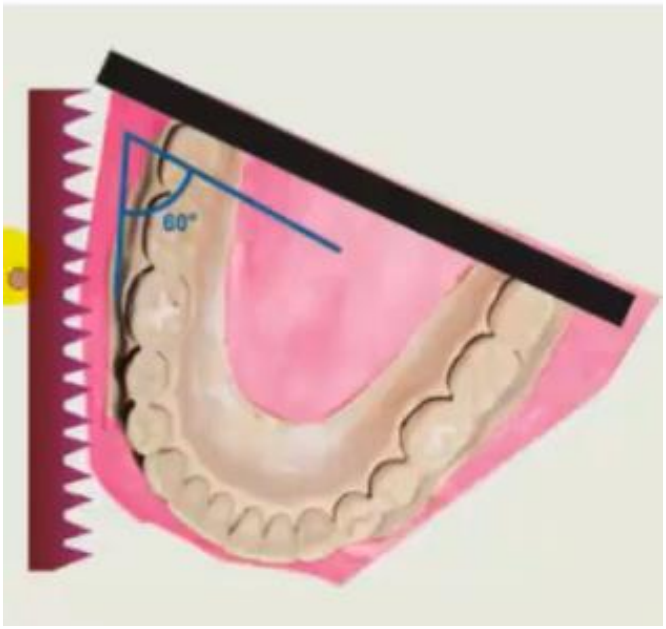




Trim Each Model Separately

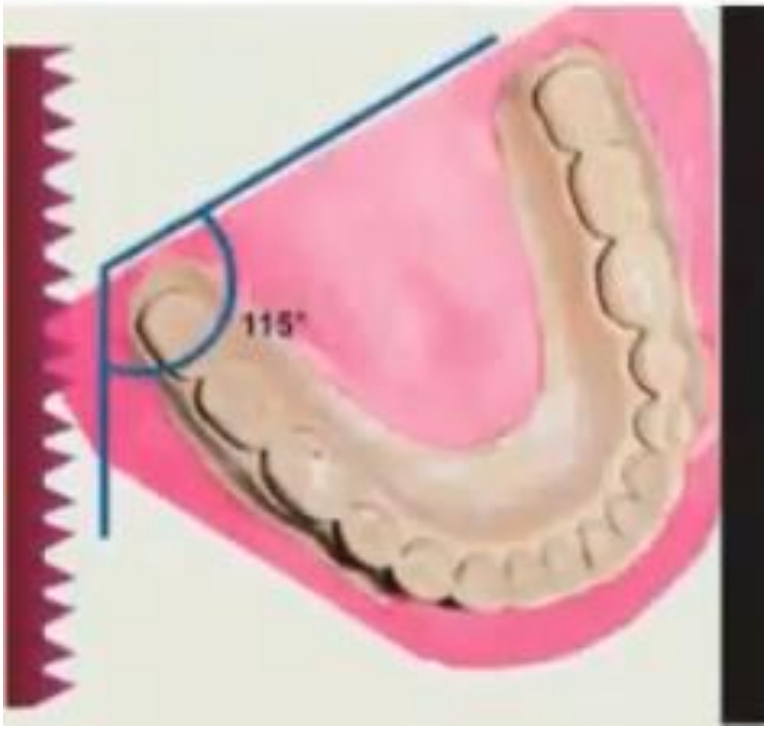
Lower model

1. **Buccal cut (60°):** 5-6 mm away from the most prominent toot (Canine or premolar)



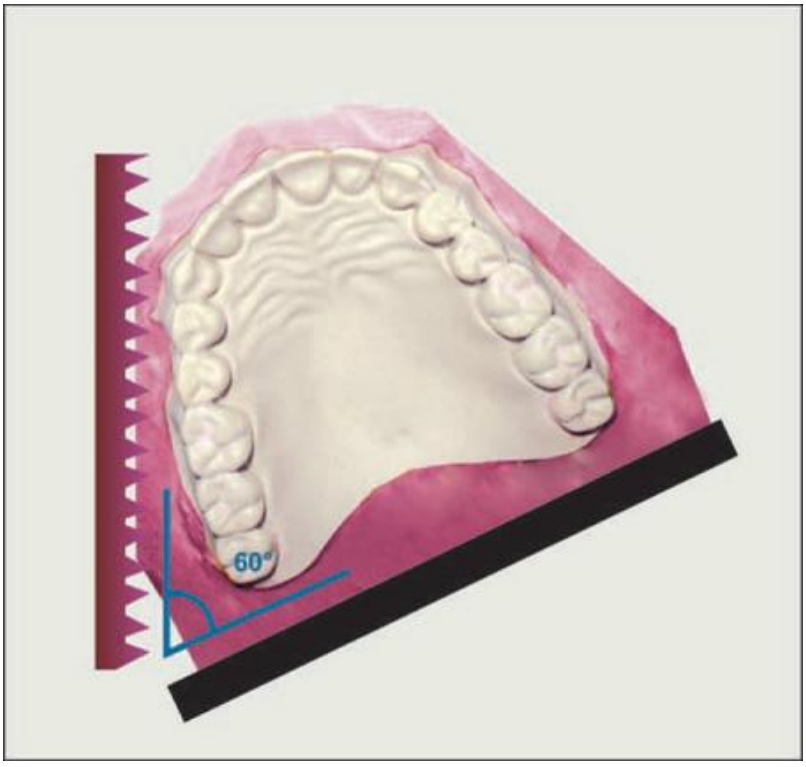
2. **Curve cut:** 5-6 mm after anterior teeth (from canine to canine)

3. **Heel cut (115°):** The heel of the lower model cut 115° to the back of the model

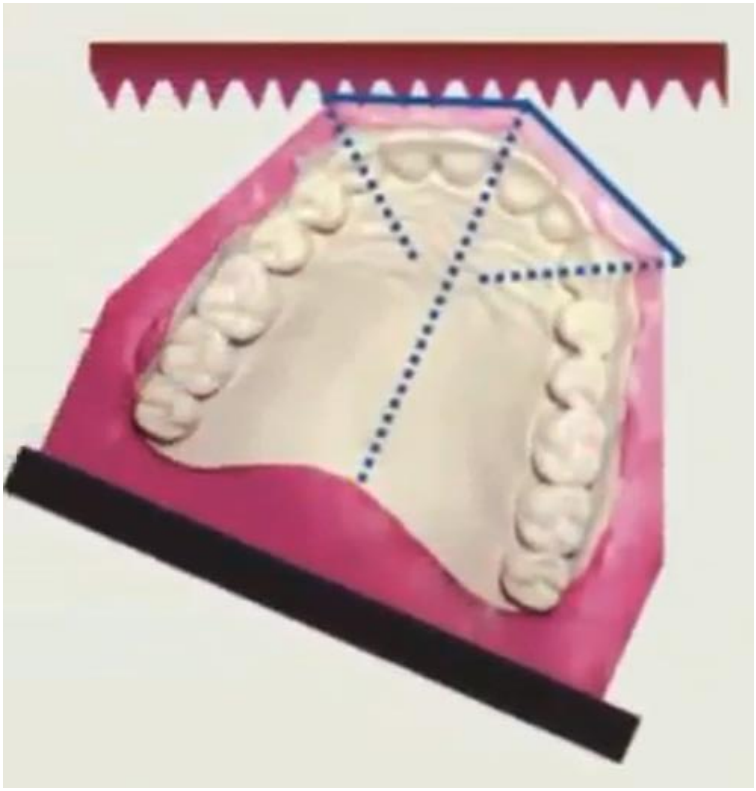


Upper Model

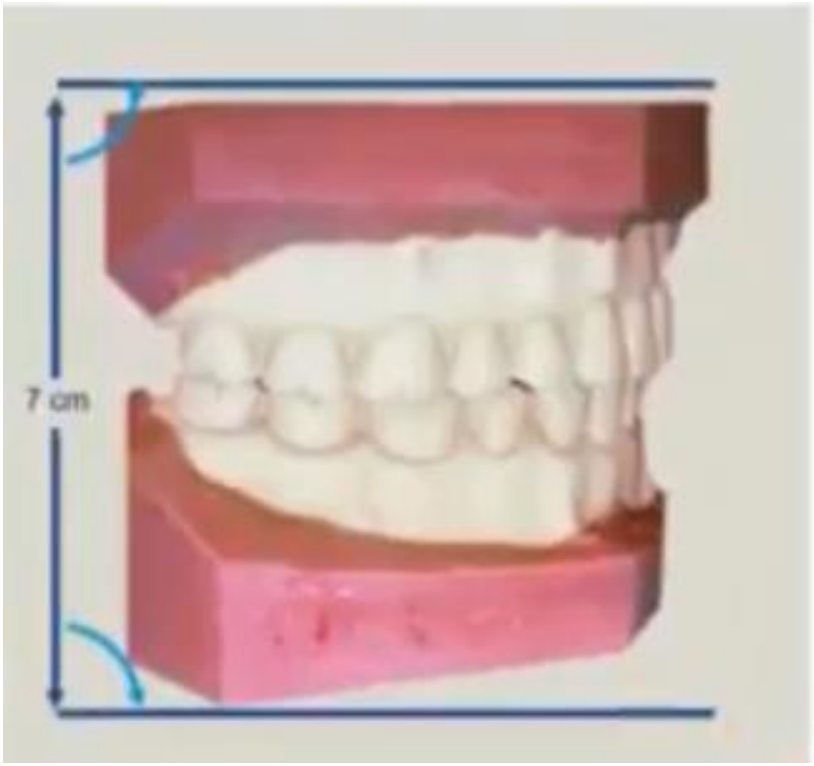
1. **Buccal cut (60°):** 5-6 mm away from the most prominent toot (Canine or premolar)



2. **Anterior cut:** Cut from the midline and canine region (Not follow a curve)



3. **Heel cut (115°):** Occlude with the lower model and follow the same cut



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.